

## **Legal Errors and Liability Insurance**

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Thistle's research was supported by the Nevada Insurance Education Foundation.

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### **ABSTRACT**

Intuition suggests that the possibility of legal errors is a source of the demand for liability insurance. We ask whether this intuition is correct. We develop a model where both the buyer and the insurer negotiate contracts with a seller. We show that, in general, an insurance policy must be a part of any equilibrium and that sellers less than fully insure. We provide a more detailed characterization of insurance policies when buyers must offer uniform price contracts. We discuss the situations where insurance exacerbates the welfare loss due to moral hazard and where it does not.

## Legal Errors and Liability Insurance

### 1. Introduction

If the courts never make mistakes, so that there is no uncertainty in the definition or application of the negligence rule, the potential injurer always meets the due care standard and is never liable (Brown, 1973, Shavell, 1982). As a result, the potential injurer bears no risk and therefore has no demand for liability insurance. However, over \$100 billion was spent on insurance against liability arising from negligence in the U.S. in 2005.<sup>1</sup> For the types of liabilities covered by these policies, knowledge of the standard of care would imply that potential injurers could avoid liability by meeting the standard of care.

Both casual empiricism and economic research provide evidence that the courts make mistakes. For example, whether punitive damages are awarded rationally or randomly remains subject to debate. Eisenberg, et. al. (1997) and Eaton (2007) interpret their empirical results implying that punitive damages are awarded rationally but Polinski (1997) argues that their results are consistent with random awards of punitive damages. Helland and Taborrock (2000) show that most of the differences between damages awarded by judges and juries are due to the types of cases tried. Hersch and Viscusi (2004) report that, controlling for the types of cases, juries are more likely to make punitive damage awards and make larger compensatory and punitive damage awards than judges. Viscusi (1999, 2001) examines the effects of cognitive biases of judges and prospective jurors. He provides evidence that judges and prospective jurors

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<sup>1</sup> This figure includes premiums for medical malpractice, the liability portion of commercial multiple peril, commercial auto liability, and the “other liability” portion of commercial general liability insurance. “Other liability” includes coverage for liability resulting from negligence, carelessness, or failure to act. This category includes, among others, professional liability (e.g., accountants, lawyers), directors and officers, errors and omissions and employment practices liability. The premium data are from the Insurance Information Institute.

may misapply the negligence rule and find against non-negligent defendants, especially if damages are large, and that jurors are prone to punish firms for carrying out risk analyses.

Craswell and Calfee (1986) and Shavell (1987) show that uncertainty in standards of due care increases the level of care beyond the socially optimal level. Png (1986) shows that errors in favor of the plaintiff or the defendant increase the sanctions required to achieve socially optimal care. Polinski and Shavell (1989) argue that legal errors reduce deterrence and may increase or decrease plaintiffs incentives to sue. Hylton (1990) analyzes a model where courts make mistakes and litigation is costly, finding that suits are brought even against non-negligent plaintiffs "... in the expectation that damages will be awarded in error." (p. 434). Kaplow and Shavell (1994, 1996) study the effect of errors in assessing liability and damages. Farmer and Pecorino (2000) argue that jury bias reduces the quality of cases that go to trial. Landeo, Nikitin and Baker (2006) find that errors by the courts increase the number of suits filed, decrease the number of trials and reduce the deterrence effect of punitive damages. These studies, and others in the now substantial literature on the effects of legal errors, assume that liability insurance is not available.

It is widely believed that one reason that liability insurance is purchased as protection the possibility of legal errors by the courts. For example, Shavell (2004, p. 265) writes "Thus risk-averse injurers will decide to purchase liability insurance, and the type of insurance that risk-averse injurers will purchase will protect them primarily against being found negligent through some sort of lapse or error." Similarly, Posner (2007, p. 200) in discussing negligence, states "But because courts make mistakes ... there is always some risk to a driver of being adjudged negligent and hence a demand for liability insurance."

The purpose of this paper is to determine whether the risk of legal errors is sufficient to create a market for liability insurance. In order to understand the incentives that lead to a market for insurance when the courts can make mistakes, we must analyze the behavior of three decision makers – potential injurers, potential victims and insurers. For concreteness, we take the potential injurer to be the seller of a product or service which may be of high or low quality. The potential victim is the buyer and may be damaged by a low quality product or by negligent provision of a service. The buyer negotiates a contract with the seller for the purchase of the good or service. The insurer also negotiates a contract with the seller to indemnify the seller if the seller loses a lawsuit. The buyer and the insurer negotiate separately. Given these contracts, the seller chooses the level of care which determines the probability of an “accident” and the buyer then decides whether or not to sue. The outcome of lawsuits is random, depending probabilistically on the state of the world and the seller’s actions.

The paper most closely related to ours is Sarath (1991). Although Sarath (1991) incorporates both insurance and legal uncertainty, he is primarily concerned with incentives for litigation. In contrast, our main focus is on the demand for insurance. Sarath analyzes a principal-agent game between the potential injurer and the potential victim; the insurer is not an active player in the game. He takes the existence and design of the insurance policy as exogenously given.<sup>2</sup> In our analysis the insurer is an active strategic player in the principal-agent game and the insurance contract is endogenous. Sarath assumes insurance is actuarially fairly priced. As is well known, risk-averse individuals will fully insure if insurance is

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<sup>2</sup> Sarath assumes that the insurance premium is perfectly retroactively rated; this form of insurance policy is not common.

actuarially fair. We show that, unless the equilibrium is at zero effort by the seller, the equilibrium insurance policy is not fairly priced and the seller chooses less than full insurance.

The model that we develop in Section 2 is similar that of Shavell (1982), with the addition of legal errors. Since both the buyer and the insurer negotiate contracts with the seller the problem is one of common agency (Bernheim and Whinston, 1986). The model differs from that of Bernheim and Whinston since the potential victim decides whether or not to sue after contracts are negotiated. The existence of equilibrium and the existence of markets for liability insurance are examined in Section 3. We show that if an equilibrium exists, then so does a market for liability insurance. In Section 4 we restrict the contracts that can be offered by the buyer to uniform price contracts. This model includes as special cases the purchase of experience goods and the situation where there is no economic relationship between the potential victim and the potential injurer. We show that equilibrium always exists, and provide a more detailed characterization of insurance policies. In Section 5 we return to the general model and discuss the efficiency of equilibrium. In some situations, the availability of liability insurance increases the welfare loss due to moral hazard. We argue that there are also reasonable situations where the availability of liability insurance does not increase the welfare loss due to moral hazard. Brief concluding remarks are offered in Section 6.

## **2. The model**

To keep the analysis simple and focus on the economics of the problem, we assume there are two states of the world with gross payoffs to the buyer of  $\mathbf{q} = (q_1, q_2)$ , where  $q_2 > q_1$ . The outcome  $q_1$  may be interpreted as receipt of a defective product or negligent performance of a service that results in injury to the buyer. The set of possible actions that the seller can take is

assumed to be  $a \in [a_L, a_H]$  where  $0 \leq a_L < a_H$ . The probability of observing the outcome  $q_i$  if the seller chooses action  $a$  is  $f_i(a)$ . We assume that  $f_2'(a) > 0$  and  $f_2''(a) < 0$  (hence,  $f_1'(a) < 0$ ,  $f_1''(a) > 0$ ) so that greater effort by the seller decreases the likelihood of the bad outcome for the buyer. The contract between the buyer and the seller is  $\mathbf{p} = (p_1, p_2)$ , where  $p_i$  is the payment made to the seller for the product or service when the outcome is  $q_i$ . We assume that the buyer cannot withhold payment. The buyer is assumed to be risk neutral and to have reservation utility level  $\underline{U}_B = 0$ .

Once the outcome  $q_i$  is observed the buyer may decide to file suit against the seller. We assume that the buyer cannot precommit to a decision not to sue. The probability that the seller will be found guilty depends on the outcome and on the seller's action. Any damages awarded to the buyer by the court are binding, and are transferred by the court from the seller to the buyer. Direct side payments between the buyer and the seller are not possible.<sup>3</sup>

The seller may obtain liability insurance against the risk of losing a lawsuit and having to pay damages. The insurance contract is specified as  $\mathbf{t} = (t_0, t_1, t_2)$ , where  $t_0$  is the premium, which is paid in all states of the world, and  $t_i$  is the gross indemnity paid to the seller if the outcome is  $q_i$  and the seller loses the suit. The insurer is risk neutral, and has reservation utility level  $\underline{U}_I = 0$ , that is, the insurer must earn non-negative expected profit.

The seller is assumed to be risk averse and have initial wealth  $w$ .<sup>4</sup> The seller's utility depends on net income after the payment from the buyer, payment of the insurance premium to the insurer, payment of any damage awards, receipt of any insurance indemnity, and the cost of

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<sup>3</sup> These assumptions rule out the possibility of out of court settlements, and therefore rule out the possibility that suits will be initiated to obtain out of court settlements.

<sup>4</sup> We assume throughout that the seller's initial wealth is sufficient to pay any damages awarded by the court, in order to abstract from the problem of "judgment-proof" defendants (Shavell, 1986).

action  $a$ . If the seller chooses action  $a$  and receives net income  $y$ , the seller's utility is  $u(y) - a$ , where  $u' > 0$  and  $u'' < 0$ . The seller's reservation utility level is  $\underline{U}_S$ .

The timing of decisions and events in the model is as follows. First, contracts are agreed upon; the buyer and seller agree to the contract  $p$ ; the insurer and seller agree to the contract  $t$ ; and the seller pays the premium  $t_0$ . The operation of the legal system is assumed to be common knowledge. Given the contracts, the seller chooses action  $a$ . The state of nature is realized and the buyer makes payment  $p_i$  to the seller. The buyer then decides whether to sue the seller based on a private signal regarding the probability of winning the suit. If a suit is filed, the buyer pays litigation cost  $L > 0$  and the court decides whether the seller is negligent based on the outcome  $q_i$  and the seller's action  $a$ . If the seller is found to be negligent, then the court transfers damages  $d_i$  from the seller to the buyer, and the insurer pays the indemnity  $t_i$  to the seller.

*2.1. Legal errors.* Given the outcome  $q_i$  and action  $a$ , the court determines whether or not the seller is negligent. The probability that the seller loses the suit is  $g_i(a)$ . Under a strict liability rule,  $g_i(a)$  is independent of  $a$ , and, if there are no legal errors, then  $g_1 = 1$  and  $g_2 = 0$ . Under a negligence rule, the seller is negligent if they breach their duty of care to the buyer and, as a result, the buyer suffers damages. If the standard of due care is  $\bar{a}$  and there are no legal errors, then  $g_2(a) = 0$  for all  $a$  and  $g_1(a) = 1$  if  $a < \bar{a}$  and  $g_1(a) = 0$  if  $a \geq \bar{a}$ .

Legal errors may arise from imperfect observability of the seller's action or from variation in how the due care standard is applied from case to case. In general,  $g_i(a)$  will depend on both the buyer's outcome and the seller's action. We assume that  $g_1(a) > g_2(a)$ , that  $g_i'(a) < 0$ ,  $g_i''(a) > 0$ , and that the  $g_i$  are bounded away from both one and zero. For a given level of effort by the seller, the probability of being found negligent is higher when the bad outcome occurs and increasing effort decreases the likelihood of being found negligent for either

outcome. If the seller loses the suit, the court awards damages of  $d_i$ , which is transferred to the buyer. We assume  $d_1 \geq d_2 > L > 0$ .

The buyer decides whether to file suit based on the expected value of litigation. If the buyer observes  $q_i$ , then the buyer will sue if  $d_i g_i(a) \geq L$ .<sup>5</sup> Since the  $g_i(a)$  are decreasing in  $a$ , the seller can choose a sufficiently high effort level so that the buyer will not sue.<sup>6</sup> Define  $\hat{a}_i$  by  $d_i g_i(\hat{a}_i) = L$ , and observe that since  $d_1 \geq d_2$  and  $g_1(a) > g_2(a)$ , we have  $\hat{a}_1 > \hat{a}_2$ . Then, if  $a \leq \hat{a}_2$ , the buyer will always file suit, if  $\hat{a}_2 < a \leq \hat{a}_1$ , the buyer will file suit only when the outcome is  $q_1$ , and, if  $a > \hat{a}_1$ , the buyer will never file suit. We let  $s_i(a)$  denote whether a suit is filed, that is  $s_i(a) = 1$  if  $q_i$  is observed and  $d_i g_i(a) \geq L$ , and  $s_i(a) = 0$  otherwise. Since the buyer makes a discrete decision to file suit or not, expected payoffs may be discontinuous at  $\hat{a}_2$  and  $\hat{a}_1$ . This in turn implies that the incentive scheme offered to the seller may be discontinuous.

While we assume damages are not random, we do not assume that the damages awarded by the courts are necessarily equal to the loss suffered by the buyer. We do not rule out the possibility of punitive damages, that is, we allow  $d_1, d_2 \geq q_2 - q_1$ . Observe that if the buyer receives  $q_2$ , there is no economic damage. Nonetheless, we allow the buyer to sue when the outcome is  $q_2$ , that is, we allow “frivolous” lawsuits.

*2.2. Payoffs to the participants and expected utility.* Table 1 summarizes the payoffs to the participants under the model specified above. Note that the seller is not concerned with the

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5 Sarath assumes that the buyer receives a private signal of the probability of winning a suit, where the density of the signal depends on  $q_i$  and  $a$ , and determines the subjective probability of winning. The buyer then sues if the subjective expected value is nonnegative. We implicitly restrict the density of the signal so that the subjective and objective probabilities are equal, i.e., we assume the buyer has rational expectations regarding the probable success of litigation.

6 However, if  $d_2$  is large enough, then  $\hat{a}_2 > a_H$  and the seller can never choose a high enough effort level to prevent being sued. We assume that this is not the case, formally,  $g_2^{-1}(L/d_2) < a_H$ .

individual components of the incentive scheme, but rather with the combined or aggregate incentive scheme offered by the buyer and the insurer jointly.

Suppose first that the outcome is  $q_1$ . If the buyer sues and wins (with probability  $\pi_1 = f_1g_1$ ), the buyer's payoff is  $q_1 - L - p_1 + d_1$ , the insurer's payoff is  $t_0 - t_1$ , and the seller's payoff is  $y_1 = w + p_1 - t_0 - d_1 + t_1$ . If the outcome is  $q_1$ , the insurer's and seller's payoffs are the same if no suit is filed or if a suit is filed and the buyer loses (with probability  $\pi_2 = f_1(1 - g_1)$ ). In either case, the insurer's payoff is  $t_0$ , and the seller's payoff is  $y_2 = w + p_1 - t_0$ . The buyer's payoff is  $q_1 - p_1 - s_1L$ , that is,  $q_1 - p_1 - L$  if the suit is lost and  $q_1 - p_1$  if there is no suit.

Now suppose that the outcome is  $q_2$ . If the buyer sues and wins (with probability  $\pi_3 = f_2g_2$ ), the buyer's payoff is  $q_2 - L - p_2 + d_2$ , the insurer's payoff is  $t_0 - t_2$ , and the seller's payoff is  $y_3 = w + p_2 - t_0 - d_2 + t_2$ . If the buyer sues and loses or does not sue (with probability  $\pi_4 = f_2(1 - g_2)$ ), the insurer's payoff is  $t_0$ , and the seller's payoff is  $y_4 = w + p_2 - t_0$ . The buyer's payoff is  $q_2 - p_2 - s_2L$ .

**Table 1: Payoff Relevant States for Insurer, Buyer and Seller**

Payoff State	Probability	Insurer's Income	Buyer's Income	Seller's Income
1	$\pi_1 = f_1g_1$	$t_0 - t_1$	$q_1 - p_1 - L + d_1$	$w + p_1 - t_0 - d_1 + t_1$
2	$\pi_2 = f_1(1 - g_1)$	$t_0$	$q_1 - p_1 - s_1L$	$w + p_1 - t_0$
3	$\pi_3 = f_2g_2$	$t_0 - t_2$	$q_2 - p_2 - L + d_2$	$w + p_2 - t_0 - d_2 + t_2$
4	$\pi_4 = f_2(1 - g_2)$	$t_0$	$q_2 - p_2 - s_2L$	$w + p_2 - t_0$

The buyer's expected utility is

$$U_B(\mathbf{p}, a) = \pi_1[q_1 - p_1 - L + d_1] + \pi_2[q_1 - p_1 - s_1L] + \pi_3[q_2 - p_2 - L + d_2] + \pi_4[q_2 - p_2 - s_2L]. \quad (1)$$

For any fixed contract  $\mathbf{p}$ , the buyer's expected utility shifts upward by  $\pi_2 L$  at  $\hat{a}_2$  and again by  $\pi_4 L$  at  $\hat{a}_1$ . The insurer's expected utility is

$$U_I(\mathbf{t}, a) = t_0 - \pi_1 t_1 - \pi_3 t_2. \quad (2)$$

The seller's expected utility is

$$\begin{aligned} U_S(\mathbf{y}, a) = & \pi_1 u(w + p_1 - t_0 - d_1 + t_1) + \pi_2 u(w + p_1 - t_0) \\ & + \pi_3 u(w + p_2 - t_0 - d_2 + t_2) + \pi_4 u(w + p_2 - t_0) - a, \end{aligned} \quad (3)$$

where  $\mathbf{y} = (y_1, y_2, y_3, y_4)$  is the aggregate incentive scheme. The seller's participation constraint is

$$U_S(\mathbf{y}, a) \geq \underline{U}_S. \quad (4)$$

The incentive compatibility constraint is

$$a \in \operatorname{argmax} U_S(\mathbf{y}, a). \quad (5)$$

### 3. Existence of equilibrium and insurance markets

v While the seller is concerned with the aggregate incentives, the buyer and the insurer negotiate their contracts,  $\mathbf{p}$  and  $\mathbf{t}$ , with the seller separately and independently. Since the buyer and the insurer act in their own self interest, there is a problem of coordination between the buyer and the insurer. Following Bernheim and Whinston,  $(\mathbf{p}^*, \mathbf{t}^*, a^*)$  is an equilibrium if the conditions in equations (6) and (7) are met:

$$(\mathbf{p}^*, a^*) \in \operatorname{argmax} U_B(\mathbf{p}, a), \quad (6)$$

subject to the seller's participation and incentive compatibility constraints, (4) and (5), and to the participation constraint  $U_B(\mathbf{x}^*, a^*) \geq \underline{U}_B$ , and

$$(\mathbf{t}^*, a^*) \in \operatorname{argmax} U_I(\mathbf{t}, a), \quad (7)$$

subject to the seller's participation and incentive compatibility constraints, (4) and (5), and to the participation constraint  $U_R(t^*, a^*) \geq \underline{U}$ .

Although the buyer and the seller negotiate their contracts with the seller separately, each takes account of the other's contract through its effect on the seller's participation and incentive compatibility constraints. While there might be inherent conflict between the buyer and the insurer regarding the action the seller should take, these conflicts are resolved as part of the equilibrium.

*3.1. Existence of equilibrium.* Bernheim and Whinston give three conditions that are individually sufficient for existence of equilibrium. First equilibrium exists if the seller is risk neutral; this does not seem a reasonable assumption in a model of the market for insurance. Second, equilibrium exists if the seller's most preferred action and the buyers' jointly preferred action are the same. Bernheim and Whinston (Theorem 4) show that, for the type of "effort" model analyzed here, this condition cannot hold. The third condition is that the seller can choose between only two actions. Our assumption of a continuum of actions can easily be replaced by an assumption that the seller can choose only "high" or "low" effort, in which case equilibrium exists.

We proceed under the assumptions that the seller's effort is continuously variable. Bernheim and Whinston (Theorem 1) show that any equilibrium incentive scheme must minimize aggregate costs. To pursue this line of analysis, we assume that, if  $a_1 > a_0$  then  $\pi_2(a_1)/\pi_2(a_0) < \pi_3(a_1)/\pi_3(a_0)$ . Combined with the assumption that the  $g_i$  are decreasing, this is sufficient for the  $\pi_i$  to have the monotone likelihood ratio property (MLRP). In addition, we assume that  $f_2''/f_2' < g_2'/(1 - g_2)$  and  $g_2''/g_2' < -f_2'/f_2$ . Combined with the assumptions that the  $f_1$  and  $g_1$  are decreasing and convex, this is sufficient for the  $\pi_i$  to have the convexity of distribution

function condition (CDFC). These assumptions together imply that the first-order approach is valid (Grossman and Hart, 1983, Rogerson, 1985) and that the cost-minimizing incentive scheme is monotonic, i.e.,  $y_1 \leq y_2 \leq y_3 \leq y_4$  (Grossman and Hart, 1983). Fraysse (1993) shows that if  $y_i(a_1) - y_i(a_0)$  is increasing in  $i$  for all  $a_1 > a_0$ , then an equilibrium exists. That is, equilibrium exists if inducing a higher effort level requires that the least cost incentive scheme must become steeper.

*3.2. Demand for liability insurance.* Suppose that equilibrium does exist. Monotonicity of the aggregate incentive scheme implies that  $t_1^* \leq d_1$  and  $t_2^* \leq d_2$ , that is, the seller will not purchase more than full insurance. To show that there will be a demand for insurance, we also need to show that either  $t_1 > 0$  or  $t_2 > 0$  in equilibrium. To begin, suppose that contract  $\mathbf{p}^0 = (p_1^0, p_2^0)$  minimizes the cost of inducing the seller to take action  $a^0$  in the absence of insurance. Now introduce insurance and let  $(\mathbf{p}^1, \mathbf{t}^1)$  minimize the cost of inducing  $a^0$ , where  $\mathbf{t}^1 = (t_0^1, t_1^1, t_2^1)$  is the insurance policy. We want to show that the combined incentives offered by the pair of contracts  $(\mathbf{p}^1, \mathbf{t}^1)$  has lower expected cost than the contract  $\mathbf{p}^0$  alone.

Proposition 1: If equilibrium exists, then there is a demand for liability insurance ( $t_1$  or  $t_2 > 0$ ).

*Proof:* First, assume the equilibrium is a zero effort for the seller,  $a^* = 0$ . Then the incentive scheme is flat ( $y_1 = y_2 = y_3 = y_4$ ), which implies  $t_1 = d_1 > 0$  and  $t_2 = d_2 > 0$ .

Now assume  $a^* > 0$ . An actuarially fair policy offering the same indemnity as  $\mathbf{t}^1$  is  $\mathbf{t}^* = (\bar{t}, t_1^1, t_2^1)$  where  $\bar{t} = \pi_1 t_1^1 + \pi_3 t_2^1$ . Then  $(\mathbf{p}^1, \mathbf{t}^1)$  yields the same payoffs to the seller as  $(\mathbf{p}^0 - \Delta t, \mathbf{t}^*)$ , where  $\Delta t = t_0^1 - \bar{t}$ . Since  $\mathbf{t}^*$  has zero expected cost, expected aggregate costs are reduced if  $\Delta t > 0$ . Suppose, by way of contradiction, that  $\Delta t = 0$ , so that the seller gets  $(\mathbf{p}^0, \mathbf{t}^*)$ . Since the

seller is risk averse, the introduction of the actuarially fair insurance policy  $\mathbf{t}^*$  gives the seller a strictly positive surplus. But, if  $(\mathbf{p}^1, \mathbf{t}^1)$  is cost minimizing, the seller's expected utility is equal to the reservation utility level, and the seller receives zero surplus. Since the seller's expected utility is decreasing in  $\Delta t$ , we must have  $\Delta t > 0$  and  $(\mathbf{p}^1, \mathbf{t}^1)$  has lower expected cost than  $\mathbf{p}^0$ .

Now if both  $t_1^1 = 0$  and  $t_2^1 = 0$ , then  $(\mathbf{p}^1, \mathbf{t}^1)$  yields the same payoffs as  $(\mathbf{p}^0 - \Delta t, \mathbf{0})$ . But with  $\Delta t > 0$ , the seller receives less than their reservation utility level from  $(\mathbf{p}^0 - \Delta t, \mathbf{0})$ . Therefore, we must have  $t_1^1 > 0$  or  $t_2^1 > 0$ . Thus, existence of equilibrium is sufficient to imply that there is a demand for liability insurance. ||

It is interesting to compare this result to Shavell (1982), where there are no legal errors. Under a perfectly enforced negligence rule, the seller always meets the due care standard, is never liable, and therefore has no demand for liability insurance. As intuition suggests, the possibility of legal errors is a source of the demand for liability insurance. It is also interesting to compare this result to Sarath (1991). Sarath assumes that insurance is actuarially fairly priced. We show that  $\Delta t > 0$ , that is, insurance is less than fairly priced and the insurer earns a positive expected profit in equilibrium. Since the insurer earns a positive expected profit, the insurer's participation constraint is satisfied, and there will be a supply of insurance as well as a demand for insurance.

#### 4. Uniform price contracts

The analysis of the general model in the previous section has two limitations. First, except where the seller can only choose from two actions, equilibrium may fail to exist. Second, the

dependence of the seller's expected utility on the aggregate payoffs is an impediment to characterizing the insurance contracts. In order to address these two limitations, in this section we analyze a special case of the model where the buyer can only offer a uniform payment to the seller regardless of the outcome the buyer observes. A strictly positive payment can be interpreted as the price of a product or service purchased from the seller. This special case is not unduly restrictive since many of the common areas of litigation fit the category of uniform price contracts. For example, payment for a physician's services is generally a fixed price contract, regardless of the outcome of the surgery. This can also describe the purchase of an experience good, where a customer cannot determine whether the product is defective until after the good is acquired.<sup>7</sup> A zero payment can be interpreted as the situation where there is no economic relationship between the potential victim and the potential injurer.

The uniform price contract between the buyer and the seller is  $\mathbf{p} = (p, p)$ , where  $p \geq 0$ . The other assumptions of the model are retained, including the assumptions that are sufficient for the MLRP and CDFC. It remains true that the buyer will decide to sue if doing so has nonnegative expected value. The expected utilities are again given by equations (1), (2), and (3) and the equilibrium is defined by equations (6) and (7).

*4.1. Existence of equilibrium.* If the seller chooses a high enough effort level, then the buyer never files suit. We show that this does not occur in equilibrium.

Proposition 2: Assume uniform price contracts. If equilibrium exists, then  $a^* \leq \hat{a}_1$ .

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<sup>7</sup> This can be viewed as a change in the timing of events in the model, so that the buyer makes the payment to the seller before  $q_i$  is realized.

*Proof:* Suppose, by way of contradiction, that  $a^* > \hat{a}_1$ . Then the buyer never sues, the seller has no demand for liability insurance, and the aggregate incentive scheme is simply the uniform price contract  $(p, p)$ . But since the incentive scheme is flat, it induces the seller to choose  $a = a_L < \hat{a}_1$ , a contradiction. ||

We point out that, since  $\hat{a}_2 < \hat{a}_1$ , Proposition 2 implies that, in equilibrium, the buyer always sues if the outcome  $q_1$  is observed.

We now show that equilibrium exists. The argument uses Fraysse's result that equilibrium exists if the incentive scheme must become steeper to induce a greater level of effort.

Proposition 3: Assume uniform price contracts. Then equilibrium exists.

*Proof:* First, suppose that  $\hat{a}_2 < a^* \leq \hat{a}_1$ . If the buyer receives  $q_1$ , the payoff to the seller is either  $y_1 = w + p - t_0 - d_1 + t_1$  or  $y_2 = w + p - t_0$ , depending on whether or not the buyer wins the suit. If the buyer receives  $q_2$ , there is no suit, so  $y_3$  is not relevant, and the seller's payoff is  $y_4 = w + p - t_0$ . Observe that the seller's payoff is the same whether or not a suit is filed, so long as the buyer does not win, i.e.,  $y_2 = y_4$ . Then the seller's expected utility is

$$U_S(\mathbf{y}, a) = \pi_1 u(y_1) + (1 - \pi_1)u(y_2) - a. \quad (8)$$

Then the seller chooses effort so that

$$u(y_1) - u(y_2) = 1/\pi_1'(a). \quad (9)$$

This implies that  $y_1 < y_2$ , or  $t_1 < d_1$ , so that the seller buys less than full coverage against damages. More importantly, the right-hand side of (9) is a decreasing function of effort, so that to induce higher effort requires increasing  $y_2 - y_1$ .

Now suppose that  $a^* \leq \hat{a}_2$  so that the buyer always sues. If the buyer receives  $q_1$ , the payoff to the seller is either  $y_1$  or  $y_2$ , as before. If the buyer receives  $q_2$ , the payoff to the seller is either  $y_3 = w + p - t_0 - d_2 + t_2$  or  $y_4 = w + p - t_0$ , depending on whether or not the buyer wins. Again  $y_2 = y_4$  so the seller's payoff is the same so long as the buyer does not win the suit. Since the least cost incentive scheme is monotonic, this implies  $y_2 = y_3 = y_4$ . It then follows that  $t_2 = d_2$ ; the seller buys full coverage against damages. Then the seller's expected utility is given by (8) and the seller chooses effort so that (9) holds. Again, inducing higher effort requires increasing  $y_2 - y_1$ . The least cost incentive scheme becomes steeper to induce higher effort levels;  $a_1 > a_0$  implies  $y_1(a_1) - y_1(a_0) < y_2(a_1) - y_2(a_0)$ . It then follows from Fraysse that equilibrium exists. ||

From (9), inducing higher effort requires increasing  $y_2 - y_1$ . Under a uniform price contract this requires reducing the seller's insurance coverage.

*4.2. Characterization of the insurance policy.* We now show that an insurance contract will be part of all equilibria where contracts are restricted to be uniform price. This result follows directly from Propositions 1 and 3. However, the proof lets us characterize the insurance policy.

**Proposition 4:** Assume uniform price contracts. Then there is a demand for liability insurance ( $t_1^* > 0$  and  $t_2^* \geq 0$ ).

*Proof:* First, suppose that in equilibrium  $\hat{a}_2 < a^* \leq \hat{a}_1$ . Since the buyer does not sue if  $q_2$  is observed,  $t_2 = 0$ , and, as has already been shown,  $t_1 < d_1$ . We want to show  $t_1 > 0$ . Suppose, by way of contradiction, that  $t_1 = 0$ . Then the equilibrium incentive scheme,  $(p^* - d_1, p^*)$ , is cost

minimizing and  $(p^*, a^*)$  satisfy the participation and incentive compatibility constraints, (4) and (9). The assumption that  $t_1 = 0$  implies that  $y_2 - y_1 = d_1$  does not depend on  $a$ . Then (9) implies that increasing  $a$  requires decreasing  $p$ , i.e.,  $\partial p / \partial a < 0$  along (9). But if  $p$  is cost minimizing, then  $\partial p / \partial a = 0$  along the seller's participation constraint, a contradiction. Consequently, we must have  $t_1 > 0$ .

Now suppose that in equilibrium  $0 < a^* \leq \hat{a}_2$ . Then  $y_2 = y_3 = y_4$  implies that  $t_2 = d_2 > 0$ . Observe that we again have  $t_1 < d_1$ , and, by the argument in the previous paragraph,  $t_1 > 0$ . Finally, suppose that  $a^* = 0$ . The least cost way of inducing zero effort is a flat incentive scheme, i.e.,  $t_1 = d_1 > 0$  and  $t_2 = d_2 > 0$ . Thus, we have  $t_1^* > 0$  for all equilibria, and  $t_2^* > 0$  for some equilibria. ||

The equilibrium demand for liability insurance is discontinuous. This is a consequence of the fact that the buyer makes a discrete decision to sue or not sue the seller. If the equilibrium is at zero effort, the seller is fully insured  $t_1^* = d_1$  and  $t_2^* = d_2$ . But if the equilibrium is at a positive but low level of effort, so that the buyer always sues (if  $0 < a^* \leq \hat{a}_2$ ), then  $t_1^* < d_1$  and  $t_2^* = d_2$ . If the equilibrium is at a higher effort level ( $\hat{a}_2 < a^* \leq \hat{a}_1$ ) then  $t_1^* < d_1$  and  $t_2^* = 0$ .<sup>8</sup> If the equilibrium is at a low effort and if the buyer gets  $q_2$ , then the buyer is not damaged and the lawsuit is frivolous. In these equilibria, the seller buys full insurance against frivolous lawsuits. If the equilibrium is at a higher effort level, buyers do not sue if they receive  $q_2$ , so the seller need not insure against frivolous lawsuits. The seller always buys less than full insurance against legitimate lawsuits.

4.3. *Increasing court awards.* Two of the sources of uncertainty in the legal system are the unpredictability of verdicts and the level of court awarded damages. Increases in damages do not change the aggregate cost minimizing payoffs for a given level of effort,  $\partial y_1/\partial d_i = 0$  and  $\partial y_4/\partial d_i = 0$ ,  $i = 1, 2$ . For example, if  $0 \leq a^* \leq \hat{a}_2$ , then an increase in  $d_2$  is exactly offset by increased coverage, and any increase in the premium is exactly offset by a higher price paid by the buyer. Increases in  $d_1$  lead to increases in price and coverage that exactly offset the increase in damages and the possible increase in the premium.<sup>9</sup> Increases in  $d_2$  and  $d_1$  also have the effect of increasing  $\hat{a}_2$  and  $\hat{a}_1$ . Similarly, increases in  $g_2$  and  $g_1$  increase  $\hat{a}_2$  and  $\hat{a}_1$ . This in turn expands the set of equilibria in which the buyer is induced to sue the seller and also expands the set of equilibria in which  $t_2^* > 0$  and  $t_1^* > 0$ . Thus, increases in the buyer's probability of success or in damages lead to increased litigation, and increase the demand for liability insurance.

## 5. Efficiency of equilibrium

In the standard principal-agent model with one principal, the inability of the principal to observe the agent's actions is typically a source of welfare loss. There are some exceptions to this (cf., Grossman and Hart, 1983, Proposition 3). Since there is the additional problem of coordination when there are multiple principals, it is reasonable to expect common agency to lead to additional welfare losses. Bernheim and Whinston show that common agency does not lead to additional welfare losses in the same cases where the nonobservability of the agent's actions

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8 The discontinuity at zero effort is a standard result (e.g. Kreps, 1990, pp. 604-605) and the same argument applies at  $\hat{a}_2$ . Berkok (1991) provides a general discussion of nondifferentiable and discontinuous incentives.

causes no welfare loss in the single buyer setting. That is, if the first best action can be induced by a single principal, the first best action is induced in equilibrium by multiple principals. However, the model analyzed here does not satisfy any of these conditions. More generally, if the nonobservability of effort leads to welfare losses, common agency leads to additional welfare losses. In the analysis here, common agency is due to the availability of liability insurance, so one can argue that the availability of insurance increases the welfare loss due to moral hazard.

We have been assuming that the buyer and insurer negotiate directly with the seller. At least in some cases, this may not be appropriate. If the seller is a firm, we are implicitly treating the firm as a “black box,” in assuming the firm acts as if it were a single individual. This ignores the principal-agent problems that arise within the firm, and their possible effect on the equilibrium. Newman and Wright (1990, 1992) examine the strict liability and negligence rules in settings where a risk-neutral principal (hereafter the “owner”) hires a risk averse agent. The agent’s actions affect the probability that a loss will be inflicted on a third party.<sup>10</sup> Newman and Wright assume that the tort system operates perfectly. They argue that the choice between the strict liability and negligence rules depends on the details of the situations, namely, the agent’s preferences and the degree of moral hazard. They also show that, under a strict liability rule, the agent is induced to choose the socially optimal level of care. Newman and Wright (1992, Proposition 2) show that, under a negligence rule, the agent will always be induced to meet the due care standard. Thus, as in Shavell (1982), a perfectly enforced negligence rule implies that there is no demand for liability insurance.

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9 An increase in damages increases the absolute amounts transferred among the participants, but leaves the seller’s aggregate incentive unchanged. Unless the increase in damages changes the relationship between  $a^*$  and one of the

In the model analyzed by Newman and Wright, how does the addition of legal errors and the availability of insurance affect the efficiency of equilibrium? Bernheim and Whinston (p. 937-938) show that, if there is a risk neutral intermediary between the buyer and insurer and the seller, then equilibrium exists and the second best efficient action is implemented. This is precisely the situation contemplated in Newman and Wright's analysis. That is, the buyer and insurer negotiate their contracts with the risk-neutral owner, who in turn negotiates a contract with the agent. This situation may exist when hospitals contract directly for group malpractice coverage on resident physicians and emergency medical personnel. That the buyer and insurer do not transact directly with the seller is critical. In these situations, nonobservability of the seller's effort still leads to a welfare loss, but the welfare loss is not exacerbated by the availability of liability insurance.

## 6. Conclusions

Shavell (1982) shows that, under a perfectly enforced negligence rule, a risk averse seller will exercise due care, avoid liability and have no demand for insurance. Intuition suggests that the possibility of legal errors is one reason individuals and firms buy liability insurance. We ask if this intuition is correct, that is, are there conditions under which legal errors lead to the development of a market for liability insurance? We allow the contracts between the buyer and the seller and between the insurer and the seller to be determined endogenously. Since the buyer and the insurer negotiate their contracts independently this creates a problem of common agency. The seller's behavior is determined by the aggregate incentives provided by the pair of

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$\hat{a}_2$ , increasing damages does not change the equilibrium effort level.

10 Newman and Wright assume there is no economic relationship between the potential victim and the firm.

contracts. Legal errors may be due to case by case variation in the due care standard or to imperfect observability of the seller's behavior. We conclude that the risk of legal errors can lead to the development of a market for liability insurance to arise.

In the most general setting, we prove that if equilibrium exists, then a market for liability insurance exists. We also examine a version of the model in which the buyer offers a uniform payment to the seller. This includes the case of experience goods and the case where there is no economic relationship between the buyer and seller. We show that equilibrium exists, and that, in equilibrium, the buyer sues the seller with positive probability. The insurance company earns a strictly positive expected profit and risk averse sellers purchase less than full coverage against liability losses. We show that increases in the probability of successful litigation and in court awarded damages lead to increases in litigation and to increases in the demand for liability insurance. In some situations, the availability of liability insurance does not increase the welfare loss due to moral hazard. There are also situations in which the availability of liability insurance does not increase the welfare loss due to moral hazard.

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