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LIABILITY, INSURANCE AND THE INCENTIVE TO OBTAIN INFORMATION ABOUT RISK

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ABSTRACT

We examine the incentives to obtain information about risk under strict liability and negligence rules when insurance is available. Information helps reduce the expected cost of accidents, but also exposes the potential injurer to classification risk. As a result, the social value of information may be negative. Under both strict liability and negligence, the private value of information may also be negative when insurance is available.

Keywords: information, tort, moral hazard

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1. INTRODUCTION AND BACKGROUND

It is generally accepted that the objectives of the tort law system are to compensate victims and to provide incentives for safety. When the risk of an accident and the amount of the resulting damages are well known, tort law provides incentives for individuals to exercise care. When potential risks and damages are not known, tort law can also provide incentives for individuals to become informed about the risks they create. This may include investment in information about the probability of causing injuries, the amount of the potential damage, or about how the legal system will value the injuries (e.g., potential pain and suffering). For example, suppose a company is considering introducing a new product, and is concerned that product failure could cause physical injuries to customers. The company has several options for investing in information relevant to the risks from this new product. For example, it could: conduct engineering studies to determine the extent of the physical injurie; seek legal advice on the probable outcome of lawsuits and the expected potential liability; consult with experts to determine methods and costs of safety enhancements to reduce the risk of injury to customers. As another example, many companies provide email and internet access to their employees. There is a great potential for employees to abuse email and internet access (e.g., sending threatening or harassing emails, downloading pornography). These companies need to decide whether to seek advice from information technology and legal professionals on the extent of their potential liability and on the costs of mitigating their exposure.[1]

[1] See Aalberts, Hames and Thistle (2009) and Aalberts, Poon and Thistle (2010) for discussions of this issue, and potential risk mitigation strategies.

The purpose of this paper is to examine the incentives that tort law provides for individuals to become informed about the risks they create when insurance is available. Shavell (1992) and Kaplow and Shavell (1992) analyze the incentives that liability rules create for potential injurers to obtain information about the severity of potential risks when insurance is not available.[2] Both Kaplow-Shavell and Shavell show that strict liability leads to socially optimal acquisition of information and levels of care. Kaplow-Shavell argue that, because individuals who meet the due care standard avoid liability, the negligence rule creates excessive private incentives to acquire information. Shavell considers several negligence rules, where liability may depend on both the decision to become informed and the level of care or may depend solely on the level of care. He concludes that whether negligence rules lead to socially optimal acquisition of information and optimal care depends on the details of the negligence rule.

Although it is interesting to hypothetically consider tort law incentives in the absence of insurance, this assumption does not seem supportable in the current legal environment. Insurance is widely used by individuals and businesses to manage liability risks, with billions of dollars spent each year on liability insurance premiums. Insurance can unwind the financial incentives intended by the legal system, by altering the costs imposed on potential injurers and the indemnities paid to potential victims. Hyman, et. al (2007), Zeiler, et. al. (2008) and Silver, et al. (2008) provide empirical evidence that victims' recovery for medical malpractice claims is typically capped at the limit of the insurance policy and that physicians rarely pay out of pocket for malpractice claims. Black, Cheffins and Klaussner (2006) analyze the liability risk that outside directors face

[2] Kaplow and Shavell analyze decisions to seek advice about properly determined liability and to seek advice about mistakes that might be made in determining liability. This paper is concerned with the first type of legal advice.

and find only thirteen cases in twenty-five years where outside directors had to make out of pocket payments. They argue that, if the company has appropriate Directors and Officers coverage, outside directors face out of pocket liability only in very rare circumstances. Black, Cheffins and Klaussner (2005) find that this is true in the U.S. and in other countries as well. The prevalence of liability insurance and its potential impact on financial outcomes for injurers and victims raises important issues regarding the impact of insurance on the incentives to obtain information about risk and the incentives to take care under alternative legal rules. [3]

Prior research suggests that the availability of insurance affects the value of information about risks. The amount and direction of this effect may differ based on many factors, including characteristics of the risk, the insurance buyer, the insurance market, the legal standard being considered, and the cost of obtaining information and taking care. Table 1 provides a brief summary of the relevant literature and clarifies the contributions that are being made in this paper. Many of these papers focus on the private value of information and on potential injurers' incentives to become informed.

[Insert Table 1 Here]

Crocker and Doherty (2000) analyze the value of information under a negligence rule when the insurance market is competitive. They argue that potential injurers' ignorance about the severity of risks they face may provide a motive for the purchase of liability insurance under a negligence rule. In their analysis, potential injurers face a choice between becoming informed and taking appropriate precautions or remaining

[3] Liability insurance policies are commonly renewed annually which allows insurers to experience rate the policyholders. Therefore, insureds with poor loss histories may face significant increases in renewal premiums. This implies that the availability of insurance does not completely unwind the financial incentives created by the tort system.

uninformed and purchasing liability insurance. Crocker and Doherty show that the private value of information may be positive or negative. Liability insurance may allow the potential injurers to hedge their "classification risk," that is, the risk associated with the unknown cost of meeting the standard of due care.

Bajtelsmit and Thistle (2007, 2009) examine the value of information about the frequency of accidents assuming that the courts apply a uniform ("reasonable person") negligence standard. They show that the private value of information depends on insurance companies' ability to observe potential injurers' information (informed/uninformed) status. If insurers can observe policyholders' information status, then the private value of information may be positive or negative. If insurers cannot observe information status, then they face an adverse selection problem. In the resulting screening equilibrium, the private value of information is positive.

In this paper, we examine the effect that the availability of liability insurance has on the social value of information as well as individuals' incentives to obtain information about risks and to take care to prevent injuring others.[4] We know, from Shavell (1992) and Kaplow-Shavell (1992), that when potential injurers are risk neutral, the social value of information is positive and that tort law provides incentives for risk-neutral potential injurers to become informed. We extend the analysis in those papers to the case of risk averse potential injurers. We show here that, when insurance is not available, the social value of information is positive under strict liability, but may be positive or negative

[4] Although the analysis and discussion here are in terms of liability risk, a broader interpretation is possible. For example, the analysis of strict liability can be reinterpreted as an analysis of the effect of property insurance on the incentives to learn about the risk of damage to the individual's own property. Similarly, the negligence rules can be reinterpreted as regulatory standards where violations lead to financial sanctions. However, the analysis in this paper does not apply to regulatory situations in which sanctions are non-monetary and therefore uninsurable.

under negligence. We also show that, when insurance is not available, tort law provides incentives for risk-averse potential injurers to become informed. We show that insurance can change the incentives that tort law provides. When insurance is available, tort law may not provide sufficient incentives for potential injurers to become informed. We consider these issues under the strict liability rule and several negligence rules. Following Shavell (1992) and Crocker-Doherty (2000), we initially assume individuals do not know *a priori* whether any accidents they cause will result in small or large damages. Individuals have the opportunity to obtain information about the severity of the risk or the cost of mitigating the risk. The advantage of becoming informed is that it leads to more efficient choice of care. The decision to become informed creates "classification risk," in effect, a lottery over the *ex ante* unknown total expected cost of accidents. Insurance allows the uninformed to hedge the classification risk as well as the underlying liability risk, reducing the cost of remaining uninformed. Which of these effects is stronger determines whether the social and private values of information are positive or negative.

Because potential injurers can choose to remain rationally ignorant or can choose to learn about the risks they face, our work is related to previous research on endogenous information in insurance markets. (Hoy, 1982, Crocker and Snow, 1992, Doherty and Thistle, 1996, Ligon and Thistle, 1996*a*, *b*). Crocker and Snow (2013) provide a survey of the literature on risk classification, including risk classification with endogenous information. Our work is also related, although less directly, to the literature on gathering information prior to contracting (e.g., Cremer and Khalil, 1994, Nosal 2006), the literature on information disclosure rules (e.g., Viscusi, 1978, Matthews and

Postlewaite, 1985, Polinski and Shavell 2012), and the literature on information about product recalls (e.g. Hua, 2011).

The next section describes the basic assumptions of the model, defines the liability rules and the value of information. The third and fourth sections analyze the incentives to obtain information and to take care under the strict liability and negligence rules. The final section provides brief concluding remarks.

2. THE BASIC MODEL.

2.1 Assumptions.

The analytical model employed is an extension of the standard model of accidents in the law and economics literature (e.g., Shavell 1982, 1987). For simplicity, we assume that only the potential injurer's care affects the probability of an accident and there is no contractual relationship that the potential victim can use to provide incentives for the potential injurer to take care.

We let x denote the level of care intended to reduce the risk of accidents. We assume that the per-unit cost of care is equal to one. The probability of an accident is $\pi(x)$ when care is x and is the same for all potential injurers. The probability of an accident is a strictly decreasing, strictly convex function of care. Accidents are never entirely certain nor entirely preventable, $0 < \pi(x) < 1$. The potential injurer is engaged in an activity that can be either dangerous or safe, depending on the level of damages in the event of an accident. If an accident occurs, a dangerous activity inflicts large damages, d_D, while a safe activity inflicts small damages, d_S, where $d_D > d_S \geq 0$. We let θ_D and θ_S be the

probabilities the activity is dangerous or safe, where θ_D, $\theta_S > 0$ and $\theta_D + \theta_S = 1$. Average damages are $\bar{d} = \theta_S d_S + \theta_D d_D$.

An important aspect of the analysis here is that potential injurers do not necessarily know whether the activity is safe or dangerous.[5] However, they do know that the activity can be safe or dangerous with probabilities θ_S and θ_D. We use the subscript *U* to denote uninformed potential injurers. Potential injurers have an all-or-nothing choice to remain uninformed or become informed. We assume throughout that information is costless. Potential injurers become informed if the private value of information (defined below) is non-negative.

Potential injurers have initial wealth $w > d_D$ and the von Neuman-Morgenstern utility function *u*, which is strictly increasing and strictly concave. We assume potential victims are risk neutral, since this leads to a simple characterization of the optimal negligence rule, and that individuals know whether they are a potential injurer or a potential victim.

If an accident occurs, then whether the injurer's activity is safe or dangerous is revealed *ex post* by the amount of damage. We assume that the courts work perfectly. This implies that victims, courts, and insurers can perfectly verify the injurer's level of care if an accident occurs. Since the injurer's care can be verified, we assume care is observable. This implies that the insurance premium can depend on the level of care.[6]

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[5] We can extend the models analyzed here to allow a portion of the potential injurers to be exogenously informed. This does not change any of the results in the paper.

[6] This is an assumption about timing, namely, that care is observed *ex ante* so that the premium can depend on care. However, under the alternative assumption that care is only observed *ex post* in the event of an accident, the indemnity can depend on the level of care.

An insurance policy consists of a premium, p, an indemnity, q_S, paid in the event damages to a victim are low and an indemnity, q_D, paid in the event damages to a victim are high. We assume throughout that the insurance market is competitive and that insurers earn zero expected profit, given the information they have about policyholders. The zero expected profit constraint is then $p = \pi(x)(\theta_S q_S + \theta_D q_D)$. Since the premium is actuarially fair, if potential injurers insure, they will choose full coverage. For informed individuals with risk severity d_i, full coverage means they choose $q_i = d_i$, $i = S, D$. For uninformed individuals, full coverage means they choose $q_S = d_S$ and $q_D = d_D$. Given the perceived potential damages, individuals who are insured choose the level of care that minimizes their expected total cost of accidents and care (henceforth, "total expected accident costs").

2.2 The Value of Information.

Kaplow (1994) clearly points out that information is potentially valuable only if it is obtained *ex ante*, before decisions are made. As Kaplow and Shavell (1996, p. 192) put it "… accuracy in the assessment of harm cannot influence the behavior of injurers - and is therefore of no social value - to the degree that they lack knowledge of the level of harm they might cause when they make their decisions." That is, potential injurers who are ignorant of the risks they create cannot take actions to mitigate that risk. Learning about it *ex post* therefore has no social value. Throughout the paper, we therefore focus on the *ex ante* value of information.

We let $a_i(x) = x + \pi(x)d_i$ denote the total expected accident cost for informed individuals when potential damages are d_i, $i = S, D$. The socially optimal (first best) level of care given damages d_i then minimizes total expected accident costs, $x_i^* = \text{argmin } a_i(x)$.

For uninformed individuals total expected accident costs are $\bar{a}(x) = x + \pi(x)\bar{d}$ and the socially optimal level of care, $\bar{x}^*$, minimizes $\bar{a}(x)$. Then the savings in social total expected accident costs is

$$A(x_S^*, x_D^*, x_U^*) = \bar{a}(\bar{x}^*) - \theta_S a_S(x_S^*) - \theta_D a_D(x_D^*) \tag{2.1}$$

$$= \theta_S[a_S(\bar{x}^*) - a_S(x_S^*)] + \theta_D[a_D(\bar{x}^*) - a_D(x_D^*)] > 0.$$

This is always positive since information leads to better choices of the level of care.

We measure the *ex ante* private value of information as the expected increase in the potential injurer's expected utility from becoming informed. Let $z = (p, q_S, q_D, x)$ be the arguments of the potential injurer's expected utility function. Let U denote expected utility and let $\hat{z}_i$ maximize expected utility for an individual of type $i = D, S, U$, subject to any relevant constraints. Then the private value of information is the change in expected utility from becoming informed:

$$I = \theta_S U_S(\hat{z}_S) + \theta_D U_D(\hat{z}_D) - U_U(\hat{z}_U). \tag{2.2}$$

We assume that individuals choose to become informed if the private value of information is non-negative.

The social value of information, Σ, is the change in social welfare when potential injurers become informed. Let V denote the expected utility of potential victims and let Π denote expected profits. When potential injurers choose to become informed, social welfare is

$$W = \theta_S U_S(\hat{z}_S) + \theta_D U_D(\hat{z}_D) + V + \Pi \tag{2.3}$$

When potential injurers decide to become informed, they face classification risk. The social value of information takes classification risk into account.[7]

An important issue is how to measure classification risk. For a risk-averse individual with wealth w facing a risk ξ, the Arrow-Pratt risk premium is defined by $E\{u(w + \xi)\} = u(w + E(\xi) - \rho)$. We can apply this concept to measure classification risk. For an informed type i individual, let $\bar{w}_i$ be expected wealth given the tort rule, the expenditure on care and insurance coverage (if any). The individual's expected utility can then be written as $U_i(z_i) = u(\bar{w}_i - \rho_i)$, where ρ_i is the risk premium for the residual uninsured risk. The risk premium is zero if there is no residual risk, so $\rho_i = 0$ if the policy is for full coverage or if the individual meets the standard of care under a negligence rule. The classification risk arises from the difference in certainty equivalent wealth, $\bar{w}_i - \rho_i$, of the different types. An individual deciding to become informed faces a lottery over the certainty equivalent wealth levels based on the differing loss severities with probabilities θ_D and θ_S. Then the *ex ante* expected utility of becoming informed can be written as

$$\theta_S u(u(\bar{w}_S - \rho_S) + \theta_D u(\bar{w}_D - \rho_D) = u(\theta_S \bar{w}_S + \theta_D \bar{w}_D - \theta_D \rho_D - \theta_S \rho_S - \rho). \quad (2.4)$$

The risk premium ρ provides a measure of the classification risk.

Under a strict liability rule, victims are fully compensated for any losses regardless of whether potential injurers are informed; this implies that potential victims' expected utility is constant. Since the insurance market is competitive, firms earn zero expected profit. Then the change in social welfare when potential injurers become informed is the change in the expected utility of potential injurers, I. Under the strict

[7] We would like to thank Mike Hoy for pointing out the importance of accounting for the cost of classification risk.

liability rule, the social and private values of information are the same. This implies that potential injurers always make the socially optimal decision about whether to become informed.

Under a negligence rule, the private and social values of information are not the same. Under a negligence rule, informed potential injurers meet the negligence standard and are not liable for damages. This implies that victims are not compensated. If potential injurers become informed, the expected utility of potential victims is reduced by the amount of expected losses. Then the social value of information is $\Sigma = I - \theta_S \pi(\hat{x}_S) d_S - \theta_D \pi(\hat{x}_D) d_D$. The private value of information is always greater than the social value of information. The difference is that, under strict liability, potential injurers internalize expected damages, while under negligence they do not.

We need a way to determine when the social value of information is positive, that is, when social welfare increases. We want a method that applies if the change is not a Pareto improvement. A change is a potential Pareto improvement if the gains to the "winners" are sufficiently large that they could potentially compensate the "losers". This leads us to use the Kaldor-Hicks criterion. Let x_i denote the level of care chosen by informed potential injurers, $i = S, D, U$. Let ρ denote the cost of classification risk. Let $K(x_S, x_D, x_U)$ denote the Kaldor-Hicks criterion, which is equal to the change in wealth of the potential injurers plus the change in wealth of the potential victims.[8] The cost of care and the cost of classification risk are always born by potential injurers. Whether the expected cost of accidents is born by potential injurers or by potential victims depends on

[8] The Kaldor-Hicks criterion involves interpersonal utility comparisons. The Kaldor-Hicks criterion assumes that a dollar gain to person A has the same social value as a dollar gain to person B. This is true whether the parties are risk neutral or risk averse. We use the certainty equivalent income of potential injurers (include the classification risk premium) to account for potential injurers' risk aversion.

the tort rule in place, however, they are always born by someone. Calculating the change in expected wealth of both potential injurers and potential victims when potential injurers become informed, the Kaldor-Hicks criterion is satisfied if

$$K(x_S, x_D, x_U) = \bar{a}(x_U) - \theta_S a_S(x_S) - \theta_D a_D(x_D) - \rho \qquad (2.5)$$

$$= A(x_S, x_D, x_U) - \rho$$

is non-negative. For this to be the case, the savings in total expected accident costs resulting from potential injurers becoming informed must be greater than the cost of the classification risk. The savings in total expected accident costs is always positive, so $K < 0$ if the cost of classification risk is sufficiently high.

This leads to our first result:

> Proposition 1: Assume potential injurers are risk averse and that insurance is available at actuarially fair prices. Then (*a*) under both strict liability and negligence, the social value of information is positive (negative) as the savings in total expected accident costs as greater than (less than) the cost of classification risk ($\Sigma \gtrless 0$ as $A \gtrless \rho$), (*b*) under strict liability, the social and private value of information are the same ($\Sigma = I$) and (*c*) under negligence, the private value of information is greater than the social value of information ($I > \Sigma$).

The risk aversion of potential injurers leads to classification risk being costly, and to the possibility that the social value of information may be negative. If potential injurers are risk neutral, as in Shavell and Kaplow-Shavell, then $\rho = 0$ and the social value of information is positive.

The Kaldor –Hicks criterion also raises the question of who the "winners" and "losers" are if potential injurers become informed. If the private value of information is

positive, then potential injurers are "winners".[9] This is straightforward, potential injurers only become informed if doing so makes them better off. Whether potential victims are worse off depends on the liability rule. Under strict liability, victims are fully compensated for damages, so their expected wealth is the same whether potential injurers become informed or not. This is a reflection of the equality of the private and social value of information under strict liability. Under a negligence rule, victims are not compensated if the injurer meets the standard of care. Then potential victims may be made worse off if potential injurers become informed. Let V_1 and V_0 denote the expected utility of potential victims when potential injurers are informed and not informed, respectively. Then

$$V_1 - V_0 = \theta_S[\pi(\hat{x}_U) - \pi(\hat{x}_S)]d_S + \theta_D[\pi(\hat{x}_U) - \pi(\hat{x}_D)]d_D. \quad (2.6)$$

The first term is negative and the second term is positive. Potential victims are better off or worse off as the expected damages they face decrease or increase.

We assume throughout the analysis that there is no financial cost to acquiring information. If there is a financial cost, c, then it is born by potential injurers along with cost of classification risk and it can be incorporated in the analysis. In that case, the cost of classification risk, ρ, is replaced by the financial cost plus the cost of classification risk, $c + \rho$. This clearly reduces both the social and private values of information, but otherwise does not have a significant impact on our analysis.

[9] Of course, after the fact, potential injurers who learn that their activity is dangerous are worse off.

3. THE VALUE OF INFORMATION AND LEVEL OF CARE UNDER STRICT LIABILITY.

Under a strict liability rule, injurers are responsible for the damages they cause, whether or not they are informed about the risks. Kaplow-Shavell and Shavell show that, if potential injurers are risk neutral, then the private and social value of information are the same, injurers choose to become informed and choose the optimal level of care given their potential damages.

First, suppose that insurance is not available. Then expected utility for an informed individual is

$$U_i(x) = (1 - \pi(x))u(w - x) + \pi(x)u(w - x - d_i),\ i = D, S. \tag{3.1}$$

Let $\hat{x}_i$ be the level of care that maximizes expected utility. An uninformed individual knows the activity may be safe with probability θ_S or dangerous with probability θ_D. Then expected utility for an uninformed potential injurer is

$$U_U(x) = \theta_S U_S(x) + \theta_D U_D(x); \tag{3.2}$$

If we let $\hat{x}_U$ maximize expected utility for the uninformed person, then the social and private value of information is

$$I = \theta_S U_S(\hat{x}_S) + \theta_D U_D(\hat{x}_D) - U_U(\hat{x}_U) \tag{3.3}$$

$$= \theta_S[U_S(\hat{x}_S) - U_S(\hat{x}_U)] + \theta_D[U_D(\hat{x}_D) - U_D(\hat{x}_U)] > 0.$$

That is, under a strict liability rule, risk averse but uninsured individuals have an incentive to become informed. However, $\hat{x}_i$, the level of care that a potential injurer chooses once becoming informed, is not, in general, equal to the socially optimal level of care, x_i*. The socially optimal level of care, x_i*, minimizes total expected accident costs and is the level of care that would be chosen by a risk neutral potential injurer. The level

of care, $\hat{x}_i$, chosen by risk averse potential injurers may be either greater than or less than x_i* (Jullien, Salanie and Salanie, 1999).

This proves the following result:

> Proposition 2: Assume a strict liability rule and that insurance is not available. Then (*a*) the social and private values of information are equal and positive and (*b*) in general, individuals choose levels of care that are not socially optimal.

Proposition 2 implies that potential injurers' risk aversion does not, by itself, lead individuals to remain uninformed about risks. However, risk aversion does affect the levels of care that informed potential injurers choose.

Now suppose that liability insurance is available and insurers offer a linear policy. Then expected utility for an informed individual is

$$U_i(p, q_S, q_D, x) = (1 - \pi(x))u(w - p - x) + \pi(x)u(w - p - x - d_i + q_i) \tag{3.4}$$

for $i = D, S$. The actuarially fair premium is $p_i = \pi(x)q_i$. Then the individual fully insures, chooses care to minimize their total expected accident cost given the potential damages and obtains expected utility $u(w - a_i(x_i^*))$.

Again, an uninformed individual's activity may be safe with probability θ_S or dangerous with probability θ_D, so that expected utility is

$$U_U(p, q_S, q_D, x) = \theta_S U_S(p, q_S, q_D, x) + \theta_D U_D(p, q_S, q_D, x) \tag{3.5}$$

The actuarially fair premium is $p_U = \pi(x)(\theta_S q_S + \theta_D q_D)$. The uninformed individual fully insures, $q_S = d_S$ and $q_D = d_D$. They choose the level of care, $\bar{x}^*$, to minimize the total expected accident cost, $\bar{a}(x)$, and obtain expected utility $u(w - \bar{a}(\bar{x}^*))$.

The social and private value of information is

$$I_L = \{\theta_S u(w - a_S(x_S^*)) + \theta_D u(w - a_D(x_D^*))\} - u(w - \bar{a}(\bar{x}^*)), \tag{3.6}$$

where the subscript "*L*" denotes the strict liability rule. In general, the value of information may be either positive or negative. The term in braces can be written as $u(w - \theta_S a_S(x_S^*) - \theta_D a_D(x_D^*) - \rho_L)$, where ρ_L is a risk premium. The decision to become informed exposes the uninformed to classification risk. The risk premium ρ_L provides a measure of the degree of classification risk, which is a private cost of becoming informed. Then the social and private value of information is negative if, and only if,

$$\theta_S a_S(x_S^*) + \theta_D a_D(x_D^*) + \rho_L > \bar{a}\,(\bar{x}^*) \tag{3.7}$$

The left hand side of the inequality is the average total expected accident cost for informed potential injurers plus the classification risk premium, while the right-hand side is the total expected accident cost for the uninformed. This inequality holds if the savings in social total expected accident costs, *A*, is less than the classification risk premium ρ_L. If individuals remain uninformed, then safe and dangerous types are pooled and the classification risk is avoided.

This proves the following result:

> Proposition 3: Assume a strict liability rule and that insurance is available. Then (*a*) the social and private values of information are equal and may be either positive or negative, (*b*) the social and private value of information is negative if, and only if, in total expected accident costs is less than the classification risk premium ($\Sigma_L = I_L < 0$ if, and only if $A < \rho_L$), and (*c*) individuals choose levels of care that are socially optimal given their information.

Comparing Propositions 2 and 3, it is clear that the possibility that the social and private value of information may be negative under a strict liability rule is due to availability of liability insurance.

However, the simple linear policy does not fully utilize all of the information available to insurers.[10] By improving the policy design, it is possible to achieve a first best outcome under a strict liability rule. Consider the policy where all individuals pay the premium

$$p = \theta_S \pi_S(x_S^*) d_S + \theta_D \pi_D(x_D^*) d_D + \theta_D(x_D^* - x_S^*). \tag{3.8}$$

If there is an accident, then injurers are indemnified q_D if $x \geq x_D^*$, are indemnified q_S if $x_S^* \leq x < x_D^*$ and are indemnified zero if $x < x_S^*$. In addition, the insured receive a rebate of $(x_D^* - x_S^*)$ if they become informed and choose $x \geq x_D^*$. Under this policy informed potential injurers choose full coverage, and choose the socially optimal level of care given their type. This implies that all informed potential injurers have riskless net wealth $w - \theta_S a_S(x_S^*) - \theta_D a_D(x_D^*)$; the structure of the policy eliminates the classification risk Expected utility for the uninformed is given by (3.5). Again, the uninformed individual fully insures ($q_S = d_S$ and $q_D = d_D$), chooses the level of care, $\bar{x}^*$, and obtains expected utility $u(w - \bar{a}(\bar{x}^*))$. Since $A = \bar{a}(\bar{x}^*) - \theta_S a_S(x_S^*) - \theta_D a_D(x_D^*)$ is positive and $\rho = 0$, the value of information is positive.

This proves the following result:

> Proposition 4: Assume a strict liability rule, that insurance is available and the policy is described in the preceding paragraph. Then (*a*) the social and private values of information are equal and positive and (*b*) individuals choose levels of care that are socially optimal.

The difference in results between Proposition 3 and Proposition 4 is due to the structure of the insurance policies. An insurance policy can be designed that leads to a first best outcome under the strict negligence rule. The effect of insurance on the value of

[10] We would like to thank the referee for pointing this out.

information depends not only on the availability of information, but also on the design of the insurance policy.

4. THE VALUE OF INFORMATION AND LEVEL OF CARE UNDER ALTERNATIVE NEGLIGENCE STANDARDS.

Under a negligence rule, injurers are responsible for the damages they cause if they fail to exercise the appropriate amount of care. In this section we consider incentives to obtain information about risk and to take care under several alternative negligence rules, including "complete" negligence, "conditional" negligence, "unconditional" negligence and "actual information" negligence. These negligence rules differ by the informational requirements they impose on potential injurers.

4.1 Complete Negligence.

Under Shavell's (1992, p. 260) "complete" negligence rule, the due care requirement is more broadly defined to include an obligation to become informed. Thus, under this type of rule, courts will find injurers negligent if they fail to become informed, regardless of their actual level of care. This rule would seem to provide strong incentives for individuals to become informed.

We assume that the negligence standard is set equal to the socially optimal level of care for each type. If potential injurers become informed, then they meet the negligence standard, are not responsible for damages, and obtain expected utility $u(w - x_i^*)$, $i = D, S$. If individuals remain uninformed, the outcome is the same as under the strictly liability rule, since they will be held responsible for any damages they cause. We initially assume that insurance is not available. Then, expected utility for the uninformed is again given by (3.2), and the private value of information is

$$I = \theta_S u(w - x_S^*) + \theta_D u(w - x_D^*) - U_U(\hat{x}_U) \tag{4.1}$$

$$= \theta_S[u(w - x_S^*) - U_S(\hat{x}_U)] + \theta_D[u(w - x_D^*) - U_D(\hat{x}_U)] > 0.$$

The private value of information is positive since $\hat{x}_U$ is not optimal for either U_S or U_D. The Kaldor-Hicks criterion is

$$K(x_S^*, x_D^*, \hat{x}_U) = \bar{a}(\hat{x}_U) - \theta_S a_S(x_S^*) - \theta_D a_D(x_D^*) - \rho, \tag{2.5}$$

which may be positive or negative. Potential injurers become informed even though it may not be socially desirable for them to do so.

Then we have the following result, similar to the strict liability rule:

Proposition 5: Assume a complete negligence rule and that insurance is not available. Then (*a*) the social value of information may be positive or negative and is less than the private value of information, (*b*) the private value of information is positive and (*c*) individuals choose levels of care that are socially optimal given that they have become informed.

Now we assume that liability insurance is available. Uninformed individuals are still responsible for any damages they cause, and with insurance, their expected utility is:

$$U_U(p, q_S, q_D, x) = \theta_S U_S(p, q_S, q_D, x) + \theta_D U_D(p, q_S, q_D, x) \tag{3.5}$$

The actuarially fair premium is $p_U = \pi(x)(\theta_S q_S + \theta_D q_D)$. Uninformed individuals fully insure, $q_S = d_S$ and $q_D = d_D$, choose the level of care $\bar{x}^*$, and obtain expected utility $u(w - \bar{a}(\bar{x}^*))$.

With the complete negligence rule, the private value of information is:

$$I_C = \{\theta_S u(w - x_S^*) + \theta_D u(w - x_D^*)\} - u(w - \bar{a}(\bar{x}^*)), \tag{4.2}$$

where the subscript "*C*" denotes the complete negligence rule. Again, the private value of information may be either positive or negative. The term in braces can be written as $u(w - \theta_S x_S^* - \theta_D x_D^* - \rho_N)$, where ρ_N is a risk premium that captures the classification risk

under a negligence rule. Then the necessary and sufficient condition for the private value of information to be negative is

$$\theta_S x_S^* + \theta_D x_D^* + \rho_N > \bar{a}\,(\bar{x}^*) \tag{4.3}$$

The left-hand side is the average expenditure on care by informed potential injurers plus the classification risk premium, while right-hand side is the total expected accident cost for the uninformed. The Kaldor-Hicks criterion is

$$K(x_S^*, x_D^*, \bar{x}^*) = A(x_S^*, x_D^*, \bar{x}^*) - \rho_N, \tag{2.4}$$

Since uninformed potential injurers choose the socially optimal level of care, the availability of insurance decreases the savings in total expected accident costs. This tends to reduce the social value of information.

This leads to the following result:

> Proposition 6: Assume a complete negligence rule and that insurance is available. Then (a) the social value of information is less than the private value of information and may be positive or negative, but the availability of insurance reduces the social value of information, (*b*) the private value of information may be either positive or negative, (*c*) the private value of information is negative if, and only if, average expenditure on care plus the cost of classification risk is greater than the total expected accident cost of the uninformed ($I_C < 0$ if, and only if, (4.3) holds) and (*d*) individuals choose levels of care that are socially optimal given their information.

As under the strict liability rule, the possibility that the private value of information may be negative is due to the availability of liability insurance. However, informed individuals are better off under the complete negligence rule than under the strict liability rule. Consequently, the value of information is higher under the complete negligence rule than under strict liability, $I_C > I_L$. This is consistent with the results of Kaplow-Shavell that negligence provides stronger incentives to become informed than strict liability.

However, since the private value of information can be negative under the complete negligence rule, it does not follow that the incentives are socially excessive.

4.2 Unconditional Negligence.

As Shavell points out, there are other possible negligence rules depending on how potential injurers' decisions to obtain information are incorporated. One possibility is that the negligence standard is based on the level of care that is socially optimal, conditional on socially optimal acquisition of information. We refer to this as the "conditional" negligence rule because the negligence standard is conditional on the social value of information. Another possible rule is based on the optimal level of care assuming that information is always obtained (whether or not it is optimal to do so). We refer to this as the "unconditional" negligence rule.[11] We examine the unconditional negligence rule first and then the conditional negligence rule.

If potential injurers become informed, then they meet the negligence standard and obtain expected utility $u(w - x_i^*)$, $i = D, S$. Now consider uninformed potential injurers. Since $x_S^* < x_D^*$, if the potential injurer chooses to spend less than x_S^* on care, the injurer is always negligent. If the potential injurer chooses to spend between x_S^* and x_D^*, the injurer is only negligent if damages are d_D. If the potential injurer spends at least x_D^*, the injurer is never negligent. The *ex ante* probability that an uninformed potential injurer will be negligent is then

$$\Pi(x) = \begin{cases} \pi(x) & \text{if } x < x_S^* \\ \theta_D \pi(x) & \text{if } x_S^* \le x < x_D^* \\ 0 & \text{if } x_D^* \le x \end{cases} \qquad (4.4)$$

[11] This is the negligence rule considered in Kaplow-Shavell and Crocker-Doherty.

Crocker-Doherty and Bajtelsmit-Thistle (2007) show that an uninformed potential injurer will fully insure ($q_S = d_S$ and $q_D = d_D$) and choose a level of care $x_S^* \leq \hat{x}_U < \bar{x}^*$. Then expected utility for uninformed potential injurers is $u(w - \hat{x}_U - \theta_D\pi(\hat{x}_U)d_D)$. The private value of information is then

$$I_{UN} = \{\theta_S u(w - x_S^*) + \theta_D u(w - x_D^*)\} - u(w - \hat{x}_U - \theta_D\pi(\hat{x}_U)d_D) \qquad (4.5)$$

The value of information is then negative if, and only if,

$$\theta_S x_S^* + \theta_D x_D^* + \rho_N > \hat{x}_U + \theta_D\pi(\hat{x}_U)d_D \qquad (4.6)$$

The expression of the left-hand side of the inequality is the same as for the complete negligence rule, while the expression on the right-hand side is the total expected accident cost for the uninformed.

This yields the following result:

> Proposition 7: Assume an unconditional negligence rule and that insurance is available. Then (*a*) the social value of information may be either positive or negative and is less than the private value of information, (*b*) the private value of information is negative if, and only if, the average expenditure on care by the informed plus the classification risk premium is greater than the private expected accident cost for the uninformed ($I_{UN} < 0$ if, and only if, (4.6) holds), (*c*) informed individuals choose levels of care that are socially optimal given their information and (*d*) uninformed individuals choose levels of care that are too low given their information.

4.3 Conditional Negligence.

Under the conditional negligence rule, the negligence standards are conditional on the social value of information. If the value of information is positive, then the negligence standards are x_S^* and x_D^* for safe and dangerous types, respectively. If the value of information is negative then the negligence standard is $\bar{x}^*$.

However, under the conditional negligence rule the value of information is always non-negative. Let Σ_{CN} denote the value of information under the conditional negligence rule. Suppose first that the value of information is non-negative. Then the analysis is the same as for the unconditional negligence rule and $\Sigma_{CN} = \Sigma_{UN}$. Now suppose that the value of information is negative; this implies the negligence standard is $\bar{x}^*$. Then both the informed and uninformed choose care $\bar{x}^*$ and the value of information is zero. This contradicts the assumption that the value of information is negative. Consequently, we have $\Sigma_{CN} = \max\{0, \Sigma_{UN}\} \geq 0$. By the same argument, $I_{CN} = \max\{0, I_{UN}\} \geq 0$. Then individuals become informed and choose the socially optimal levels of care.

> Proposition 8: Assume a conditional negligence rule and that insurance is available. Then (a) the social value of information is not greater than the private value of information, (*b*) the social and private values of information are non-negative and (*c*) individuals choose levels of care that are socially optimal

.

4.4 Actual Information Negligence.

Another possible negligence rule sets the standard of care to the level that is socially optimal given the information that the individual actually possesses. We refer to this as the "actual information" negligence rule. Under this negligence rule, informed individuals choose the level of care x_i^* and obtain expected utility $u(w - x_i^*)$. Uninformed individuals choose the level of care $\bar{x}^*$ and obtain expected utility $u(w - \bar{x}^*)$. Because both informed and uninformed potential injurers meet the appropriate standard of care, the availability or unavailability of liability insurance is irrelevant. Then the private value of information is:

$$I_A = \{\theta_S u(w - x_S^*) + \theta_D u(w - x_D^*)\} - u(w - \bar{x}^*). \qquad (4.7)$$

Again, the private value of information may be either positive or negative. The necessary and sufficient condition for the value of information to be negative is

$$\theta_S x_S^* + \theta_D x_D^* + \rho_N > \bar{x}^* \qquad (4.8)$$

The following proposition summarizes these results:

> Proposition 9: Assume an actual information negligence rule. Then (*a*) the social value of information is less than the private value of information and may be either positive or negative, (b) the private value of information may be positive or negative, (*c*) the private value of information is negative if, and only if, the average expenditure on care by the informed plus the classification risk premium is greater than the expenditure on care by the uninformed ($I_A < 0$ if, and only if, (4.8) holds)and (*d*) individuals choose levels of care that are socially optimal given their information.

This is essentially the result obtained by Shavell for the actual information rule where potential injurers are risk neutral. The inequality in (4.8) implies that, if the optimal level of care is a convex function of damages, then the private value of information is negative.[12]

Both the complete and absolute information negligence rules require that the courts determine whether injurers are informed. The social value if information under the actual information negligence rule is negative if $A(x_S^*, x_D^*, \bar{x}^*) < \rho_N$. This is the same as under the complete negligence rule. The uninformed are better off under the absolute information rule, hence, $I_A < I_C$, the private value of information is lower under the absolute information negligence rule than under the complete negligence rule. .

[12] The optimal level of care is convex as a function of damages if, and only if, $tx^*(d_1) + (1 - t)x^*(d_2) > x^*(td_1 + (1 - t)d_2)$. In particular, if optimal care is convex in damages then $\theta_S x^*(d_S) + \theta_D x^*(d_D) > x^*(\theta_S d_S + \theta_D d_D) = x^*(\bar{d})$. The private value of information is positive if the inequality in (4.8) is reversed. This is equivalent to requiring that the optimal level of care be "sufficiently" concave as a function of damages.

5. CONCLUSIONS

Tort law provides incentives for individuals to exercise care to avoid injuring others. Tort law also provides incentives for individuals to learn about the risks that they may impose on others. Since insurance is widely used to manage liability risks, it is important to understand how insurance interacts with tort law and how it affects the incentives to obtain information about risks.

We show that, when potential injurers are risk averse and insurance is available, then the social value of information may be positive or negative. The decision to become informed creates classification risk, a lottery over the *ex ante* unknown expected cost of accidents. This classification risk is a social cost of information. We show the social value of information is positive if the Kaldor-Hicks criterion is met, that is, if the savings in total expected accident costs are greater than the costs of classification risk. We show that the private and social value of information are the same under strict liability, but the private value of information is greater than the social value under a negligence rule.

The availability of insurance changes the incentives for potential injurers to learn about risks they may create. The private value of information about risks may, in general, be either positive or negative. Potential injurers may choose levels of care that are not socially optimal, even given their information. The advantage of obtaining information is that it allows potential injurers to make more efficient choices of how much to invest in care. For risk averse individuals, classification risk is a private cost of deciding to become informed. Remaining uninformed and purchasing insurance allows potential injurers to hedge both the classification risk and the underlying liability risk.

Whether the efficiency effect or the hedging effect is stronger determines whether the private value of information is positive or negative.

We show that, under the strict liability rule, the private value of information about the severity of a risk is positive when insurance is not available, but potential injurers do not choose optimal levels of care. When insurance is available, the value of information about risk severity may be positive or negative and potential injurers choose levels of care that are socially optimal given their information. In effect, the availability of insurance may make a potential injurer less likely to seek legal advice. However, insurance policies can be designed that eliminate the classification risk, in which case the the social and private values of information are positive.

Under a negligence rule, the private value of information to risk averse potential injurers is positive when insurance is not available. When insurance is available, the private value of information may be positive or negative. We derive the conditions under which it is negative. The exception is the conditional negligence rule, where the social and private values of information are always non-negative. Under a negligence rule, when insurance is available, potential injurers choose levels of care that are socially optimal. The exception is the unconditional negligence rule, where uninformed potential injurers choose suboptimal levels of care.

There are a number of other factors that could affect the value of information that are not considered in our analysis. We assume that insurance is available at actuarially fair prices. If insurance premiums contain a loading and are actuarially unfair, then potential injurers buy less than full coverage. This would increase the value of information under some negligence rules. We also assume that the courts and insurance

companies can determine whether or not individuals are informed. If insurance companies cannot determine whether potential injurers are informed, then informed high risk individuals may have an incentive to mimic the uninformed. This may lead to adverse selection problems in the insurance market, changing the insurance contracts that are available. It may be the case that the courts can determine the level of care, but that insurance companies cannot condition policies on this information. If so, then moral hazard problems arise in the insurance market. We have assumed that the courts work perfectly, in particular, that the negligence rules are applied without error. Courts do in fact make errors, and legal errors weaken the incentive effects of tort law. All of these factors are likely to reduce the private value of information. Finally, we assume that the information that potential injurers obtain is perfect. If the information is noisy, then the value of information will be lower and the choice of the investment in care is likely to be affected. Even if some or all of these additional considerations are taken into account, the availability of liability insurance will affect the incentives created by the tort law to obtain information about risk and to invest in care.

References

Aalberts, Robert, David Hames, and Paul Thistle (2008) Detours and Frolics on the Internet: Employer Liability and Management Control of Cybertorts. *Journal of Business Research*, 62: 1335-1341.

Aalberts, Robert, Percy Poon, and Paul Thistle (2010) A Tale of Two Internet Service Providers: A Risk Management Perspective. *Communications of the ACM*, 53: 119-123.

A.M. Best, (2008) *Best's Aggregates and Averages, Property/Casualty, United States and Canada.* Oldwick, N.J. : A.M. Best Co.

Bajtelsmit, Vickie, and Paul Thistle, (2007) Negligence, Ignorance and the Demand for Liability Insurance. Proceedings of the Risk Theory Society, http://www.aria.org/rts/proceedings/2007/default.htm.

Bajtelsmit, Vickie, and Paul Thistle, (2008) The Reasonable Person Negligence Standard and Liability Insurance. *The Journal of Risk and Insurance*, 75(4): 815-823.

Bajtesmit, Vickie, and Paul Thistle, (2009) Negligence, Ignorance and the Demand for Liability Insurance. *Geneva Risk and Insurance Review*, 34:105-116.

Bajtelsmit, Vickie, and Paul Thistle, (2013) Mistakes, Negligence and Liability. Working Paper.

Black, Bernard, Brian Cheffins, and Michael Klausner (2005) Liability Risk for Outside Directors: A Cross-Border Analysis. *European Financial Management*, 11: 153-171

Black, Bernard, Brian Cheffins, and Michael Klausner (2006) Outside Director Liability. *Stanford Law Review*, 58: 1055-1160.

Cremer, Jacques, and Fahad Khalil, (1994) Gathering Information Before the Contract is Offered: The Case with Two States of Nature. *European Economic Review*, 38: 675-682

Crocker, Keith, and Neil Doherty (2000) Why People Buy Liability Insurance Under the Rule of Simple Negligence. in M.R. Baye (ed.) *Advances in Microeconomics*: *Industrial Organization*, Amsterdam, Elsevier Science.

Crocker, Keith, and Art Snow (1992) The Social Value of Hidden Information in Adverse Selection Economies. *Journal of Public Economics*, 48, 317-347.

Crocker, Keith, and Art Snow (2013) The Theory of Risk Classification. *Handbook of Insurance*, G. Dionne (ed.),New York: Springer.

Doherty, Neil, and Paul Thistle (1996) Adverse Selection with Endogenous Information in Insurance Markets. *Journal of Public Economics*, 63, 83-102.

Fagart, Marie-Cecile, and Claude Fluet (2009) Liability Insurance Under the Negligence Rule. *RAND Journal of Economics,* 40(3): 486-508.

Hoy, Michael (1982) "Categorizing Risks in the Insurance Industry," *Quarterly Journal of Economics*, 97: 321-336.

Hua, Xinyu, (2011) Product Recall and Liability. *Journal of Law, Economics, and Organization*, 27: 113-136.

Hyman, David, Bernard Black, Kathry Zeiler, Charles Silver and William Sage (2007) "Do Defendants Pay What Juries Award? Post-Verdict Haircuts in Texas Medical Malpractice Cases, 1988-2003." *Journal of Empirical Legal Studies*, 4: 3-68.

Jullien, Bruno, Bernard Salanie, and Francois Salanie (1999) "Should Risk Averse Agents Exert More Effort?" *Geneva Papers on Risk and Insurance Theory*, 24, 19-28.

Kaplow, Louis (1994) The Value of Accuracy in Adjudication: An Economic Analysis. *Journal of Legal Studies*, 23: 307-401.

Kaplow, Louis, and Steven Shavell (1992) Private versus Socially Optimal Provision of Ex Ante Legal Advice. *Journal of Law Economics and Organization*, 8, 306-320.

Kaplow, Louis, and Steven Shavell (1996), Accuracy in the Assessment of Damages. *Journal of Law and Economics*, 39: 191-210.

Ligon, James, and Paul Thistle (1996a) Information Asymmetries and Informational Incentives in Monopolistic Insurance Markets *Journal of Risk and Insurance*, 63, 434-459.

Ligon, James, and Paul Thistle (1996b) Consumer Risk Perception and Information in Insurance Markets with Adverse Selection. *Geneva Papers on Risk and Insurance Theory*, 21, 191-210.

Matthews, Steven, and Andrew Postlewaite. (1985) Quality Testing and Disclosure. *Rand Journal of Economics* 16, 328-340.

Nosal, Ed. (2006) Information Gathering by a Principal. *International Economic Review*, 47: 1093- 1111.

Polinski, A. Mitchell and Steve Shavell (2012) Mandatory versus Voluntary Disclosure of Product Risks. *Journal of Law Economics and Organization*, 28, 360-379.

Shavell, Steven. (1982) On Liability and Insurance. *Bell Journal of Economics*, 13, 120-132.

Shavell, Steven. (1987) *Economic Analysis of Accident Law*, Cambridge,MA: Harvard University Press.

Shavell, Steven. (1992) Liability and the Incentive to Obtain Information About Risk. *Journal of Legal Studies*, 21, 259-270.

Silver, Charles, Kathryn Zeiler, Bernard Black, David Hyman, and Willaim Sage (2008) "Malpractice Payouts and Malpractice Insurance: Evidence from Texas Closed Claims, 1990-2003," *Geneva Papers on Risk and Insurance Issues and Practice*, 33: 177-192.

Viscusi, W. Kip. (1978) A Note on "Lemons" Markets With Quality Certification. *Bell Journal of Economics* 9, 7-279.

Zeiler, Kathryn, Charles Silver, Bernard Black, David Hyman, and William Sage (2008) Physician's Insurance Limits and Malpractice Payments: Evidence from Texas Closed Claims, 1990-2003. *Journal of Legal Studies*, 36: 9-45.

Table 1 Summary of the Related Theoretical Literature

Authors (Journal)	Insurance Market	Legal Rule(s) Considered	Negligence Standard	Risk Aversion	Type of Information	Prob. of Loss Depends on:	Insurers Observe:	Legal Error	Cost of Info	Cost of Care	Main Findings Related to Insurance Demand
Bajtelsmit & Thistle (this paper)	Yes Competitive	SL Negligence	Many variations	RA injurers RN victims	Risk Type Care	Care Type	Care	No	0	Same for all	When insurance is available, both the social and private value of information may be negative. Under strict liabiltiy, the social and private values of information are equal, but under negligence rules, the private value is greater.
Bajtelsmit & Thistle (*JRI*, 2008)	Yes Competitive	Negligence	Uniform	RA injurers RN victims	N/A	Care or Type	Care or Risk Type	No	N/A	Same Hi/Low	With a uniform negligence standard and heterogeneity of risk type and cost of care, those who are low risk or low cost will be negligent and buy insurance; those who are high risk or high cost will insure.
Bajtelsmit & Thistle (*GRIR*, 2009)	Yes Competitive	Negligence	Uniform	RA injurers RN victims	Frequency (=Risk Type)	Care Type	Care	No			If insurers cannot observe the information statu of potential injurers, adverse selection results. The value of information is positive when insurers can screen on information status.
Bajtelsmit & Thistle (Working Paper, 2013)	Yes Competitive	SL Negligence	Uniform	RA injurers RN victims	N/A	Mistakes by Self or Others	Care*	No			Under strict liability, the possibility of mistakes increases the probability of loss, but does not change the outcome. Under negligence, potential injurers will buy insurance and take too little care.
Crocker & Doherty (*IO*, 2000)	Yes Competitive	Negligence	Depends on Risk Type	RA/RN injurers RN victims	Severity (=Risk Type)		Pre-Info & Care Post -Type	No	0	Dep on Type	With individualized negligence standard, potential injurers may choose to be uninformed and buy insurance in order to hedge classification risk. Risk neutral potential injurers do not buy insurance.
Fagart & Fluet (*RJE*,2009)	Yes Competitive	Negligence	Due Care	RA injurers RA victims RN insurers	Care	Care	Care Signal *ex post*	Yes- imperfect obs of care			Introduces concept of evidentiary standard (weight of evidence) separate from due care. If contract can only depend on the court outcome, negligence standard results in inefficient allocation of risk bearing and precautionary incentive.
Kaplow & Shavell (*JLE*, 1992)	No	SL Negligence	Uniform	RN injurer	Severity Legal Error	Care	N/A	Yes	>0	>0	Strict liability leads to socially optimal acquisition of information and level of care. Negligence results in too much investment in information. Legal advice about the potential for legal error causes decline in social welfare because the potential injurer may adjust behavior to conform to mistakenly applied rules.
Ligon & Thistle (*JRI*, 1996)	Yes Monopolistic	N/A	N/A			Effort					Where moral hazard distortions are moderate, price quantity contracts can deal with both adverse selection and moral hazard issues. Pre-contract and post-contract information are both valuable to consumers
Shavell (*BJE*,1982)	Yes (both parties) Competitive	SL Negligence	Due Care	RN/RA injurers RN/RA victims	Care	Care	Care	No	0	>=0	If insurers cannot observe effort, policies must offer incomplete coverage to deter moral hazard. If policies depend on effort, risk averse potential injurers will buy complete coverage and take care. Under negligence, risk averse injurers will meet the negligence standard and and not buy insurance.
Shavell (*JLS*, 1992)	No	SL Negligence	Care Info+ Care	RN injurer	Whether there is risk or not	Care	N/A	No	>=0	>=0	Potential injurers will act socially optimally in obtaining information and exercising care under strict liability, complete negligence rule or negligence where level of care presumes optimal knowledge of risk. The incentive to obtain information about risk is inadequate if negligence depends on care that should be taken given actual knowledge and excessive if it depends on optimal care.

Note: *JRI = Journal of Risk and Insurance; BJE = Bell Journal of Economics; GRIR = Geneva Risk and Insurance Review;JLEO = Journal of Law, Economics and Organization, JLS = Journal of Legal Studies; IO = Advances in Microeconomics: Industrial Organization; RJE = Rand Journal of Economics*

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LIABILITY, INSURANCE AND THE INCENTIVE TO OBTAIN INFORMATION ABOUT RISK

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Reply to Editors Comments:

1. We now explicitly state whether the social and private values of information are equal or not in Propositions 2 through 9.

2. We have added a paragraph defining classification risk (p. 11). We have rewritten the paragraph introducing the Kaldor-Hicks criterion (p. 12) to better explain the rational for using it.

Minor points:

Suggested edits in Minor points 1, 2, 3, 6, 8, 9, 10, 11 have all been made

3. We have added a paragraph defining classification risk, pointing out that the classification risk is due to differences in expected certainty equivalent wealth between the two types.

4. As part of the definition of classification risk, we have made it clear that classification risk is not simply due to the availability of insurance.

5. We have added a paragraph (p. 13-14) explaining that, when potential injurers become informed, the potential injurers are the winners and potential victims are the potential losers.

Referee 1:

1. Subscript in equation 3.8 is corrected

2. The missing references in the table have been added to the reference list, the Kaplow and Shavell (JLE) reference is corrected to be (JLEO). The footnote to the table is also corrected to include journals that were missing.

Referee 2:

p. 10: The sentences were edited as suggested.

p. 11, line 7: The sentence has been rewritten and clarified.

p. 11, line 31: The typo has been corrected

p. 11, line 51: We have added a paragraph defining classification risk.

Paragraph after Equation 3.8: The subscript is corrected

p. 21 line 38: The sentence has been edited as suggested.

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*Author biography (100 words max.)

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