3.1. Introduction

Every day, people take actions for their own benefit that impose a risk of harm on others.\(^1\) They use the health and safety of others as a means to their own ends. Many risky activities benefit both the risk-imposer and society; others only benefit the risk-imposer, and impose a net cost on society as a whole. Thus, most societies seek to regulate, rather than prohibit, activities that create risk. Social welfare is maximized when society deters risk-producing activities whose expected costs exceed the social benefits and induces risk-imposers to invest optimally in precautions needed to reduce risk (see generally Coase 1960; Calabresi 1970; Shavell 1980).

Tort liability is one of the most potentially effective mechanisms for optimally deterring risk. When properly structured, tort liability can use the threat of liability for harm caused to deter socially harmful activities and induce optimal precautions by both injurers and victims (e.g., Shavell 1980; Landes and Posner 1980, 1987). The central aim of the economic analysis of law is to identify the rules governing liability, damages, and procedure that induce optimal investment in risk reduction and optimal activity levels.

Yet in order to determine the structure of optimal tort liability, it is important to identify the central challenges that tort liability is designed to address. Tort liability is far from costless. The tort system itself imposes social costs in the form of litigation costs, the fixed costs of a court system, and the costs associated with liability-induced distortions in incentives (see, generally, Calabresi 1970). It also is not the only mechanism available to deter people from creating excessive risk of harm. Others mechanisms include private ordering, ex ante regulatory duties and monitoring, and ex post regulatory enforcement.

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\(^1\) Jennifer Arlen is Norma Z. Paige Professor of Law, New York University School of Law. I benefited from the helpful comments of Giuseppe Dari-Mattiacci, Mark Geistfeld, Jennifer Reinganum, Francesco Parisi, and Abraham Wickelgren, as well as from the financial support of the D’Agostino/Greenberg Fund of the New York University School of Law.
This suggests that, in order to be optimal, tort liability should be employed to induce optimal precautions only when it is a welfare-enhancing alternative or supplement to alternative mechanisms, such as private ordering or regulation (see, e.g., Coase 1960; Calabresi and Melamed 1972; Epstein 1976; Spence 1977; Shavell 1980, 1984; Landes and Posner 1987; Polinsky 1980).

Thus, economic analysis of torts must address both the optimal domain and structure of tort liability. Indeed, these two inquiries are inextricably linked. Tort liability is needed in certain circumstances and not others, and these circumstances determine the goals that optimal liability rules should be designed to achieve.

Tort liability thus is not justified by the presence of risk-producing activities alone. Instead, tort liability is justified by the combination of risk-producing activities and substantial information and transactions costs. Tort liability is not needed when information is costless and transactions costs are low because, in this situation, private ordering will induce optimal risk-taking. When transactions costs are low and parties are perfectly informed, private bargaining or market forces should induce optimal precautions (Coase 1960; Calabresi and Melamed 1972; see, e.g., Spence 1977; Shavell 1980; Polinsky 1980).

Private ordering will not suffice when transactions costs are high (Coase 1960). But even here tort liability may not be needed when everyone is perfectly informed. In this situation, the state may be more effectively able to induce the desired precautions through regulation: it could specify the optimal precaution, and use its costless observation of actual conduct to intervene to sanction noncompliance (e.g., Kaplow 1992; Shavell 1984; Shavell 2014; see Epstein 2013). Tort liability is needed, and is potentially superior to regulation, when information is sufficiently costly that regulators cannot optimally determine and specify the optimal precaution for each activity ex ante, adequately monitor conduct to ensure compliance, or detect (and sanction) breach ex post (e.g., Kaplow 1992; Shavell 1984, 2014; see Epstein 2013).²

The conclusion that tort liability is needed to optimally deter risk when information costs are substantial has two important implications for the economic analysis of tort liability. First, it reveals that economic analysis of optimal tort rules generally should

² This discussion only touches on the considerations that determine the use of liability versus regulation. Other considerations include potential insolvency, interest group capture, and differences between private and social incentives to sue. Whatever are the considerations affecting the decision to use tort liability, these considerations should be taken into account when determining the optimal structure of tort liability and the features of the models used to analyze it.

One potential consideration that is not seriously addressed in this chapter is the fact that tort liability provides compensation to victims (Shavell 1987, 206–27). There are several reasons not to focus on this distinction. First, it is not an essential difference: regulators, in theory, could (and in some cases do) impose restitutionary sanctions in order to compensate injured victims. Second, when negligence functions optimally, injured victims are not compensated in equilibrium because injurers take due care (Shavell 1980; but see Arlen and MacLeod 2005a). Third, tort liability generally cannot be justified primarily on compensation grounds if lower cost first-party insurance is readily available, because liability is a very costly and time-consuming way of getting compensation to victims. What justifies tort liability, instead of insurance or no-fault, is deterrence. When we look at deterrence-based arguments for liability, information costs (and related considerations) tend to lie at the foundation of arguments for imposing tort liability in addition to (or instead of) regulation.
employ economic models where information is costly. Second, it reveals that the goals of optimal tort liability should extend beyond optimal precautions (and activity levels), as classically understood. In many situations, people undertaking risky decisions are imperfectly informed about the available precautions and their costs and benefits. They can, but may not, invest in obtaining information needed to improve their decisions. In these situations, a central purpose and effect of tort liability should be to induce optimal acquisition of information needed to identify the optimal level of care.

In addition, when information is costly, people conducting complex activities that naturally require multiple participants are more likely to conduct these activities through organizations—generally corporations—than through contracts (Coase 1937). In this situation, information costs alter the scope of optimal tort liability by introducing an additional player, the organization, whose incentives and capacity to influence care must be considered and guided toward optimal decisions. Tort liability also can enhance deterrence by providing risk-imposers incentives to make decisions regarding care within and through an organization, when this would reduce total expected accident costs (including the expected cost of information acquisition).

This chapter presents economic analysis of optimal tort liability focusing on the use of liability where information is costly, and private parties cannot provide optimal incentives through private ordering. It shows that the central motivations for tort liability—imperfect contracting and costly information—alter its optimal structure and incentive effects, both as applied to individual injurers and risk-imposers operating within organizations.

Section 3.2 examines optimal tort liability in the context where liability is most obviously needed: where injurers and victims are “strangers,” in that they cannot plausibly bargain over optimal risk prevention or responsibility for losses. This section begins with the foundational analysis of accidents between strangers when all parties possess perfect costless information. This analysis shows that many liability rules—negligence (with and without contributory or comparative negligence) and strict liability with contributory negligence)—induce optimal behavior by both potential injurers and victims (e.g., Brown 1973; Shavell 1980; Landes and Posner 1987). It then examines optimal liability when information is costly: when injurers or courts must incur costs to determine optimal (or actual) precautions and can do so only imperfectly. This section examines how information costs affect the goals of optimal deterrence, the optimal structure of liability and damages rules, and the effect of liability on injurers’ and victims’ incentives to deter risk optimally.

Section 3.3 examines tort liability when injurers and victims are in a market relationship, as is the case with product liability and medical malpractice. This part identifies the factors justifying the liability in market settings. The analysis of strict liability focuses on product liability; the analysis of negligence liability focuses on medical malpractice. Again, information costs are shown to affect the optimal structure and incentive effects of liability and damage rules.

Section 3.4 examines the argument that liability in market settings need not be imposed by the state because it will be optimally supplied by contract. It shows that this
argument generally is not correct because information costs and other impediments to optimal contracting will usually render contracting over liability inefficient.

Finally, Section 3.5 extends the analysis of optimal tort liability to the situation where risk-imposers respond to information costs by conducting their activities through organizations, such as corporations. It shows how liability should be structured to induce optimal behavior by organizations and the agents who work for them, and it discusses limitations with existing liability rules on these issues.

3.2. Accidents between Strangers

This section examines the incentive effects and the optimal structure of tort liability when the injurer and victim are “strangers” with no market relationship and no ability to contract or bargain with each other. This section first presents the classic model of liability with perfect information and zero litigation costs, and then it examines tort liability when information about optimal and actual precaution is costly.

3.2.1. Classic Model of Accidents between Strangers: Full Information

Many, if not most, accidents involve two parties, each of whom can take precautions that affect the probability that the accident occurs and/or the magnitude of the harm caused. These accidents fall into one of two categories. The most common are “bilateral-risk” cases, where two parties each undertake an activity that presents a risk of harm to themselves and the other. Automobile accidents involving either two cars, or a car and a pedestrian, are classic examples of bilateral risk accidents (Diamond 1974; Arlen 1990a, b; 1992). The other standard type of case involves “unilateral-risk and bilateral-care” accidents (hereinafter bilateral care): where one person (the injurer) undertakes an activity that imposes a unilateral risk of harm on the other (the victim), but both parties can affect the probability that the accident occurs (Brown 1973; Shavell 1980; Landes and Posner 1987). Product defects that injure nonconsumers and activities that produce environmental risks are examples of potential torts with well-defined potential injurers and victims where both parties may be able to affect the probability or magnitude of the harm, but only one side imposes a risk of harm on the other (absent liability).

In both types of cases, social welfare is maximized when both care and activity levels are optimal. Specifically, every risk-imposing party should undertake the activity only when, and up to the point that, the social benefit of the activity equals or exceeds the expected social cost. In addition, when they conduct the activity, they should invest optimally in precautions to reduce the risk of harm to others or themselves (or both).
In each type of case, the motivation for tort liability is the same: rational, self-interested, utility maximizers will not behave optimally absent liability because they set care and activity levels without considering to the risk of harm to others. Tort liability can induce risk-imposers to take optimal care and activity levels by making them bear the social costs of the accidents they cause. This is easily accomplished by holding injurers strictly liable for all harms caused. Yet in order to induce optimal care, tort liability also must ensure that victims invest in optimal precautions to protect themselves. Victims will not do this if all accidents are paid for by injurers (Brown 1973; Shavell 1980). To induce optimal care by both parties—whether by two injurers in the bilateral risk case or the injurer and a victim in the bilateral care case—tort liability must be structured to ensure that each expects to bear expected accident costs if they fail to take optimal care. This will ensure existence of an equilibrium in which each takes optimal care. Optimal tort liability rules that satisfy this requirement include pure negligence, negligence with contributory (or comparative) negligence, and strict liability with contributory negligence (Brown 1973 [bilateral care]; Shavell 1980 [bilateral care]; Arlen 1990a [bilateral risk]; Arlen 1992 [bilateral risk]; Cooter and Ulen, 1986 [comparative negligence]). By contrast, strict liability with full compensation damages will not induce optimal care by both injurers and victims because it insulates victims from expected accident costs, eliminating their incentive to take due care. These conclusions hold whether injurers impose risk unilaterally on victims (Brown 1973; Shavell 1980; Landes and Posner 1987) or both parties to the accident impose risk on each other (Diamond 1974; Arlen 1990, 1992).

3.2.1.1. Formal Analysis: Bilateral Care

The classic model assumes that information and litigation is costless; expected accident costs depends on a single input by each party, “care,” given by \(x\) for injurers and \(y\) for victims. The cost of care is given by \(C(x)\) and \(c(y)\), respectively, with \(C'(x)\), \(c'(y) > 0\); and \(C''(x)\), \(c''(y) > 0\). Expected accident costs are given by \(p(x,y)H\), where \(H\) is the harm to the victim and \(1 \geq p(x,y) > 0\) is the probability that the harm occurs, where \(p_i(x,y) < 0\), \(p_i(x,y) > 0\), \(i = x, y\). All parties and the court know the optimal level of care for each party ex ante; each party’s actual level of care is verifiable ex post.

Social welfare is maximized when injurers and victims invest in the level of care \((x, y)\) that minimize expected accident costs:

\[
C(x) + c(y) + p(x, y)H
\]  

(1)

This implies that social welfare is maximized when injurers take care \(x^*\) and victims take care \(y^*\) as given by:

\[
C'(x) = -p_x(x, y)H
\]  

(2)

\[
c'(y) = -p_y(x, y)H
\]  

(3)
Thus, each party should invest in care up to the point where the marginal cost of care equals the social marginal benefit of care, where the latter is given by the reduction in expected accident costs resulting from a marginal increase in care.

Absent tort liability, injurers will not take optimal care. Injurers minimize their own expected accident costs, given by $C(x)$, and thus take no care.

Victims do take optimal care (given injurers’ care levels) because victims bear their own accident costs and thus select care to minimize $c(y) + p(0,y)H$.3 As a result, they select care to minimize the total private (and here social) cost of accidents, given the injurer’s suboptimal investment in care. Nevertheless, their care-taking is not first best. If the marginal reduction in the probability of an accident resulting from victim care-taking is lower when injurers take no care than when they take optimal care, then victims will take less care than is first-best optimal because injurers under invest in care.

By contrast, all of the standard liability rules, except pure strict liability, can induce injurers and victims to take due care. Pure strict liability is inefficient because it produces the mirror result of no liability. Under strict liability, each injurer bears all expected accident costs; but each victim does not bear any of his own damages, assuming that damages equal the victim’s harm, $H$. In this case, each victim minimizes $c(y) + p(x,y) (H-D) = c(y)$. Victims take no care because they have no reason to spend money to avoid accidents that injurers inevitably pay for. Each injurer thus selects care to minimize $C(x) + p(x,0)D = C(x) + p(x,0)H$, and thus selects the level of care at which:

$$ C' (x) = -p_s (x, 0) H $$

The injurer will select the level of care that is optimal given the victim’s suboptimal behavior (i.e., second best optimal care), but will not select first-best optimal care, $x^*$.

Under pure negligence, injurers are liable only if they fail to take “due care.” Thus, an injurer can, by selecting care $x^*$ instead of zero care, avoid all liability for the victim’s expected accident costs. We know that an injurer who expects the victim to take due care will do so as well. The definition of optimal care implies that $C(x^*) + p(x^*, y^*) H < C(x) + p(x, y) H$ which in turn implies that the injurer incurs lower expected costs if he takes optimal care, $C(x^*)$, than if he does not and faces $C(x) + p(x, y) H$. A victim who expects the injurer to take due care knows he must bear his own accident costs. He thus faces expected cost of $c(y) + p(x^*, y^*) H$ and takes optimal care (Equation (2)). This equilibrium is unique. An equilibrium will not arise in which both parties decide to be negligent. Both parties cannot find it in their best interests to be negligent because we know that $C(0) + c(0) + p(0, 0)H > C(x^*) + c(y^*) + p(x^*, y^*) H$, thus it cannot be the case that the injurer and victim would both be better off being negligent.

Under negligence with contributory negligence, injurers are liable only if they failed to take due care and the victim took due care. Victims bear losses whenever injurers took due care or the victim did not. This rule also induces optimal care by both parties.

3 In the bilateral-risk case, where each party can injure the other and be injured by them, then neither party takes optimal care.
Victims will always take due care because they are better off taking due care whether they expect injurers to do so. If they expect injurers to be negligent, then victims will take due care in order to shift their own expected accident costs to injurers. If they expect injurers to take due care, then victims will take due care because they bear the full costs of accidents, and we know that their expected costs \( c(y) + p(x^*, y)H \) are minimized when \( y = y^* \). Injurers in turn will be nonnegligent because they know victims will take due care. In this case, injurers face expected costs of \( C(x) + p(x, y^*)H \) if they are negligent and expected costs of \( C(x^*) \) if they take due care. Thus they take due care to minimize their costs. Negligence with comparative negligence also yields an equilibrium where both parties take optimal care (Cooter and Ulen 1986).

Strict liability with contributory negligence also can induce optimal care by both parties. In this situation, it is the victim who always has incentives to invest in care (no matter what he expects the injurer to do), because the victim, by taking due care, shifts all accident costs onto the injurer. The injurer in turn will take due care because he expects to bear expected costs of \( C(x) + p(x, y^*)H \), which are minimized when he takes optimal care (see Equation 2).

### 3.2.1.2. Discussion and Analysis

Several features of this model and equilibrium are worth noting. First, under the assumptions of this model, negligence liability (with or without contributory negligence) would be the lowest cost rule were there are litigation costs, because injurers always take due care, and thus no one ever sues anyone. Therefore, negligence accomplishes its task without a single tort action ever being filed (Shavell 1980).

Second, and related, in this model, all negligence is deliberate: no one ever fails to take due care accidentally (compare with Arlen and MacLeod 2003, 2005a).

Third, strict liability only induces optimal care when damages precisely equal the harm caused because strict liability in effect sets a price on risk-taking. The rule provides optimal incentives only when the expected price equals the expected social cost of accidents (Cooter 1984). By contrast, negligence can induce optimal care (by both parties) even when damage awards deviate from the social cost of harm, \( H \). Excessive damages do not distort care-taking when everyone is perfectly informed because excessive damages simply provide injurers with additional motivation to take due care. They do not incentivize excessive care. Injurers take due care leaving victims with expected costs of \( c(y) + p(x^*, y)H \), which is minimized at \( y^* \). Damages less than \( H \) also can induce optimal care as long as damages equal or exceed the level at which \( C(x^*) < C(x) + p(x, y)D \) for all \( x < x^* \) (Cooter 1984).

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4 This equilibrium is unique because there does not exist an equilibrium where both parties take suboptimal care. Under such an equilibrium, injurers would take no care, leaving victims with expected costs of \( c(y) + p(0, y)H \). Yet we know from Equation (2) that a victim who expects to bear his own accident costs maximizes welfare by taking care at least equal to \( y^* \). Thus, an equilibrium where both fail to take optimal care does not exist.
3.2.1.3. Wrongful Death and Serious Permanent Injury

Nevertheless, neither strict liability nor negligence induce optimal care if courts set optimal damages too low (below the level needed to induce due care). Negligence will also not induce optimal care if courts set due care too low. This may occur if courts predicate due care on a value of the harm that is well below the social cost of the harm caused.

Both sources of inefficiency are a concern for activities that risk death or serious permanent injury. To provide optimal incentives, expected damages for wrongful death should equal the social cost of either the harm imposed on any realized victims (e.g., death) or the social cost of the risk created by the defendant, which is the amount that all parties subject to the risk from the activity would require to be compensated for the risk of death divided by the expected number of victims (Arlen 1985). Usually, the latter must be used because damages cannot be set at the amount needed to compensate injured victims for being killed because money has no value to those who are dead; as a result, optimal ex post compensation for death becomes infinite (see Cook and Graham 1984; Arlen 1985). Using similar techniques, regulators set the value of a statistical life at between $2.5 million to over $8 million (Cooter and DePianto 2013, 449; see Arlen 2000).

Yet wrongful death statutes do not predicate recovery on the social cost of life, but instead use lost income plus pain and suffering; increasingly, the latter is capped. Median damage awards under these rules are in the hundreds of thousands in most types of cases. As a result, average damage awards for wrongful death in successful cases are well below the social cost of lives lost; expected damages for accidents caused (including cases where suits are not brought or injurers prevail) are even lower (Arlen 1985, 2000; Cooter and DePianto 2013, 451).5

Injurers also have inadequate incentives to take optimal care if courts do not use the right value of life when establishing due care under negligence liability. In the United States, neither judges nor juries are provided adequate guidance on how to measure the social cost of the risk wrongful death or serious permanent injuring for purposes of determining due care. This undermines the ability of the tort system to achieve its goals, independent of any of the other factors that we consider in Section 3.2.2.

3.2.2. Liability when Information about Optimal Behavior Is Costly

The classic model provides the foundational framework for the economic analysis of liability. Yet actual tort liability rules differ in structure and effect from the simple classic model in a host of ways, including the scope of liability (e.g., Geistfeld 2013;

5 Observe that, in theory, under negligence liability, setting tort damages for death and injury at the amount needed to deter injurers optimally would not distort victim’s incentives under negligence—even if it exceeds an individual victim’s losses—because these awards would induce injurers to take due care, leaving victims to bear their own losses.
Dari-Mattiacci 2005), forms of injurer care-taking (e.g., Shavell 1980; Dari-Mattiacci; Arlen and MacLeod 2005a); role of causation (Kahan 1989; Ben-Shahar 2000; Hylton 2013), level of damages (e.g., Arlen 1985, 2000), and litigation costs (Hylton 1990). Optimal-liability rules also often differ.

Of particular importance, the classic model assumes information is costless. Yet tort liability is needed when high transactions costs (Coase 1960), information problems (e.g., Spence 1977), and other impediments to optimal contracting (e.g., Arlen and MacLeod 2005a; Wickelgren 2006; Arlen 2010; Choi and Spier 2014) preclude private parties from optimally regulating risk by contract, and when information and enforcement costs render liability superior to regulation (e.g., Shavell 1984, 2014). The information costs that help justify tort liability also inevitably alter its optimal and actual structure and its deterrent effect.

3.2.2.1. **Courts Cannot Observe All Precautions**

The classic economic analysis of negligence assumes that expected accident costs depend on a single input, “care” or “precaution,” whose optimal level is known by all parties ex ante, and actual level is verifiable ex post. Yet in fact expected accident costs depend on a host of different decisions by the injurer that each affect expected accident costs. Injurers may invest in information, systems, and technology that affect risk before undertaking the activity that puts the victim in peril (Grady 1988; Arlen and MacLeod 2005a); they may take both observable and unobservable care while undertaking the activity (e.g., Shavell 1987, 9; Grady 1983, 1988), and they affect expected accident costs through decisions concerning how frequently to engage in the risky activity (Diamond 1974, 146–147; Shavell 1980).

The manifold type of available precautions is important because information about optimal and actual precaution is costly, and the social cost and benefits of assessing optimal and actual precaution differ across the forms of precaution (see, generally, Dari-Mattiacci [2005], and Grady [1988] discussing durable versus nondurable precaution). In many situations, courts can optimally base liability on some forms of precaution—e.g., “care”—but not on others. For example, courts may be able to predicate negligence on the investment in “care” per unit of the risky activity but may not be able to apply a “due care” standard to govern other precautions, such as activity levels (Diamond 1974, 146; Shavell 1980), the investment by the injurer in information/expertise needed to determine and provide optimal care (Arlen and MacLeod 2005a), or technology adoption costs (Dari-Mattiacci and Franzoni 2005). These precautions are left outside the negligence determination (Dari-Mattiacci 2005; see Shavell 1980; Grady 1983, 1988; Arlen and MacLeod 2005a). Accordingly, to understand optimal tort liability, we must examine how the various liability rules function in this situation.

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6 By contrast, were information costless, these differences would not matter because courts imposing negligence liability could impose separate duties to govern each separate form of precaution and predicate the negligence determination on the injurer’s adherence to each duty (see Dari-Mattiacci 2005; Shavell, 1980, 22–23; 1987, 26, 46).
We now examine strict liability and negligence when courts cannot observe a particular form of precaution: injurers’ and victims’ activity levels. Often parties affect expected accident costs through two distinct forms of precautions: (1) the level of care employed in undertaking the activity and (2) the decision as to how frequently to engage in the activity. Yet negligence liability predicates liability on the care decision; courts generally do not consider activity levels when determining whether precautions were optimal (Shavell 1980, 1987, 25–26; but, see Gilles 1992). In this context, tort liability alone cannot ensure both optimal care-taking and optimal activity levels by injurers and victims (Shavell 1980, 1987, 29–30; see Diamond 1974, 146–147).

The reason is easily explained intuitively. Negligence (with or without contributory negligence) and strict liability (with contributory negligence) each can induce optimal care by both parties, but only because each rule simultaneously threatens both injurers and victims with the same expected loss, \( p(x,y)H \), should they fail to take optimal care. When we turn to activity levels, however, each rule only provides incentives to one party. Negligence shifts all accident losses onto victims (as injurers will take due care), thus providing victims—but not injurers—with optimal incentives to reduce activity levels to optimal levels. By contrast, strict liability places all losses on injurers. Injurers thus undertake optimal activity levels; victims do not (Shavell 1980, 1987, 29–30; see Diamond 1974, 146–147). Accordingly, neither negligence nor strict liability can induce optimal care and activity levels by both injurers and victims, when the negligence determination is predicated on care-taking alone. The choice between the two liability rules thus should depend, in part, on whether it enhances social welfare more to deter excessive activity levels by injurers or victims (Shavell 1980).

Although neither traditional strict liability nor negligence can induce both optimal care and activity levels by all parties, it is possible to do so through a combination of liability and regulatory sanctions. For example, the state can induce optimal care and activity levels by all parties by using negligence liability supplemented by regulatory liability (equal to \( H \)) imposed on injurers whenever they cause harm. In this situation, tort liability regulates care and victims’ activity levels; the regulatory sanction will induce injurers to undertake optimal activity levels. Whether this approach is indeed optimal depends in part on the social cost of regulatory enforcement relative to the social cost of leaving either injurers’ activity levels or victims’ activity levels unregulated by liability.

### 3.2.2.2. Injurer Information Costs

Information costs do not just affect courts. Injurers also often must incur costs to identify both optimal precautions and the legal duty, and cannot reliably take optimal care unless they make these investments in information and expertise. Thus, these information costs are themselves a form of precaution. Increased information increases the likelihood that defendants can select optimal care if the legal standard imposes a duty to do so. Information is particularly important when the decision of what precaution to

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7 In this context, the analysis of activity levels also can apply to other precautions that do not affect a party’s cost or probability of complying with the due care standard (compare with Section 3.2.2.2.).
select requires the injurer to select between discrete forms of precaution—e.g., different medical treatments or product designs—whose expected effect on potential victims can vary significantly, independent of cost.

Injurer information costs do more than introduce an additional form of precaution for liability to regulate. They also help explain, and allow us to model, accidental negligence. In the traditional model (Brown 1973; Shavell 1980), injurers chose to be negligent. In this framework, by contrast, injurers may be negligent knowingly, as before, but they also may be negligent by accident. Injurers may fail to take due care accidentally because they failed to invest optimally in information or expertise and as a result were misinformed about optimal care. They also may err accidentally, even when they did invest optimally in information or expertise when optimal investment in information does not eliminate the risk of error, as when the task is complicated or involves dynamic technology (Arlen and MacLeod 2003, 2005a).

In this situation, in order to enhance social welfare and minimize the social expected cost of accidents, tort liability must induce injurers to invest optimally in two forms of precaution—ex ante information (or expertise) and “care.” Absent liability, injurers would not invest optimally in either care or information/expertise. Injurers would have no incentive to invest in precautions to safeguard others, as they bear the cost of these precautions without obtaining a benefit. As a result, they also do not benefit from investing in information or expertise about optimal precautions (see Arlen and MacLeod 2003, 2005a).

Negligence liability can be used to induce both optimal information investment and optimal precaution if damages are set correctly. Interestingly, this result holds even if, as is likely, courts applying negligence liability base due care on the precaution selected, not on information or expertise. Negligence liability is able to induce both optimal care and optimal investment in information—even though it is unable to induce optimal activity levels—because liability for failure to select the optimal precaution provides injurers an incentive to invest in information or expertise on optimal precautions.

Under negligence, injurers may be negligent for one of two reasons. First, an injurer who is optimally informed about optimal precautions nevertheless may select a suboptimal precaution deliberately. This is the form of negligence considered in the traditional model (Brown 1973; Shavell 1980). Second, the injurer may be negligent accidentally after selecting a precaution that he erroneously believed to be optimal because he was not fully informed. Indeed, injurers may err accidentally, even if they invest optimally in information and expertise, if the activity is sufficiently complex that optimal expertise does not eliminate the risk of error (e.g., medical care). This liability for accidental negligence serves a vital role: it provides needed incentives for injurers to invest in information and expertise. The reason is that, unlike activity levels, this

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8 In the classic model (e.g., Brown 1973; Shavell 1980), injurers are not liable in equilibrium in the situation considered here. They may be negligent in equilibrium as a result of a variety of problems. These include (1) victim information costs, litigation costs, and burdens of proof that deter some injured victims from suing negligent injurers who harm them (e.g., Hylton 1990; Talley 2013); (2) the availability of liability insurance that is not perfectly experience rated (e.g., Shavell 2007, 149–150); (3) the impact of asymmetric information (Wickelgren 2013) and behavioral limitations (Babcock and Ferguson 2013) on
information directly affects the probability that the injurer will fail to select the optimal precaution, and be found negligent. Accordingly, negligence liability can be structured to induce optimal investment in information and expertise by setting expected damages for accidental negligence equal to the expected benefit to society of informed, rather than uninformed, decision making. This is given by the expected benefit of optimal precautions (rather than suboptimal ones) (Arlen and MacLeod 2003, 2005a; cf. Grady 1983, 1988, discussing the zone of strict liability within the negligence rule).

The conclusion that negligence can regulate both care and information reveals that the mere fact that a form of precaution falls outside the due care standard does not mean that negligence liability does not reach the alternative form of precaution. Negligence liability may be able to induce “due care” and provide optimal incentives to invest in the additional precaution if that precaution affects the injurer’s ability to comply with the due care standard, as is the case with information (Arlen and MacLeod 2005a; see Grady 1983; Shavell 1987, 96–97).

3.2.2.2.1. Optimal Damages

Incorporating information costs changes the analysis of optimal damages in three important ways. First, the traditional analysis finds that negligence liability can induce optimal precautions if damages equal the harm caused (Shavell 1980) although lower damage awards often suffice to induce optimal care (Cooter 1984). By contrast, when injurers must incur costs to identify optimal care, this finding holds for deliberate or knowing negligence, but not for accidental negligence. Damages for accidental negligence must be less than the harm caused because these damages are not intended to internalize the social cost of negligence. Instead, they are needed to internalize the social cost of under investment in expertise. Damages for accidental error thus must be less than \( H \) whenever the victim would have faced a risk of injury even if the injurer took the optimal precaution (see Equation (10) below) (Arlen and MacLeod 2005a). By contrast, under strict liability, damages of \( H \) will induce both optimal expertise and care (as shown in Section 3.2.2.2.3).

Second, and related, this analysis reveals that optimal negligence liability generally requires higher damages for deliberate negligence than for accidental negligence. If a single damage rule is used for both, it may be possible to induce optimal care using the damage rule that induces optimal expertise because less than fully compensatory damages often induce optimal care (Cooter 1984). But in some cases, the optimal damages for accidental negligence will be too low to deter informed injurers from being negligent.

(settlement outcomes, and, in turn incentives to take care, and (4) damage rules for death and serious permanent injury that set expected damages below the expected cost of the harm (Arlen 1985, 2000). Nevertheless, with or without these impediments, when injurers take less than is optimal or consistent with due care, this neglect is deliberate (compare Brown 1973; Landes and Poser 1987; Shavell 1980, with Grady 1983; Shavell 1987, 96–97; Arlen and MacLeod 2003, 2005a).

9 This analysis thus may be relevant to the analysis of punitive damages. For alternative explanations see Cooter (1982; 1989); Polinsky and Shavell (1988); Haddock et al. (1990); Sharkey (2013).
Finally, the present analysis reveals that accuracy in setting damages may be almost as important under negligence as is strict liability. Under the traditional analysis, excess damages do not induce excessive care under negligence because injurers can avoid the risk of liability by taking optimal care (Cooter 1984). But this is not true of damages for accidental negligence. If damages for accidental negligence are greater than the optimal damages determined in Equation (10), then people will over invest in expertise (see Arlen and MacLeod 2005a).

3.2.2.2. Formal Analysis

Consider a potential injurer who undertakes an activity that provides him a benefit, $b$, but imposes expected accident costs on others of $p(x^i)H$, depending on which of several discrete precautions, $x^i$, he selects. For simplicity, we let $i = \ast$ or $0$. The cost of precaution is given by $c(x^i)$. Expected accident costs are given by $p(x^i)H$. Assume that $x^\ast$ is more costly than $x^0$ and thus $c(x^0) < c(x^\ast)$; $x^\ast$ nevertheless is the optimal precaution because the resulting reduction in expected accident costs, $(p(x^0) - p(x^\ast))H$, exceeds the additional cost of care.

The injurer does not know all the possible precautions, $x^i$. Nor does he know $p(x^i)H$. In order to identify precautions and evaluate their relative merit he must invest in information or expertise, $e$. Expertise increases the probability that the injurer is accurately informed about available precautions and their costs and benefits—a probability given by $q(e)$, where $q'(e) > 0$, $q''(e) < 0$. Injurers who are not informed select suboptimal precaution. The cost of expertise is given by $C(e)$, where $C'(e) > 0$, $C''(e) > 0$. Investment in expertise is unverifiable. We assume that ex post the court can accurately determine both optimal care and the injurer’s actual precaution.

Social welfare is given by Equation (5), assuming that uninformed injurers always select the suboptimal precaution $x^0$:

$$b - q(e)\{c(x^\ast) + p(x^\ast)H\} - (1 - q(e))\{c(x^0) + p(x^0)H\} - C(e)$$

Social welfare is maximized when two conditions are met. First, informed injurers (who exist with probability $q(e)$), should select the precaution that minimizes the total cost of accidents, $c(x) - p(x)H$. Thus, they should select optimal precaution, $x^\ast$. Second, injurers should invest optimally in expertise.

Social optimal expertise is the expertise that maximizes social welfare, assuming that informed injurers select optimal precautions and uninformed ones do not. It is given by the expertise such that:

$$q'(e)\{[p(x^0) - p(x^\ast)]H - [c(x^\ast) - c(x^0)]\} = C'(e).$$
no precaution even if informed, the injurer will not invest in information about precautions at all.

Consider now the effect of negligence on both the ex ante decision to invest in expertise and the precaution decision. In most circumstances, courts can observe precautions but cannot observe expertise. Thus, one form of precaution is directly governed by negligence liability, but the other (expertise) is not. Nevertheless, negligence liability can induce both optimal precaution and optimal investment in expertise.

Consider first the incentives of an informed injurer to select precaution under a negligence regime. The informed injurer will select the precaution that minimizes expected costs:

\[ c(x^i) + p(x^i)D^i, \]

where \( D^i \) is the damage award, with \( i = *, 0; D^* = 0 \) and \( D^0 = H \). We know from previous analysis that an informed injurer facing damages of \( H \) for losses caused by negligence will minimize expected costs by selecting optimal care, \( x^* \), thereby avoiding liability.

As for expertise, the injurer invests in the level of expertise that maximizes his expected welfare, assuming that he selects optimal care when informed. Thus, he selects expertise to maximize

\[ b - q(e) \{c(x^*)\} - (1 - q(e))\{c(x^0) + p(x^0)D\} - C(e). \]

He thus sets expertise such that the marginal cost of expertise equals the net marginal benefit of expertise, where the latter equals the reduction in liability minus the added cost of selecting optimal care instead of negligent care (accidentally):

\[ q'(e)\{p(x^0)D - (c(x^*) - c(x^0))\} = C'(e). \]

Accordingly, the injurer will invest optimally in information and expertise so long as the expected damage award for accidental negligence, \( p(x^0)D \), precisely equals the benefit to victims of expertise: \( p(x^*) - p(x^0)H \). Actual optimal damages for accidental harm thus equal:

\[ D = \frac{(p^0 - p^*)H}{p^0} < H. \]

This implies that the optimal damages for injuries resulting from a knowing decision to select suboptimal care exceed the optimal damages for accidental negligence, even when liability is imposed for all injuries attributable to injurer negligence. By contrast, setting damages equal to \( H \) for both types of cases induces excessive investment in expertise (Arlen and MacLeod 2003; 2005).
3.2.2.2.3. Formal Analysis: Strict Liability

Unlike negligence, strict liability can induce both optimal precaution and optimal investment in information when damages equal the harm caused in all cases. We know that damages equal to $H$ suffice to induce informed injurers to select the optimal precaution. Thus, under strict liability with full compensation damages the injurer faces expected costs of:

$$b - q(e) \{c(x^*) + p(x^*)H\} - (1 - q(e))\{c(x^0) + p(x^0)H\} - C(e)$$  \hspace{1cm} (11)

A comparison of Equation (11) and (5) reveals that injurers expected costs of care and expertise equal the social costs; thus they invest optimally in expertise and care.

3.2.2.3. Courts Err When Determining Optimal Care

The preceding analysis assumed that courts are perfectly and costlessly informed. But courts also must incur costs to obtain information, and regularly are only imperfectly informed. This affects both the cost and the accuracy of the litigation process. The possibility that courts will be imperfectly informed affects both the relative efficacy of strict liability and negligence and the impact of negligence on incentives to invest in precautions.

Strict liability can provide optimal incentives, even if courts have no information on optimal care, as long as courts set damages correctly and the parties have (or can optimally obtain) information on optimal care (Cooter 1984). By contrast, negligence is potentially (but not always) vulnerable to court error in determining optimal care (Cooter 1984; Craswell and Calfee 1986) and damages (Arlen and MacLeod 2005a). To assess the impact of error, we must first identify more precisely the type of court error, as well as whether the affected party can predict the court’s decision.

Assume first that courts err in determining due care, but injurers accurately predict the error. If courts predictably set due care too low, then injurers also will select suboptimal care, assuming damages are set correctly (Shavell 2007, 161). This under-investment in care also can affect other precautions. For example, when due care is suboptimal, injurers may under-invest in expertise—and obtain it on the “wrong” precautions (from society’s perspective) because injurers gain nothing by determining optimal care. Thus, if damages are set second best optimally, then injurers will select suboptimal precaution when informed and will have an excessive risk of accidental error.

If, by contrast, courts set due care too high, court error will not necessarily induce excessive care. Should courts set due care so high that the cost of compliance exceeds the reduction in expected liability, then injurers will not try to comply. In this case,

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10 Ex ante information costs do not inevitably translate into costly or even inaccurate adjudication. After all, if the parties invest optimally in information about optimal precautions ex ante, ex post adjudication would not entail additional costs to obtain information if the parties can credibly share their information about optimal care and information on actual conduct is readily available. Nevertheless, often the information available to courts is not only costly but also imperfect.
negligence in effect becomes strict liability: injurers will take optimal care if damages equal the harm caused (Shavell 2007, 161). Injurers also will invest optimally in information and expertise, provided damages equal the harm caused (see Section 3.2.2.2.3).

By contrast, if courts set due care too high, but not so high that injurers would prefer to be deliberately negligent, then injurers will take excessive care (Shavell 2007, 161). This excessive care will also distort investment in information, causing injurers to seek information on due care (excessive care), not optimal care. It also will lead to less investment than is optimal because the injurer gains less marginal benefit from taking due care when due care is set too high than does society when care is set optimally.

Alternatively, courts may err in setting damages. Strict liability is very vulnerable to error in setting damages because liability in effect imposes a price that the injurer must pay for his activities. Charging a price less than the social cost will induce too little care and excessive activity levels (Cooter 1984). By contrast, the traditional analysis finds that negligence is less vulnerable to errors in setting damages. As long as damages exceed the damages at which the injurer is better off taking optimal care—which is the $D$ at which $c(x^*) = c(0) + p(x')D$—then negligence will induce due care. Damages thus often can be less than $H$ and still induce optimal care. Damages also can substantially exceed $H$ without inducing excessive care-taking because injurers can avoid all expected liability by taking due care (Cooter 1984).

These conclusions do not hold, however, when injurers can be negligent accidentally and can reduce the risk of accidental negligence by investing in expertise. In this situation, all errors in setting damages affect expected accident costs through the impact on expertise. Negligence liability holds injurers liable for accidental negligence. In effect, this operates to “price” the injurer’s decisions to invest in information. As we have seen, this price must be set precisely equal to the social marginal benefit of expertise in order to induce optimal expertise (Arlen and MacLeod 2003, 2005).

Finally, courts may err in setting the standard of care in ways that cannot be predicted ex ante. In this case, under negligence liability, court error may induce injurers to take excessive care, even if, on average, courts set due care equal to optimal care (Calfee and Craswell 1986; see Diamond 1974). To see this, assume that injurers expect the due care to be set equal to $x^* \pm \varepsilon$, where $\varepsilon$ is an error term. Assume that half the time $\varepsilon > 0$ and the other half $\varepsilon < 0$. In this situation, negligence liability will induce each injurer to take excessive care. An injurer who takes excessive care $x^* + \varepsilon$ incurs unnecessary expected care costs since there is a 50% probability the court will set care too low: $\frac{1}{2}[c(x^* + \varepsilon) - c(x^* - \varepsilon)]$.

By contrast, when the court sets due care too high, injurers obtain a large benefit from taking excessive care: they can avoid any liability for injuries caused. Whenever the expected liability savings exceeds the marginal increase in care, injurers will over-invest in care: $p(x^* - \varepsilon)D > c(x^* + \varepsilon) - c(x^* - \varepsilon)$ (Calfee and Craswell 1986).

The conclusion that court error induces excessive care-taking does not hold in all situations, however. Negligence may not induce excessive care—or the effect will be less pronounced—in bilateral care cases that include a defense of comparative negligence, provided the uncertainty or risk of error affects both parties (Cooter and Ulen 1986;
see Dari-Mattiacci and Hendriks [2014], finding comparative negligence is welfare-enhancing when due care is set above optimal care).

In addition, negligence may not induce excessive care if courts accurately apply causation rules (Kahan 1989). The preceding analysis assumes that small deviations between the injurer’s level of care and due care can have large consequences—causing the injurer to bear liability of $H$ for all harms caused. Under negligence liability, injurers are not liable for harms caused unless it is more likely than not that, had the injurer taken due care, the injury would not have occurred. Accordingly, if the court sets due care at $x^*+\varepsilon$, but the defendant only took care, $x^*$, he nevertheless will not be held liable unless the plaintiff can show that it is more likely than not that the injury would not have happened if the injurer took due care ($x^*+\varepsilon$) rather than allegedly negligent care, $x^*$. In other words, if we consider all the ways the harm could have happened given care $x^*$, more than half the risk of harm would need to be removed by an additional marginal investment of $\varepsilon$. Given that $x^*$ is optimal and the marginal benefit of care is declining, in most circumstances, failure to take excessive care rather than optimal care will rarely be the legal cause of the harm, unless courts err by a wide margin. To the extent that injurers anticipate this, uncertainty will not induce them to take excessive care (Kahan 1989; see Grady 1983; see, generally, Hylton 2013, 100–103).

### 3.2.2.4. Implications for Future Research

Comparing Section 3.2.2 and Section 3.2.1 we see that tort liability is more effective at minimizing the expected cost of accidents the lower the cost to injurers, courts, and victims (see infra Section 3.2.4) of determining both optimal and actual care and the greater the marginal benefit of information relative to the marginal cost. This suggests that a productive avenue for scholarship and tort reform includes mechanisms for improving information flows both into the tort system, as well as out of the tort system, to those making decisions about due care and whether to litigate (e.g., Daughety and Reingaman [2005], discussing secrecy and settlement).

### 3.2.3. Risk-Averse Victims

When victims are risk averse but injurers are not, the social cost of accidents is higher when victims bear their own losses than when injurers do. This can affect optimal liability rules.

By definition, a risk-averse person would prefer to receive $\$X$ with certainty than to accept a risky bet with an expected value of $\$X$. This implies that the social cost of accidents is higher when losses fall on a risk-averse person than when they fall on someone who is risk neutral because an accident introduces variance in expected outcomes. Thus, when injurers are risk neutral (e.g., large corporations) and victims are risk averse, tort liability can reduce the social cost of accidents simply by shifting losses from victims to injurers, all else equal. This risk-spreading benefit potentially provides an argument for favoring strict liability (with contributory negligence) over any form of negligence
liability, as strict liability provides victims compensation for losses even when injurers took due care (Shavell 1987, Chapter 9). By contrast, when victims and injurers are each risk averse—as with automobile accidents—then tort liability cannot increase or decrease expected social welfare by shifting the loss from one party to the other.

Nevertheless, even when only victims are risk averse the social benefit of using strict liability to insulate victims from accident costs purely for risk-spreading reasons may not be as large as it might at first appear. First, tort liability is not the only mechanism for insulating victims from expected accident costs. First-party insurance, such as health insurance and life insurance, provides coverage against many costs associated with accidents more quickly and with lower administrative costs compared with tort liability (see, e.g., Weiler 1991).

Insurance is particularly attractive because even under strict liability, victims generally would have to purchase first-party insurance. First, victims inevitably face a risk of suffering harms for which they will not receive tort compensation (e.g., because the harm was caused by an act of nature, causation cannot be shown, or the injurer is judgment proof). Second, tort recovery rarely arrives in time to cover the mounting medical bills of a seriously injured person. Thus, even with tort liability, victims need to purchase first-party insurance, the cost of which may not be significantly lower under strict liability than under negligence if the risk of non-tort-based accidents and the cost to insurers of pursing claims against injurers is high (see Shavell 2004, 268–269; see also Epstein [1985] for additional discussion of limitations of tort liability as insurance). Thus, while victims can benefit from the risk-spreading benefits of tort liability, in practice, the risk-spreading benefits of strict liability versus negligence may not be sufficiently large, on net, to justify favoring the former or the latter independent of the deterrence benefits of liability.

3.2.4. Litigation Costs and Settlement

Litigation costs also affect the optimal choice of liability rule. As between several equally effective rules, the optimal liability rule is the one that optimally deters at the lowest cost (in terms of administrative and litigation costs). Strict liability (with or without contributory negligence) would appear to be more costly because it generates more litigation (Posner 2011). After all, in a perfect world, no one sues under negligence because injurers always take due care (Shavell 2007, 155). Nevertheless, once we expand the analysis to include information costs and other imperfections, injurers will fail to take due care even under an optimal negligence rule (see supra Section 3.2.2). In this case, relative administrative costs are less clear.

Negligence generates fewer suits than strict liability does. Nevertheless, each negligence action may be substantially more expensive because each party may incur enormous expenditures to establish optimal or actual care.\(^{11}\) Negligence also may reduce

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\(^{11}\) This conclusion may not hold if we compare negligence with strict liability with contributory negligence if courts applying the latter must calculate optimal care by injurers to determine optimal
parties’ willingness to settle if parties are more likely to have divergent expectations of outcomes under negligence (Spier 1997; Shavell 2007, 155; Wickelgren 2013). Finally, negligence liability may undermine optimal deterrence if victims cannot easily determine ex ante whether injurers took due care. In this case, victims may be less likely to sue under negligence than under strict liability, even when litigation would be publicly and privately optimal under full information, because litigation costs exceed expected recovery when victims are uncertain. In this situation, injurers who fail to take care may face a lower risk of liability under negligence than strict liability, leading them to take too little care. This result is particularly likely if victims know they were injured, but cannot identify who injured them without paying for an investigation (as with many environmental wrongs). Accordingly, reforms that increase victims’ upfront litigation costs—as arbitration appears to do—may undermine the deterrent effect of the tort system if it reduces litigation and expected damage awards below the level needed to induce injurers to take optimal care.

3.3. Products Liability and Medical Malpractice

Much of the risk of harm that people face is not imposed by strangers. Instead, people often, in effect, invite risk of harm into their lives through the goods and services (e.g., medical care) that they purchase, seeking to improve their lives. This situation differs from strangers cases in two respects. First, when potential injurers sell risky goods and services to consumers, both producers and consumers are better off ex ante when potential injurers are able to credibly commit that they will invest optimally in care. Optimal care maximizes the value of the product to the consumer and care by victims, as is the case in the traditional model (Shavell 1987, 16–17), but this might not be the case when courts can optimally set victim’s due care without calculating the injurer’s optimal care. For example, courts may optimally conclude pedestrians should not jaywalk or rush out into traffic, without determining the optimal care of drivers.

Negligence also may increase the risk of underdeterrence if information to determine the injurer’s care is costly and victims rationally fail to incur this cost, even when it would be optimal for them to do so, because the harm is one that could have occurred even absent negligence. Tort liability could induce optimal litigation in this situation through supercompensatory damage awards. Yet actual tort damages rules for accidental injuries are not supercompensatory. Punitive damages tend to be reserved for harms that result from deliberate (or wanton and willful) breaches.

In litigation, the victim often can hire a lawyer on a contingency fee basis and does not pay for the judge. By contrast, under arbitration, each party not only must pay his own litigation costs, but also must pay the arbitrator. Thus, even when arbitration reduces each person’s own lawyer’s fees by shortening the process, it may increase the victim’s litigation costs by requiring him to pay for a decision maker who otherwise would be provided by the state. This may reduce incentives to sue, particularly if arbitrators tend to award lower expected damages.
thus the consumer’s willingness to pay. Second, in this context the justification for tort liability does not root in traditional transactions costs: transactions costs generally are low since the producers and consumers are in a market relationship (Spence 1977; Polinsky 1980). Instead tort liability is needed when information costs render markets inefficient (Spence 1977) and impediments to optimal contracting render contracting over liability inefficient (Arlen 2010).

This section examines the justifications for and optimal structure of tort liability to govern these market relationships. It highlights the importance of victim information costs in both justifying liability in the first place and victim or injurer information costs in justifying the use of mandatory liability instead of contractual liability. Specifically, this section shows that tort liability is preferred to contractual liability when, as is often the case, the parties cannot contract optimally because consumers lack the required information (e.g., Geistfeld 1994) or contracting is plagued by inefficiencies, such as collective goods, adverse selection, or time-inconsistency problems largely arising from injurers’ imperfect information (Arlen 2010). Tort liability thus emerges as a potentially valuable supplement to contract, enabling the parties to reduce inefficiencies produced by information costs.

3.3.1. All Parties Are Perfectly Informed

Informed producers of goods and services (e.g., medical care) will invest optimally in precautions that affect the risk of harm to consumers or patients if purchasers are perfectly informed about either investments in care or the expected accident costs associated with each individual injurer (Spence 1977; Polinsky 1980). Tort liability is not needed.

The intuition behind this result is straightforward. Consider producers operating in a competitive market making goods that are identical on all dimensions except expected accident costs. It might appear that producers would seek to minimize their expected costs by not investing in care. But producers know that consumers want to purchase the product with the lowest total expected cost to them, which includes the expected accident costs associated with the product. Accordingly, using the notation from Section 3.2, consumers select the producer of the product with the lowest \( P + p(x)H = c(x) + p(x)H \), where \( P \) is the competitive market price (which equals the marginal cost of the product, \( c(x) \)). A producer seeking to minimize the total cost of his product thus must invest in care to minimize the consumer’s total expected costs. He thus selects care to minimize \( c(x) + p(x)H \), which is optimal care (see Section 3.2.1) (Spence 1977; Polinsky 1980; see Daughety and Reinganum 2013, 70–73).

Activity levels also are efficient. Activity levels are efficient when producers only produce up to the point where the social marginal benefit of the last unit made (as given by the marginal consumer’s willingness to pay for that unit) equals the marginal cost to society of making the product \( (c(x) + p(x)H) \). When consumers are informed, each consumer will only demand the product if his willingness to pay equals or exceeds the
cost of the product to him, which equals \( c(x) + p(x)H \). Thus, activity levels are optimal (see Polinsky 1980; Shavell 1980).

### 3.3.2. Product Liability When Consumers Cannot Observe Quality

Consumers of products and purchasers of medical care rarely can accurately determine the expected risk associated with purchasing a good or service from a particular producer. Consumers of products often can get information on the relative reliability (in terms of repair rates) of products made by different producers, but they rarely have good information on either the precise probability that they will be injured by a product or the expected magnitude of the harms caused (e.g., Geistfeld 1994, discussing information problems).\(^{15}\)

When consumers cannot directly observe the producer’s choice of care before purchase,\(^ {16}\) each producer knows that his investment in care will not help him compete for consumers (but see Section 3.3.4, discussing signaling). Producers in competitive markets thus will not invest in care as low care enables them to compete by lowering prices. Thus, absent liability, producers make suboptimal-quality products and expected accident costs are too high (Polinsky 1980; Shavell 1980).

Activity levels, however, may be second-best optimal—optimal given actual risk. Although consumers cannot observe care, they can predict that producers will take zero care. Consumers thus will be able to correctly calculate the total cost to them of the product, including expected accident costs, provided they can estimate \( p(0) \) and \( H \) (Daughety and Reinganum 2013, 75). By contrast, if consumers underestimate product risk, then they will underestimate the total cost to them of the product, and may purchase the product even when the total expected cost of the product is less than its benefit. This results in excessive activity levels (see Spence 1977; Shavell 1980).

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\(^{15}\) For example, consumers of pharmaceuticals are provided information through warning labels about harms that may occur, but rarely receive good information about the precise probability of each adverse event. They have even less information about the risks they face given their personal health characteristics. Similarly, patients seeking medical care can obtain some information on their caregivers. But they cannot obtain accurate information on the probability of medical error associated with receiving treatment from any particular physician or hospital because this information is not publicly disclosed (Glied 2000; Arlen and MacLeod 2003; see, generally, Arrow 1963). In addition, even if it were disclosed, the market is unlikely to function optimally as patients’ choice of provider often is distorted by both health insurers—which favor some providers over others—and by geography, as patients often cannot obtain long-term care too far from home.

\(^{16}\) Specifically, we now consider the situation where information asymmetry produces a moral hazard problem. Information asymmetry also can produce an adverse selection problem when unobservable ex ante investments result in some firms being higher-quality than others. In this case, strict liability is superior to no liability. For a discussion of how adverse selection affects the optimal liability rule see Daughety and Reinganum (2013, 76–79).
Strict tort liability for product-related harms can enhance the ex ante welfare of both producers and consumers by inducing producers to take optimal care. This enables consumers to get the quality of product that they want and are most willing to pay for. It also induces optimal activity levels. The analysis is similar to the analysis in Section 3.2.1. Under strict liability, each producer bears the full social cost of his product—both production costs and expected accident costs. Accordingly, to minimize total expected costs, they each take optimal care. Each producer then sets his price equal to his marginal cost of making the product, including expected liability: \( c(x^*) + p(x^*)H \). Consumers thus face a price equal to the full social cost, including their expected accident costs. This leads to optimal activity levels as consumers who bear the full expected social cost of the product will only purchase it if their willingness to pay equals or exceeds the social cost of the product (Polinsky 1980; Shavell 1980). Here, unlike in Section 3.3.1, the price leads to optimal activity levels even if the consumer under-estimates expected accident costs.

Negligence liability also can induce optimal care; whether it induces optimal activity levels depends on the source of the consumers’ imperfect information. Negligence liability will induce optimal care if due care equals optimal care and damages equal the harm caused (or the minimum amount needed to induce due care) (Shavell 1980; Polinsky 1980).

Activity levels also are optimal, but only if consumers accurately estimate product risk. Under negligence, all producers take due care and thus do not pay damages. Accordingly, they each charge a price equal to the marginal cost of the product \( (P = c(x^*)) \). Activity levels nevertheless will be efficient if, but only if, consumers accurately estimate expected accident costs when care is optimal. In this case, they will anticipate expected costs per unit equal to the price plus their expected accident costs, even if consumers cannot observe actual quality. In this case, activity levels will be optimal because consumers purchase the product only if their willingness to pay exceeds the total expected cost to society of making the product, \( c(x^*) + p(x^*)H \). By contrast, if consumers have no information on product quality, then under negligence consumers will predicate their purchasing decision on the price plus their inaccurate guess of expected risk. As a result, activity levels will be inefficient.

3.3.3. Producers Also Are Imperfectly Informed: Medical Malpractice

Information costs can affect both producers and consumers. This is particularly an issue with medical care.\(^{17}\) Evidence shows physicians regularly provide erroneous treatment;\(^{18}\)

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\(^{17}\) The present analysis focuses on Arlen and MacLeod (2003, 2005a). For an analysis of products liability where producers can invest in research and development related to product safety see Daughety and Reinganum (1995, 2006).

\(^{18}\) See Institute of Medicine (2007). Patients seeking medical treatment face a serious risk that they will be severely injured or be killed by the treatment they receive. Studies suggest that 4%–18% of patients seeking care in hospitals are the victims of preventable medical error, with many suffering serious injury.
moreover, medical error generally is accidental (see Mello and Studdert 2008; see also Studdert et. al 2006).

Medical providers often err accidentally because they lacked the information or expertise needed to properly diagnose the patient, identify the correct treatment, or provide the treatment correctly (Arlen and MacLeod 2003, 2005a; see Mello and Studdert [2008], identifying inadequate knowledge as an important cause of medical negligence). Physicians can reduce the probability of accidental error by investing in expertise and systems that reduce the risk error (such as health care technology). Thus, expertise constitutes a form of precaution that affects patients' safety (Arlen and MacLeod 2003, 2005). Optimal deterrence thus requires that liability induce optimal investment in expertise by uninformed physicians, as well as optimal care when physicians are informed about how to best care for their patients.

In many ways, the analysis of malpractice liability with expertise is similar to Section 3.2.2.2 supra. But there are two differences that warrant giving it separate attention in the formal section. First, in the medical care context, information and expertise are collective goods. Physicians' investments in the expertise needed to properly diagnose patients and select treatments, and in the systems and health care technology needed to ensure treatment is properly delivered, constitute “collective goods” because they affect the quality of care a physician provides to all of his patients. As a result, liability that enhances expertise also is a collective good, as a physician's incentive to invest in expertise to protect each patient depends on his expected liability for accidental harm to all of his patients (Arlen and MacLeod 2003, 2005a; Arlen 2010, 2013). We develop the implications of this in Section 3.3.4 infra.

Second, medical markets usually involve an additional party—the health insurer—who is in a contractual relationship with both the patient and the medical provider. Insurers alter the analysis because they bear most of the cost of medical services ex post and enter into contracts ex ante with physicians designed to alter treatment choices often to reduce costs relative to the treatment the patient would often prefer ex post.

(Weiler et al. [1993], reviewing written hospital records, found that 3.7% of the patients were victims of an error that caused significant harm; Andrews 2005, finding that 17.7% of patients were the victim of at least one error that extended their hospital stay). About 1% of hospital patients suffer errors that constitute medical negligence (Brennan et al. 1991). Indeed, medical error increases average hospital costs by $1,246 per patient admission, and, increases average costs in the riskiest hospitals by $4,769 per patient admission (Mello et al. 2007, 847). Moreover, medical error reaches beyond hospital walls: physicians routinely provide their patients less than medically recommended care (McGlynn et al. [2003, 2641] finding that patients on average receive only about 55% of recommended care; Schuster et al. [1998, 521] finding that, for chronic conditions, only “60% [of patients] received recommended care and 20% received contraindicated care”). Overall, medical error costs about $17–29 billion per year (Institute of Medicine 1999).

In addition, even when physicians want to provide optimal treatment, their ability to do so depends on whether they and the medical institutions within which they practice invested optimally in the systems and health care technology needed to reduce optimally the risk of medical error (Abraham and Weiler 1994; Mello and Brennan 2002; Arlen and MacLeod 2003).
Section 3.3.3.1. evaluates optimal negligence liability for medical malpractice assuming that patients pay a fixed price for treatment and physicians bear both all subsequent treatment costs, and the cost of obtaining information on optimal treatment for the patient’s condition. Section 3.3.3.2 considers the situation where the health insurer covers some or all of the patient’s treatment costs.

3.3.3.1. Formal Analysis: No Insurance

Assume that each patient seeks treatment from a physician who he must rely on entirely to select the medically appropriate treatment. For simplicity, we assume that the physician can select one of two treatments: (1) high-quality and higher cost treatment, \( t^* \), and (2) lower cost treatment, \( t^0 \). Lower cost treatment imposes a higher risk of harm on the patient. We assume that the expected benefit to the patient of receiving treatment is given by \( b - \text{expected accident costs} \), which are given by \( p(t_i)H \), where \( i \) is an index of treatment choice and \( p(t^0) > p(t^*) \). It is assumed that the net social benefit of high cost treatment is higher than the net social benefit of low cost treatment: \( (p(t^0) - p(t^*))H > c(t^*) - c(t^0) \), where \( c(t) \) is the cost of treatment. Thus, treatment \( t^* \) is both the optimal treatment and the treatment that the patient would prefer, whether or not he bears his own medical costs. We assume that treatment quality is unobservable and noncontractible. Thus, it is assumed that the patient pays a price for treatment that is based on expected quality, but the patient and physician cannot contract in advance to ensure the physician selects \( t^* \).

Physicians do not automatically know which treatment is optimal. Instead, each physician must invest \( e \) in expertise at a cost of \( C(e) \). This investment determines the probability, given by \( q(e) \), that the physician correctly identifies the optimal treatment for each patient’s condition. Thus \( q(e) \) is the probability that the physician provides “informed” treatment. We assume that the physician invests in patient safety after contracting with the patient. The analysis applies, as well, to unobservable investments made pre-contract when investment is nonverifiable and the physician bears this cost directly.

Physicians who are “informed” select the treatment that maximizes their welfare. When uninformed, physicians are assumed to provide suboptimal treatment. Patients cannot observe either the amount the physician invests in patient safety or the probability he selects suboptimal treatment.

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20 The following analysis is based on Arlen and MacLeod (2003, 2005a) who provide a model of medical malpractice in which patient welfare depends on both physician’s ex ante investment in expertise and information on the patient’s condition and the physician’s treatment choice when informed.

21 \( C'(e)<0, C''(e)>0 \).

22 \( q'(e)>0, q''(e)<0 \).

23 For example, a physician who is unable to diagnose the patient properly either will not treat the patient or will select the wrong treatment. Similarly, a physician who does not know the latest literature on treatments will select the wrong treatment—and possibly a contraindicated treatment (see McGlynn 2003)—believing that it is the correct treatment. Arlen and MacLeod (2005a) employ a more realistic assumption that uninformed physicians may accidentally provide optimal treatment (e.g., when it is optimal not to treat). The model also recognizes that patients are not always injured by erroneous treatments. We abstract from this additional complexity here.
Social welfare is maximized when the provider selects the treatment and invests in the level of expertise that maximizes the joint welfare of the patient and the physician, and depends on both the physician’s treatment choice when informed and his investment in expertise.

We know that social welfare is maximized when informed physicians select optimal treatment, \( t^* \). Incorporating this into the social welfare function, we find that social welfare is maximized when the physician invests in the level of expertise that maximizes:

\[
\begin{align*}
&b - q(e)(p^0 H + c^0) - (1 - q(e))(p^0 H + c^0) - C(e),
\end{align*}
\]

where \( p^i \) and \( c^i \) equal \( p(t^i) \) and \( c(t^i) \), respectively. This implies that optimal expertise is given by the \( e \) such that:

\[
q'(e)((p^0 - p^i)H - (c^i - c^0)) = C'(e).
\]

Accordingly, physician expertise is optimal when the physician invests up to the point where the marginal cost of investment in expertise equals the net social marginal benefit of expertise. The social marginal benefit of expertise equals the net expected marginal benefit to society of the patient receiving optimal instead of suboptimal treatment, multiplied by the change in the probability of accidental error resulting from the investment in patient safety.

The conclusion that \( t^* \) and \( e^* \) maximize social welfare implies that patients’ and physicians’ joint welfare would be maximized if physicians could credibly commit that they would invest optimally in expertise and select the optimal treatment when informed.

The parties cannot contract optimally when treatment quality and expertise are non-contractible. As a result, absent liability, physicians will select suboptimal treatment because they bear treatment costs but do not bear the expected cost of accidents. Specifically, when informed each physician selects treatment to maximize his welfare as given by:

\[
P - q(e)c^i - (1 - q(e))c^0 - C(e).
\]

Informed physicians thus select suboptimal treatment.

As a result, absent liability, physicians also under invest in expertise because expertise provides no benefit: they select the same treatment whether the choice is informed or uninformed. It also can be shown that physicians under invest in expertise even when they are motivated to select optimal treatment when informed. Physicians’ incentives to invest in expertise are suboptimal as long as physicians suffer less harm than their patients when they provide suboptimal treatment instead of optimal treatment. (Arlen and MacLeod 2003, 2005a). Accordingly, absent liability, patients face an excessive risk of injury. In turn, patients seeking medical care are not willing to pay the price for high

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24 Arlen and MacLeod (2003, 2005a) considers the situation where the physician cares about patient outcomes, either as a result of compassion or reputation. Thus, the expected benefit to a physician of providing treatment is given by \( \alpha(b - p^i H) \), where \( \alpha \), the measure of compassion, is less than 1 and \( i \) is the treatment choice (optimal or suboptimal). In this case, informed physicians may select the optimal treatment even absent tort liability.
quality care because they expect to receive suboptimal care. Both parties are worse off than when care and expertise are optimal.

We now consider optimal negligence liability. To provide optimal incentives, negligence must optimally regulate two different types of care decisions: the ex ante decision to invest in expertise and the treatment decision by informed physicians. Consistent with Arlen and MacLeod (2005a), assume that courts predicate the negligence determination on treatment choice and not on investment in expertise.

Under negligence liability, informed physicians select optimal treatment as this lowers his expected costs. Thus, each physician invests in the level of expertise that maximizes his expected payoff assuming expertise induces optimal treatment:

\[ P - q(e)e^* - (1 - q(e))(c^0 + p^0D) - C(e), \]

where we assume the price is set equal to the physician’s expected costs.

Accordingly, the physician will select optimal expertise as long as expected damages for accidental negligence equal the expected cost to the patient of receiving suboptimal instead of optimal treatment, \((p^0 - p^*)H\). Thus, the optimal damage award for accidental negligence is given by:

\[ D^* = \frac{(p^0 - p^*)H}{p^0} < H. \]

3.3.3.2. Discussion

Accordingly, negligence liability increases social welfare by enabling physicians to credibly commit to provide the level of care patients want to receive when informed. Patients know that informed physicians will select optimal care as this enhances their welfare. Negligence liability also enables physicians to credibly commit to invest optimally in expertise. As patients anticipate this, physicians can charge patients for the expected cost of care when informed physicians select optimal treatment and physicians invest optimally in expertise (Arlen and MacLeod 2005). Negligence liability thus enables patients to obtain the expected quality of care they are willing and able to pay for, given the expected cost to physicians of providing optimal care.

As in Section 3.2.3, we see that injurers (physicians) are negligent in equilibrium but only by accident. Liability for accidental negligence performs a vital function by incentivizing physicians to invest optimally in expertise. Thus, liability for accidental negligence creates a zone of strict liability within the negligence rule that enhances social welfare by inducing optimal investment in expertise (Arlen and MacLeod 2005a).

Inducing optimal expertise, however, requires that expected damages for accidental negligence precisely equal the benefit to the patient of receiving optimal instead of erroneous treatment. This amount generally is less than the ex post harm caused should the erroneous treatment injure the patient, \(H\). In the model above, expected damages should equal the difference in expected accident costs between optimal and erroneous
Where treatments vary in both the benefits they provide and their cost, then optimal expected damages for accidental negligence would equal \((b^i - b^*)\), where \(b^i\) is the net expected benefit to a patient of receiving treatment \(i\) (Arlen and MacLeod 2005a). Expected damages for deliberate negligence can be set equal to the harm caused, however, without distorting incentives to invest in expertise (Arlen and MacLeod 2003, 2005a).

### 3.3.4. Medical Malpractice for Insured Patients

We now assume that each patient’s treatment costs are covered by a group health insurer. The insurer charges an ex ante premium based on expected treatment costs and bears the cost of all treatment selected. The insurer does not adjust the premium to reflect a patient’s actual treatment costs.\(^{25}\) Neither the patient nor the insurer can ensure that the physician selects optimal treatment by contract. We assume that the informed physician selects optimal treatment if he is indifferent between optimal and suboptimal treatment.

As before, social welfare is maximized when informed physicians select optimal treatment and all physicians invest optimally in expertise.

Absent liability, negligence liability is not needed to deter insufficient optimal treatment because insurers, not physicians, bear all treatments costs. Thus, informed physicians have no reason not to select optimal treatment. Accordingly, malpractice liability is not needed to deter physicians from selecting suboptimal treatment when physicians are fully informed and patients are fully insured (Danzon 1977; Posner 2011, at 219; see Arlen and MacLeod 2005a, 510–511).\(^ {26}\)

Yet, absent liability, physicians do not invest optimally in expertise. Physicians select expertise to maximize their expected profit, which is the price minus their expected expertise costs (given insurance). Accordingly, they under-invest in expertise because they do not benefit directly from providing optimal treatment—indeed, here, they do not invest at all (Arlen and MacLeod 2003, 2005).

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\(^{25}\) Arlen and MacLeod (2005a) expands this analysis to consider the situation where the insurer attempts to control treatment costs through utilization review and capitation contracts. Zeiler (2005) also considers capitation contracts.

\(^{26}\) Tort liability may be needed to protect patients if informed physicians profit more from treatments that are more risky, for example because they are more invasive (Danzon 1997; see Epstein and Sykes 2001; Arlen and MacLeod 2003; Korobkin 1999). Negligence liability can optimally deter informed physicians from selecting excessive treatment if due care is predicated on optimal treatment (Arrow 1968; Arlen and MacLeod 2003; see Currie and MacLeod [2008], finding malpractice liability can deter offensive medicine). But it cannot if due care is predicated on the customary treatment, as customary care will be excessively costly and risky if most patients are insured (Posner 2011, 219; see Danzon 1997; cf. Kessler and McClellan 1996, discussing defensive medicine; Currie and MacLeod 2008; Frakes 2012). Malpractice liability nevertheless can induce optimal treatment if physicians are not liable if they provided medically appropriate care (as determined by scientific evidence), even if the treatment selected was not the customary treatment (see Peters 2002, 913–921, some states employ a reasonable physician standard, not a customary standard).
Negligence liability can induce optimal expertise. The optimal damage award when insurers pay treatment costs differs from the optimal award for accidental negligence when insurers do not cover treatment costs because expected damages must equal the social benefit of the patient receiving optimal treatment instead of erroneous treatment, minus treatment costs since the physician does not bear those:

\[
D = \frac{(p^0 - p^0')H - (c' - c^0)}{p^0}.
\]  

This award will be less than the harm caused. It also is less than the optimal award for accidental negligence when physicians bear the cost of treatment.

Although physicians select optimal treatment when health insurers bear treatment costs, it should be noted that it may be necessary to impose liability on health insurers as well. Health insurers often attempt to control treatment costs by asserting the right to preapprove treatment choice through a process called utilization review. In this situation, absent liability for health insurers, insurers will intervene to favor suboptimal treatment over optimal treatment (Arlen and MacLeod 2003, 2005a).

Physician negligence liability does not address this problem because physicians are not liable as long as they recommend optimal care. Accordingly, if a patient rejects optimal treatment recommended by his physician because the insurer refuses to pay for it, the physician is not liable. Absent liability, health insurers have excessive incentives to use utilization review to select suboptimal treatment that is less expensive. They also will assert authority more often than is optimal, as it lowers treatment costs. To deter this, it is necessary to hold them liable for harms caused should they assert authority and refuse coverage for the optimal treatment in favor of suboptimal care (Arlen and MacLeod 2003, 2005a; see also Epstein and Sykes [2001], concluding MCO liability may be optimal in this context but should be contractual; see also Sage 1997).

### 3.4. Contractual Liability Versus Tort Liability

Accordingly, liability enhances the welfare of both producers/medical providers and consumers/patients when consumers cannot observe the risk of harm associated in individual producers’ goods and services (e.g., Spence 1977; Shavell 1980; Polinsky 1980), enabling producers and medical providers to credibly commit to producing the quality of goods and services that consumers value most (Arlen and MacLeod 2005a). Nevertheless, the conclusion that liability enhances joint welfare does not automatically imply that tort liability is needed to govern accidents between patients and physicians or producers and customers. After all, the possibility arises that consumers27 and

27 Throughout this section, the term *consumers* refers to consumers of both products and medical services. The term *producers* refers to both product producers and medical providers.
producers can and will voluntarily impose optimal liability by contract (e.g., Grossman 1981; Priest 1981; Rubin 1993; Epstein 1976). Nevertheless, economic analysis reveals that tort liability usually is superior to contractual liability because parties generally do not have optimal incentives to contract over liability, even when they are informed about the costs and benefits of imposing liability (Arlen 2010; Wickelgren 2009; Choi and Spier 2014; see Geistfeld 1997; Baker and Lyon 2010).

3.4.1. Contractual Liability with Informed Consumers and Complete Contracts

When potential injurers and victims are perfectly informed about the costs and benefits of contracting into liability, there are no other impediments to optimal contracting, and insurance does not distort incentives, then the parties can and will contract voluntarily into optimal tort liability (e.g., Epstein 1976; Grossman 1981; Priest 1981; Robinson 1986; see also Spence 1977). Indeed, in this situation, tort reform could best be accomplished by allowing the parties to contract over (and potentially out of) liability (Thaler and Sunstein 2008, Chapter 14; Epstein 1976, 2005; Danzon 1997, 493–494; Hylton 2000; Rubin 1993, 75–77; Robinson 1986, 198; Epstein and Sykes 2001, 644–648; Havighurst 1986, at 161–162; Havighurst 1995, 265–302).

Consumers can contract optimally over liability only if they can achieve the same benefit from imposing liability by contract, at the same cost, as when liability is imposed optimally by the state (Arlen 2010). Optimal tort liability enables consumers to benefit from higher quality goods and services. These quality benefits can result from investments in care made before or after the consumer contracted with the producer to purchase his goods (or services) or after.\(^{28}\) In addition, tort liability also benefits consumers by inducing investment in expertise and technology that benefit all consumers or patients collectively. Finally, under tort liability, consumers seeking higher quality goods are charged a higher price, but the additional cost equals the marginal cost of higher care plus any expected liability costs.

Proponents of contractual liability assume that contractual liability offers that same benefits at the same cost to consumers. They assume that each consumer who would be willing to pay to induce producers to take due care knows that he can induce due care, if, but only if, he elects to impose liability by contract. Moreover, he will expect to be charged a price equal to the additional cost of higher quality, plus any expected liability costs. (Priest 1981; see Hylton 2000).

Indeed, scholars have shown that, under the right conditions, contracting can be optimal even when consumers’ decisions cannot directly affect producer care-taking

\(^{28}\) Pre-contractual investments in care include all the investments made when producing a good; they also include much physician expertise. Post-contractual investments include investments by manufacturers to detect and warn consumers about previously unknown risks associated with using the product and investment by physicians in expertise to diagnose a patient correctly and select and provide treatment (Arlen and MacLeod 2003, 2005). Optimal tort liability induces optimal investment in both forms of precaution.
because all care decisions were made pre-contract, before the goods reached the market. Contracting over liability can enable consumers to obtain higher quality goods by enabling them to identify the producers who made the optimal investment pre-contract (Spence 1977; Grossman 1981). Producers who invest optimally in care can signal their quality by offering to bear liability for a premium equal to the marginal cost of added quality plus expected liability costs. High quality producers can use the offer to bear liability to signal their quality as long as low-quality producers cannot make the same offer without suffering a loss. This condition is met when low quality producers expect patients to accept their offer to bear liability. Low quality producers’ expected liability costs will exceed the additional price charged for liability if they charge the same premium as the high-quality producers (Spence 1977; Grossman 1981). In this situation, contracting over liability should produce a Perfect Bayesian Separating Equilibrium (PBSE) in which consumers correctly believe that only high-quality producers offer to bear liability and thus are willing to pay more when producers offer to bear liability.

When contractual liability produces a PBSE, then consumers who value the higher quality produced by tort liability can indeed obtain the same benefit, or more benefit, from liability imposed by contract than from liability imposed by the state. Moreover, contracting over liability provides producers with an incentive to invest optimally in pre-contractual care as this investment enables them to use liability profitably to signal quality (Spence, 1977, 569–570; Grossman 1981, 474–477).

It is worth noting that, when contracting is optimal, consumers can contract optimally, even when they do not have enough information to determine product quality, as long as they can calculate the expected cost and benefit of imposing liability. In this situation, consumers could be better off under contractual liability than under tort liability. Those consumers who would benefit from tort liability would contract into it. By contrast, those consumers who are not willing to pay for the level of safety induced by optimal tort liability could contract for the standard of care they prefer (see, e.g., Priest 1981; Epstein 1976; Robinson 1986; Schwartz 1988; Danzon 1997; Rubin 1993; Hylton 2000; see Thaler and Sunstein 2008, Chapter 14; Havighurst 1986).

### 3.4.2. Why Contracting Over Liability is Inefficient

In an ideal world, contracting over liability should produce optimal-liability rules and optimal care, as consumers are able to obtain the full deterrence benefits of tort liability through liability imposed by contract as long as they (1) understand that absent liability they will face excessive risk of harm, (2) correctly calculate the costs and benefits of imposing liability on producers, (3) have sufficient capacity to contract in their own best

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29 Pre-contractual investments in care include investments by product manufacturers in design, testing, equipment, and safety monitoring designed to reduce the riskiness of the products reaching the market; they also include investments by hospitals in equipment and systems to reduce risk and investments by individual physicians in expertise (Arlen and MacLeod 2003, 2005a).
interests, (4) consumers’ incentives are not distorted by insurance, (5) transactions costs are low, and (6) contracts are otherwise complete. Liability contracts must be sufficiently complete that consumers can obtain the same deterrence benefit, for the same increase in price, when they impose liability by contract as they would if optimal tort liability was imposed by the state (Arlen 2010).

Yet in the real world, these prerequisites to optimal contracting are almost never met. Hosts of problems plague contracting over liability, rendering it inefficient in many, if not most, situations. As a result, consumers and patients generally will not impose optimal (or indeed any) liability by contract. Product quality (and thus consumer and producer welfare) will suffer as a result (Arlen 2010; see also Wickelgren 2006; Choi and Spier 2014; see Geistfeld 1994; Baker and Lyon 2010).

3.4.2.1. **Imperfect Information**

Consumers of products and medical care almost never have sufficient information to contract optimally over liability. In order to do so, consumers must be able to calculate how liability will affect their expected risk of being harmed. Consumers and patients often do not know enough about either the producer’s cost of care or the impact of care on expected accident costs to be able to calculate the effect of liability on the expected quality of products and medical care (e.g., Geistfeld 1994; Shavell 2004, at 221–222; Arlen and MacLeod 2003; Arlen 2010; see Baker and Lytton 2010; see also Arrow 1963). Consumers also need to be fully informed about the terms of the liability clauses themselves. Contracting over liability often occurs through standard form contracts which the vast majority of consumers do not read (see Bakos et al. 2014) for a variety of reasons (see, generally, Katz 1998). Moreover, even when consumers do read standard form contracts, they do not always understand them. Finally, contracting over liability will be suboptimal if consumers do not have the capacity to contract voluntarily: for example, because contracting with a medical provider or producer of a drug occurs when the patient is facing a medical emergency and is in need of immediate care (Arlen 2010).

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30 Information problems are exacerbated in the case of contracting with physicians at the point of service. Patients tend to underestimate the expected benefit of liability because they underestimate the risk of medical error and the differences in expected provider quality. In addition, search costs often are high. Thus, under contractual liability medical providers could include suboptimal liability waivers because patients often face long wait times to get an appointment; if they do not learn the liability clauses until they are in the office, they may not be in a position to seek a new provider. Patients’ choices of providers also often are restricted by their health plans or the lack of specialists in the area (Arlen 2010, 1005 n. 120, 107 n. 123). In the health context, imperfect information remains a problem even if employers are informed and contracts over liability clauses are drawn on behalf of employees. Employers operating in competitive markets will provide the liability terms consumers are willing to pay for, not those that are optimal; thus, consumer misperceptions will distort employers’ incentives to select liability clauses (Arlen and MacLeod 2003; but see Epstein and Sykes 2001, suggesting that informed employers will negotiate optimally on their employees’ behalf).

31 For example, it is likely that most consumers do not understand that arbitration clauses may substantially increase their litigation costs by requiring them to pay for judges who otherwise would be provided by the state. Arbitration clauses also may alter the damages that victims can collect.
3.4.2.2. Inefficient Informed Contracting Over Liability: Incomplete Contracts

Contracting over liability can be inefficient even when consumers and patients are fully informed about the expected costs and benefits of liability, know and understand the contractual liability terms offered and available, and can freely negotiate for the terms they prefer. Informed contracting over liability can be suboptimal as a result of inefficiencies that commonly plague contracts: collective goods, time inconsistency, and adverse selection.

To demonstrate the impact of these problems, we first consider contracting over liability by patients and medical providers assuming that (i) contracting is costless, (ii) consumers/patients know the contractual liability terms in each potential producer/provider’s contracts, (iii) all parties accurately estimate the deterrence benefits of contracting over liability, and that (iv) consumers/patients actively negotiate for the terms that maximize their welfare at the moment of contracting. Later we consider contracting over liability through standard form contracts.

3.4.2.2.1. Post-Contractual Care and The Collective Goods Problem

The classic analysis of contractual liability finds that individual consumers have optimal incentives to contract into liability because the decision to impose liability by contract offers the same deterrence benefit they would obtain from liability imposed by the state (see Hylton 2000; see Epstein 1976; Robinson 1986; Danzon 1997). These analyses implicitly assume that each medical care-giver (or producer) affects patient (or consumer) safety entirely through patient (consumer)-specific investments in care.

This assumption often does not hold. Patient and consumer welfare depends critically on post-contractual investments in obtaining and processing information about product risks and treatment quality that affect all those purchasing the good or service. For example, each patient’s welfare depends on the physician’s investment in expertise needed to diagnose the patient and select the appropriate treatment. It also depends on his ex ante investment in health care technology and adequate systems and ex post use of this technology and systems while caring for the patient. These investments in patient safety are collective goods because once the physician has invested in patient expertise or safety protocols, all patients benefit (Arlen and MacLeod 2003; Arlen 2010). Similarly, consumer welfare also often depends on fixed post-contractual investments in care to identify product defects or unknown risks, thereby enabling consumers to either get the product repaired (e.g., as in the case of automobile recalls) or to avoid using the product.

Contracting over liability is not optimal when care is a collective good because each patient does not internalize the effect of his decision to impose liability on the welfare of other patients. In addition, each patient recognizes that his individual decision to impose liability may have little effect on his own expected accident costs, because the providers’ incentives to invest in collective care depend on whether others impose liability. As a result, each patient may fail to contract into liability, even when he would be better off if liability were imposed by all patients, if liability is needed to induce investments in equipment or
systems that are only cost-effective because they benefit many patients. In this situation, each informed patient’s individual decision to contract into liability is likely to have little effect on his expected accident costs. A decision to impose liability when others do not has little effect, if the provider’s expected liability to one patient is too low to induce the safety investment. A decision not to impose liability when others do also has little effect, because the provider’s expected liability to others should be sufficient to induce the desired investment in safety whether or not the patient imposes liability. As a result, each patient may rationally eschew liability, even when he would be better off if liability were imposed by the state, because his individual decision to impose liability will not materially affect the producer’s incentives to invest in collective care (Arlen 2010, 992–997; Arlen and MacLeod 2003, 2003–204).

3.4.2.2.2. Pre-Contractual Care: Renegotiation and Time Inconsistency
Contracting over liability also is inefficient when patients (consumers) can negotiate freely with medical care-givers (producers) at the point of service.

The expected quality of medical care and product quality both depend critically on investments in care made prior to the point of sale. Providers will only undertake these investments if they benefit from them. When quality is not observable, providers only benefit if consumers correctly identify producers who made the desired investments.

Contracting over liability can enable consumers to identify high-quality producers, if, but only if, producers can use their offer to bear liability at a lower price to signal quality. Signaling is possible when low-quality producers expect consumers to accept offers to impose liability. In this case, low-quality producers cannot mimic the terms of high-quality producers without losing money because their products are riskier. In turn, the ability to signal quality provides producers with optimal incentives to invest in quality pre-contract (see Spence 1977, 569–570; Grossman 1981, 474–477; see also Epstein 1976).

But contracting over liability will not produce a Perfect Bayesian Separating Equilibrium in which consumers (and patients) rationally and correctly believe that only high-quality producers contract into liability if consumers (and patients) can negotiate over liability clauses at the moment of sale (Arlen 2006; see Arlen 2010; Wickelgren 2006; Arlen and MacLeod 2003).\(^{32}\) The problem roots in time inconsistency. Ex ante consumers and producers benefit from producer’s ability to offer to bear liability if it signals quality. Yet ex post, any consumer who believes that liability signals quality is better off renegotiating to waive liability in return for a price reduction (Arlen and MacLeod 2003; Arlen 2010; see Fudenberg and Tirole 1990).

\(^{32}\) This problem could be addressed by the use of contracting with commitment, as when patients are presented with take-it-or-leave-it standard form contracts under which all patients contracting with the provider are required to make the same choice regarding liability. While this would reduce the collective good problem, it would introduce other problems, as discussed in Arlen (2010) and Section 3.3.4.7.

\(^{33}\) The present analysis also shows why a producer’s ability to offer products for sale at two prices (one with liability and one without) will not provide optimal incentives if quality depends on pre-contractual care.
To see why, consider a patient bargaining with a medical provider who has offered to bear liability for a price. Assume that the patient believes that only high-quality providers offer to bear liability, as is required for existence of signaling equilibrium (PBSE). Assume further that all quality investments occur before the patient seeks care and that liability is priced to reflect both the added cost of quality and the expected cost of liability (including litigation costs). A rational patient who believes that liability signals quality will seek out providers who offer liability contracts (assuming that this induces optimal care). But he will not actually impose liability. A patient who identifies a provider willing to bear liability has an incentive to negotiate to waive liability in return for a price reduction equal to the provider’s expected liability plus litigation costs (Arlen and MacLeod 2003, 2002–2003; Arlen 2006; Wickelgren 2006). The consumer will seek to waive liability because, at the point of sale, liability provides no deterrence value because quality is already set. Thus, liability only serves to signal quality; the producer provided the signal by offering to bear liability. In addition, a rational patient will not value liability for its insurance value because the price charged for liability exceeds its expected value to the consumer because it includes the providers’ expected litigation costs (Arlen 2010). Patients thus rationally should waive liability in return for a lower price and purchase first-party health, accident, or life insurance to cover the risk of injury. Medical providers rationally will accept the offer to waive liability because this enables them to reduce prices and compete against other allegedly high-quality providers offering liability (Arlen and MacLeod 2003, 2002–2003; Arlen 2006; Wickelgren 2006; Arlen 2010).

Although renegotiation benefits each patient ex post, the prospect of renegotiation renders contracting inefficient. Specifically, if patients (consumers) can negotiate to waive liability, then contractual liability cannot produce a signaling equilibrium in which patients (consumers) correctly believe that only high-quality providers offer to bear liability. Informed patients will anticipate that low-quality providers also will offer to bear liability, at the same price as high-quality providers. They will make this offer knowing that patients will renegotiate to waive liability post-contract. Thus, negotiable contracting over liability will not produce an equilibrium in which high-quality providers can signal quality. As a result, medical providers (producers) will not have optimal ex ante incentives to invest in care when liability is voluntarily imposed. Patients and consumers who would have benefited from liability will be worse off than when optimal liability is imposed through the tort system (Arlen 2006, 2010; see Arlen and MacLeod 2003, 2002–2003; Wickelgren 2006).34

3.4.2.2.3. Contracting Through Standard Form Contracts and Adverse Selection

Producers and medical providers can potentially eliminate collective goods and renegotiation problems if high-quality providers precommit that they will only sell to

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34 A second inefficiency plagues contracting over liability to govern medical care. Physicians do not have optimal incentives to contract over liability because they are insulated from their expected liability costs by non-experience-rated malpractice liability insurance. In this situation, liability clauses will not signal quality because low-quality providers can mimic the liability offers of high-quality providers without directly bearing higher expected liability costs (Arlen 2010, 997–1000). Of course, malpractice
consumers who agree to pay to impose liability by contract. This would eliminate free
riding, as no consumer can obtain the safety benefits of liability without agreeing to pay
for it. It would also eliminate the renegotiation problem (Arlen 2010). The most effective
method would be to employ take-it-or-leave-it standard form contracts. Nevertheless,
while this form of contracting would ameliorate inefficiencies arising from renegotia-
tion and collective goods, it likely would be inefficient for other reasons.

First, and most obviously, contracting through standard forms increases the risk that
consumers (patients) will not be informed about liability clauses as they often do not
read these clauses (Bakos et al 2014; see Katz 1998).

Second, contracting over liability often will be inefficient as a result of adverse selec-
tion (Arlen 2010; Choi and Spier 2014). Adverse selection distorts contracting over lia-
bility if the expected costs of serving each consumer or patient differs, the differences are
known to consumers or patients but not to potential injurers, and the factors that lead a
consumer or patient to be high-cost correlate with a higher demand for safety.

Risks can differ across consumers for a variety of reasons including consumers’ pref-
erences for risk-taking, pre-existing health conditions that may make them more vul-
nerable, differences in how they intend to use the product, and differences in clumsiness
(Arlen 2010; see Choi and Spier 2014, 736–737). Patients inevitably differ in ways that
affect the physician’s probability of liability. For example, patients with undisclosed
health problems are likely to present a higher-than-average risk that treatment may
trigger a medical emergency, which increases the risk of physician error (Arlen 2010).
Differences in patients’ expected health care costs are even more important when con-
tracting occurs through health plans, as patients with serious medical conditions are
likely to have higher demand for both medical services and liability designed to induce
higher quality care.

When consumers (e.g., subscribers) have private information affecting the expected
cost of liability, producers (e.g., insurers) offering products in competitive markets
have an incentive to use liability clauses to identify higher-cost patients, who they will
charge a higher price. They will not simply offer one contract to all, priced at the aver-
age cost of providing the service and liability. High-cost consumers will flock to this
contract, but those who are low cost will not. They will likely conclude that the price
exceeds the expected benefit of the product plus the liability. To attract low-risk con-
sumers and discourage high-risk ones, producers will offer two types of products and
contracts: (1) low-cost/low-quality products with suboptimal liability and (2) high-cost/
higher quality products with liability. The market will produce this equilibrium if the
difference in expected accident costs between high- and low-risk consumers is suffi-
ciently great that low-risk consumers would be better off with suboptimal quality at a
low price than they would be if they purchase optimal quality insurance priced at the

liability insurance undermines both contractual liability and malpractice liability imposed on individual
providers. Imposing tort liability on medical entities can address this problem because these entities
either self-insure or have experience-rated insurance (e.g., Abraham and Weiler 1997; Mello and Brennan
2002; Arlen and MacLeod 2003; see Sage 1997).
expected accident costs of the high-risk consumers. High-risk consumers will not purchase the low-cost insurance because they regularly need medical care and thus need the higher quality associated with the higher cost insurance. But the high price of the insurance they need may force some from the market (or into lower quality insurance). Accordingly, if a competitive equilibrium exists, it will be characterized by suboptimal liability, insufficient investment in safety, and insufficient demand by higher-risk purchasers (Arlen 2010; Choi and Spier 2014).

Adverse selection would be a particularly significant problem were contracting over liability to occur through health insurers, who could collectively contract with patients and health providers. Adverse selection problem arises because patients vary enormously in their expected medical costs over the year, but health insurers are required to charge the same premium to all patients who purchase a particular plan. Health insurers benefit if they can separate high-cost from low-cost patients, and try to use differing plan structures to do so. Contracting over liability gives providers an opportunity to distinguish high- and low-cost patients because patients who are ill derive more benefit from malpractice liability as they are more likely to need more complex medical care, where differences in expected treatment quality matter more. Providers thus can attract low-cost patients by offering a no-liability plan priced on the assumption that most subscribers have low health-cost demands and then offer a liability plan priced for the expected cost of higher-cost patients.

This structure may make low-cost patients worse off than they would be with mandatory liability for two reasons. First, each low-cost patient may be worse off than under state-imposed liability because contracting will lead them to obtain lower-quality care than they would prefer (and be willing to pay for), because with a separating equilibrium, the price of higher-quality care will be prohibitive (as it would be priced assuming that almost all patients are high cost). By contrast, tort liability offers lower-cost patients the ability to obtain, collectively, higher-quality care at a dramatically lower price because it pools high- and low-cost patients together (Arlen 2010, 1013–1017). Second, low-cost patients may be worse off because today’s low-cost patients can expect to become high-cost patients in the future should they survive. Patients optimally would insure against the risk of getting ill in the future but cannot (Glied 2000). State-imposed liability benefits these patients by creating an insurance pool that in effect promises them access to lower-cost insurance in the future in return for higher premiums than they otherwise would like to pay when healthy. Contractual liability, by contrast, would leave them on their own when seriously ill, unable to obtain the high-quality care they need without paying exorbitant prices. Thus, both low-cost and high-cost patients may be worse off as a result of contracting than under malpractice liability where all patients get the benefit of liability but lower-cost patients cross-subsidize higher-cost ones (Arlen 2010, 1013–1017; see generally Newhouse [2008]; but compare with Epstein [1985]). This could leave both healthy and unhealthy patients

35 In extreme situations, contractual liability could lead to a “premium death spiral” under which all health insurers offer only lower-quality no-liability plans even when most patients would be better off were liability imposed by the state (Arlen 2010, 1013–1017).
worse off, especially over the long run,\textsuperscript{36} than they would be were liability imposed by fiat (Arlen 2010, 1013–1017).

\subsection*{3.4.3. Risk-Averse Victims}

Expected accident costs are enhanced when victims are risk averse because the cost of an expected loss to a risk-averse person exceeds the expected value of the loss. In this case, tort liability in effect enables potential victims to purchase insurance against harms from products or medical services. Providers charge a higher price under tort liability—equal to expected liability (e.g., expected accident costs) plus their litigation costs. In return, victims obtain compensation against losses suffered. This can enhance social welfare as long as victims are risk averse and injurers either are risk neutral or can purchase low-cost experience-rated liability insurance. The insurance benefit also would argue for replacing negligence with strict liability (with contributory negligence) (Shavell 1987, Chapter 9).

Nevertheless, insurance rarely provides an independent justification for tort liability—indeed of deterrence—for the reasons given in Section 3.2.3 supra (see also Epstein [1985], for additional discussion of limitations of tort liability as insurance). Thus, even though tort liability can enhance welfare through risk spreading, risk spreading rarely justifies imposing products liability or medical malpractice independent of the deterrence benefits of liability.

\section*{3.5. Organizational Defendants}

The preceding analysis assumes that injurers are autonomous individuals. Yet most accidents (other than automobile accidents) are caused by people acting on behalf of organizations, as either owners or employees.

Organizations alter the economic analysis of deterrence in four ways. First, organizations can intervene to alter employees’ incentives to take care through their selection of employees (Arlen and MacLeod 2005b), and their choice of compensation structure (Kornhauser 1982; Observe that healthier patients are particularly likely to prefer a pooling equilibrium once we extend the analysis to recognize that today’s younger, healthier patients will, almost inevitably, become tomorrow’s older patients with higher expected health costs (unless they pass prematurely). If insurance markets were complete, healthier patients would purchase insurance today against the risk of becoming unhealthy in the future. But insurance markets are not complete. Pooled health plans offered by employers help address this problem by pooling younger and older patients together across their careers: today’s younger patients pay higher premiums knowing that in return they will be able to remain in this pool as they get older (Arlen 2010; see Glied [2005], discussing how pooled employer-provided health insurance helps provide a form of insurance against the risk of becoming a high-risk patient in the future).
Sykes 1984; Arlen and Kraakman 1987; Arlen and MacLeod 2005a). In addition organizations often affect expected accident costs by either asserting direct authority over the decisions agents make (Arlen and MacLeod 2003, 2005a) or providing equipment and systems that affect the riskiness of their employees’ actions (Shavell 2007, 171–172; cf. Mello and Studdert [2008], discussing how hospitals affect patients’ welfare). Third, organizations can affect care through their ability to “police” their employees (Arlen 1994; Arlen and Kraakman 1997). For example, principals are in the best position to monitor employees to determine neglect before it causes harm. They are also better able to identify harms resulting from wrongful employees who should be sanctioned. Principals can use this information to sanction employees themselves (Kornhauser 1982; Sykes 1984; Arlen 1994) or provide it to others, enabling victims to determine whether the harm justifies a tort action and who should be sued (Arlen 1994; Chu and Qian 1995; Arlen and Kraakman 1997). Finally, organizations affect expected accident costs through their control over activity levels (Polinsky and Shavell 1993; see Arlen and Kraakman 1997).

Accordingly, in order to optimally deter, tort liability must ensure that organizations maximize profits when they intervene optimally to affect expected accident costs. This raises two questions. First, whether efficient deterrence requires that organizations be held liable for torts by their agents? Second, what is the optimal structure and scope of this liability?

3.5.1. **Entity-Level Versus Individual Liability:**

The Neutrality Result

In the United States, tortious accidents can subject both the individual wrongdoer and his employer to joint and several liability for damages caused. Economic analysis reveals that joint liability is not necessary in a perfect world, but is needed once we introduce common imperfections, such as asset insufficiency.

We begin with the classic model of accidents, adapted to the organizational context. Assume that a firm hires an employee to do an activity that can injure third-parties. The probability of an accident depends on the employee’s investment in care. The employee knows his level of care but the principal does not. Expected accident costs depend on the employee’s level of care. The total risk of harm to society also depends on the firm’s activity level (e.g., how much the firm produces).

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37 Principals’ ability to sanction employees is particularly valuable when employee negligence may escape detection and employees do not have sufficient assets to pay the optimal damage award, H/P (where P is the probability of detection). In this case, firms may be able to impose a higher expected sanction than can tort liability because firms can sanction employees if they take suboptimal care even if their neglect does not cause a harm. By contrast, tort liability can only be imposed when harm also occurs (Kornhauser 1982; Sykes 1984; see Arlen and MacLeod 2005a).
As before, social welfare is maximized when the employee takes due care and the firm undertakes optimal activity levels. Because the employee bears the cost of care, but does not directly benefit from safety, he will not take care unless he is required to bear the cost of accidents resulting from suboptimal caretaking. In this model, sanctions for harm caused can be imposed by either the firm or the state through tort liability. Accordingly, optimal deterrence requires that the tort system either impose liability on individuals directly or impose costs on firms structured to induce them to optimally sanction employees.

The central questions to be addressed are, first, whether these goals can be achieved equally well through individual and entity-level liability, and second, whether negligence and strict liability are equally effective at inducing optimal employee care and organizational activity levels.

The seminal articles found that individual and entity-level liability for harm are equally effective at inducing both optimal care and optimal activity levels, assuming that everyone is perfectly informed ex post, injurers are strictly liable for harms caused, and firms and individuals can pay optimal damages (Kornhauser 1982; Sykes 1984). This is referred to as the neutrality result.

Consider first individual liability. We know from Section 3.2.1 that individuals held strictly liable for the harms they cause will take optimal care because liability forces them to bear the total social cost of care plus accidents. Thus, individuals’ efforts to minimize their expected costs will lead them to take the care that minimizes total social costs: optimal care.

Individual liability also can induce optimal corporate activity levels. Corporate activity levels are optimal only if the firm also bears the expected accident costs associated with its activities. Strict liability imposed on employees ensures that firms bear their full expected accident costs. Employees facing strict liability for harms caused will treat this liability as an expected cost of working for the firm. Employees thus will seek additional wages (that the firm will pay) to compensate them for both their expected costs of taking optimal care and their expected liability (assuming optimal care), $c(x^*) + p(x^*)H$. These wages ensure that the firm bears, and product prices reflect, the full social cost of care and accidents (Kornhauser 1982; Sykes 1984).

Now consider entity liability. Under entity liability, the firm is strictly liable for all harms caused by the employee, but the employee is not liable. The firm also must pay wages equal to employees’ expected costs of care (given the incentives to take care provided by the firm). Thus, the firm expects to bear both the cost of care and expected accident costs. The firm can minimize its expected costs by structuring employee compensation to induce employees to take optimal care. Although the firm cannot observe care, it can induce employees to take optimal care by imposing a sanction equal to the harm caused, $H$, on any employee who causes harm. This sanction will induce optimal effort. The sanction will shift expected accident costs onto employees ex post, inducing due care. But it does not shift the cost off of firms. The firm must set wages to reflect both employees’ expected cost of taking due care, and their expected sanction costs. Thus, employees take due care and firms still bear the full social cost of accidents, which leads to optimal activity levels (Kornhauser 1982; Sykes 1984; see Polinsky and Shavell 1993).
3.5.1.1. **Formal Analysis**

Consider a firm operating in a competitive market who hires an employee to make one unit of the product each time he works. Consumers’ willingness to pay is given by \( R(q) \); the willingness to pay for the marginal unit is \( R'(q) > 0 \) (with \( R''(q) < 0 \)). Assume that each unit imposes a risk of harm on third parties, given by \( p(x)H \), where \( H \) is the harm caused, \( p(x) \) is the probability of the accident, and \( x \) is the employee's level of care (\( x \) is unobservable ex ante). Assume that employees bear the cost of effort, \( c(x) \).

Social welfare is given by the joint welfare of the employee, firm, victim, and consumer

\[
R(q) - (c(x) + p(x)H)q.
\]  

(17)

Differentiating with respect to care and activity levels, we see that social welfare is maximized when employees take the level of care at which the marginal cost of care equals the marginal benefit of care:

\[
c'(x) = -p'(x)H;
\]  

(18)

and activity levels are such that

\[
R'(q) = c(x) + p(x)H.
\]  

(19)

Assume now that strict liability is imposed solely on individual employees. The principal maximizes profits subject to two constraints. First, it must ensure the employee nets his reservation wage (which we set equal to zero). Second, the firm cannot dictate effort; instead, the agent selects the effort that maximizes his welfare (incentive compatibility constraint). Accordingly, the principal and the agent will solve the following problem (per unit sold) assuming competitive product and labor markets:

\[
P - w
\]  

(20)

subject to

\[
w = c(E(x)) + p(E(x))H;
\]  

(21)

\[
E(x) \text{ is the } x \text{ that maximizes } w - c(x) - p(x)H,
\]  

(22)

where \( E(x) \) is the employee's expected level of care, \( P \) is the price per unit (which equals marginal cost), \( w \) is wages, and tort damages are given by \( D=H \).

Employees will select the level of care that minimizes their expected costs as given by Equation (22). Differentiating by \( x \) reveals that they take optimal care. Given this, the individual rationality constraint, Equation (21), implies that the firm must pay wages equal to the \( c(x') + p(x')H \). In turn the firm will set the price equal to \( c(x') + p(x')H \). This induces optimal activity levels: consumers purchase up to the point where the marginal benefit of the last unit equals the price, which in turn equals the social cost of
Assume now that only the firm is strictly liable for harms caused by employees. The firm initially bears liability of $p(x)H$. To minimize its price, which includes the cost of its expected liability, it needs to incentivize its employees to take care. It can do this by imposing a sanction on employees who cause harm. Accordingly, the firm will solve the following maximization problem, where $s$ is the sanction imposed on employees:

$$\max_{p} P - w - p(x)(H - s)$$

subject to

$$w = c(E(x)) + p(E(x))s;$$

$$E(x)$$ is the $x$ that maximizes $w - c(x) - p(x)s.$

Combining Equations (23) and (24), we see that in equilibrium, the firm bears expected cost of $c(x) + p(x)H$ regardless of what sanction it selects. It will incorporate these costs into its price. Firms operating in competitive markets seek to minimize prices and thus expected costs. As a result, the firm will seek to induce its employees to take optimal care. To achieve this goal, it will select the sanction that induces optimal care. Equation (25) implies that the firm will set the sanction equal to $H$, the harm caused, thereby inducing optimal care. Equation (24) implies that the firm will have to pay wages of $c(x^*) + p(x^*)H$. Thus, it sets prices equal to the social cost of the product, inducing optimal activity levels (Kornhauser 1982; Sykes 1984; Segerson and Tietenberg 1992; Polinsky and Shavell 1993). Thus, corporate and individual liability each induce optimal care and activity levels in the simple model.

### 3.5.2. Nonneutrality: Economic Justification for Corporate Liability

Although individual liability can induce optimal behavior by firms and employees in the simple model, in most real-world situations individual liability will not produce optimal care and activity levels.

Individual liability will not induce optimal activity levels when liability for accidents is governed by negligence and not strict liability, unless consumers are perfectly informed about product quality. In addition, individual liability alone will not induce optimal behavior when optimal deterrence depends on firms taking actions that affect (but are

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38 Firms facing wage payments equal to the expected cost of crime have optimal incentives to invest in measures to deter crime. Thus, in this mode, when the state imposes optimal individual liability, firms have optimal incentives to prevent crime. This implies that they will not act because individual liability is sufficient to deter crime optimally, in this model.
independent of) employees’ care-taking care and are neither observable nor contractible ex ante. These investments include systemic investments that reduce employees’ risk of accidental error, monitoring, and self-reporting (Arlen 2012; see Shavell 2007, 171–172). Finally, pure individual liability will not induce optimal behavior by agents or firms if agents cannot pay optimal damages under pure individual liability (Kornhauser 1982; Sykes 1984).

3.5.2.1. **Agents Liability Governed by Negligence**

Pure individual liability will not induce optimal behavior by firms if agent liability is governed by negligence. Pure individual negligence liability does not induce optimal corporate activity levels because employees take optimal care and thus are not liable. As a result, the firm does not bear expected accident costs and thus does not incorporate them into product prices. This leads to excess activity levels if accidents fall on strangers or consumers who under-estimate the risk of harm (Polinsky and Shavell 1993). By contrast, firms will have optimal activity levels if individual negligence liability is combined with strict liability for firms (Polinsky and Shavell 1993).

3.5.2.2. **Firms’ Noncontractible Conduct Directly Affects Expected Accident Costs**

Expected accident costs regularly depend on investments by both the employee and the firm in care. For example, the firm often can reduce expected accident costs by investing in technology, equipment, or systems. We can represent this formally by assuming that expected accident costs are given by \( p(x,y) \), where \( y \) is the firm’s investment in safety. This investment may affect expected accident costs directly and also may make employees’ care investments more effective, \( p_{xy}(x,y) > 0 \). Employees often cannot observe or contract over the firm’s investment.

When organizations can take actions that directly affect expected accident costs, the organizations (or the individuals making those decisions) must be held liable. Liability can either be imposed for all harms or for harms resulting from the organization’s failure to invest optimally in care. Relying entirely on individual liability targeted at employees who directly determine care, \( x \), will not induce optimal organizational precautions when these precautions are unobservable because under individual liability the firm only bears expected liability through employees’ wages. These wages will be based on employees’ expectations of organizations’ investment in precautions. When firms are not liable and precautions are unobservable, employees will expect firms not to take precaution. They will insist on higher wages no matter what the firm does. Organizational investment also is suboptimal if employees do not understand how organizational precautions affect their expected liability (Shavell 2007, 170–171). In either case, both firms and employees would be better off if firms also are held liable, as this enables them to credibly commit to optimal precautions, thereby lowering wage payments (see Arlen 2012; Arlen and MacLeod 2005a; see also Shavell 2007, 170–171).
3.5.2.3. **Employee Asset Insufficiency**

Corporate liability also is an essential prerequisite to achieving optimal deterrence if employees do not have sufficient wealth to pay the optimal damage award. In this situation, employees take too little care under individual liability. As a result, firms’ activity levels are too high. Under individual liability, firms bear employees’ expected care and liability costs through wages. Since asset constrained employees take too little care and bear less than full liability, firms do not internalize the full expected costs associated with their activities (Kornhauser 1982; Sykes 1984). Moreover, under pure individual liability, firms have incentives to create an insolvency issue by strategically selecting asset-constrained employees in order to lower costs, as when firms hire thinly-capitalized outside contractors (Arlen and MacLeod 2005b).

Corporate liability promotes optimal deterrence by inducing both optimal corporate activity levels (Polinsky and Shavell 1993) and corporate actions that induce optimal (or second-best optimal) care-taking by employees (Kornhauser 1982; Sykes 1984; see Arlen 2012). Activity levels are (second-best) optimal because the firm bears the full cost of accidents and employees’ care costs; thus, prices will result in the full social cost of the product.

Corporate liability also can improve employee care-taking. Under corporate liability, firms bear their employees’ expected accident costs and thus have optimal incentives to select employees who are less likely to be asset constrained (Arlen and MacLeod 2005b). They also may intervene to induce optimal care by using a combination of direct mandates, *ex ante* monitoring, and non-harm contingent sanctions imposed on any employee who takes suboptimal care even if no harm occurs. The latter approach increases employees’ care-taking by increasing employees’ expected sanction for selecting suboptimal care from $p(x)W$ to $W$ (if all negligence is detected) (see Kornhauser 1982; Sykes 1984). Third, if corporate liability is properly structured (see Section 3.4.3), it can be used to induce firms to render individual tort liability more effective by reporting tortious harms and helping victims sanction negligent employees (see Arlen 1994; Chu and Qian 1995).

### 3.5.3. Optimal Corporate Liability

Respondeat superior holds organizations, and other principals, strictly liable for their employees’ torts committed in the scope of employment. Strict entity-level liability can be used to induce efficient activity levels, as we have already seen. It also can induce optimal investment in the type of precautions that reduce the probability of an accident without affecting the probability that harm or negligence is detected. These actions include screening employees, super-compensatory wages, and firm-level precaution.

Strict corporate liability with full compensation damages will not induce firms to undertake optimal precautions that take the form of corporate
“policing”—precautions that increase the probability that a harm is detected, negligence is proved, or causation is established (see Arlen 1994; Chu and Qian 1995; Arlen and Kraakman 1997; Arlen 2012). This is important because in many situations (e.g., pharmaceuticals), the organization that produced the risk is the least cost provider of information about both the tortious nature of the harm and the identity of the individual(s) responsible. Moreover, in the case of environmental harms, product defects, and other widespread harms, corporate action is needed to induce firms to both detect tortious conduct and report them to authorities so that they can warn potential victims and reduce harm (see Arlen 1994; Arlen and Kraakman 1997).

Firms held liable through respondeat superior for all harms will not optimally invest in these “policing” measures because policing enhances the firm’s expected liability for any employee torts that do occur. Thus, when damages equal $H$, the net benefit to the firm of policing does not equal the social benefit of the harms deterred, as is needed to provide optimal incentives to police. Instead, the firm’s benefit equals its benefit from all harms deterred minus the increase in its expected liability for any harms that do occur resulting from its policing efforts (Arlen 1994; Arlen and Kraakman 1997; see Chu and Qian [1995], discussing negligence liability). Indeed, when liability is high and policing detects many torts that otherwise would remain hidden, respondeat superior may deter policing (see Arlen 1994; see Arlen and Kraakman 1997; cf. Shavell [1994], examining the effect of mandatory disclosure on incentives to acquire information about product risks).

Entity liability can be structured to induce firms to invest optimally in corporate policing—e.g., measures to detect tortious conduct and identify responsible individuals. But liability must be structured so that firms that undertake optimal policing bear lower expected liability than those who do not. When optimal deterrence requires optimal investment by the firm in prevention and corporate policing, then the optimal corporate liability regime imposes respondeat superior liability on the firm with expected liability equal to the harm caused, coupled with enhanced regulatory sanctions imposed only on firms that fail to optimally monitor, self-report, and cooperate by providing evidence. These regulatory duties will induce optimal investment in information and self-reporting so long as firms that breach these duties are subject to enormous sanctions, whereas firms are not subject to enhanced sanctions if they comply with their duties and harm nevertheless results. In turn, the residual liability for harm caused imposed on all firms ensures that firms will induce optimal care-taking and that activity levels are optimal (see Arlen and Kraakman 1997; Arlen 2012).

This analysis focuses on strict corporate liability with a fixed sanction equal to $H$, or, in the case of imperfect detection, $H/P$, where $P$ is the expected probability of detection. For a discussion of strict corporate liability when liability equals $H/P(c)$, with $P(c)$ equaling the actual probability of liability given the firm’s behavior, see Arlen and Kraakman (1997).
3.5.4. Limitations of Existing Corporate Liability

In addition to the inefficiencies discussed in the preceding section, corporate liability may fail to induce optimal corporate behavior as a result of legal rules: specifically, limited liability and the independent contractor rule.

3.5.4.1. Limited Liability

Organizational liability induces optimal care-taking by people who own (or control) firms only if those in control bear the expected costs of their failure to induce optimal investment in care. Even when tort liability rules are optimal, corporate law allows owners to avoid bearing the full expected cost of the risks they create if they conduct their risky activities through corporations and do not personally engage in the risky conduct. Corporations enjoy limited liability: a tort plaintiff can seek recovery from the firm, but cannot go after the personal assets of the owners (as long as the owner follows corporate formalities). Moreover, owners can retain the benefits of limited liability even if they enhance the asset insufficiency problem by removing almost all profits from the firm each year. Limited liability thus will lead smaller, less-well-capitalized firms to under-invest in care (see Hansmann and Kraakman 1991).

3.5.4.2. Independent Contractor Rule

Under respondeat superior, firms are liable for harms caused by their agents if the agent and principal had a “master–servant” relationship, giving the principal the right to control the conduct of the agent. By contrast, the principal generally is not liable if the agent is an independent contractor. This rule has been justified on the grounds that there is little reason to hold firms liable for agents whose conduct the firm does not directly control (Sykes 1988; see Epstein and Sykes 2001). Yet a dynamic perspective reveals that corporate liability for independent contractors often is needed to induce firms to take optimal steps to deter risk-taking by their independent contractors.

Firms can affect care-taking by their independent contractors in a host of ways including (1) their choice of agent, (2) compensation structure, and (3) sanctions for harm caused. The independent contractor rule fails to provide optimal incentives to firms and can actually deter socially valuable corporate actions.

To see this, consider a firm that has hired an independent contractor to undertake a risk-producing activity. Under U.S. law, the independent contractor would be liable for any torts he causes and will charge the firm for his expected liability (and care) costs. Absent corporate liability, the firm can reduce its costs by hiring independent contractors who are asset constrained because they will have lower expected liability costs and thus will charge less (Arlen and MacLeod 2005b).

In addition, under the independent contractor rule, a firm that would have optimally hired an agent as an employee in order to exert control and oversight may choose instead to hire the employee as an independent contractor in order to avoid liability. This is a serious issue if the employee is asset constrained. Consider a firm who must
hire an agent to perform an important task. Assume the firm can hire the agent as an employee or an independent contractor. Assume further that all available agents would be judgment proof. In this situation, it often will be socially optimal for the firm to hire the agent as an employee in order to increase care by monitoring. Yet, under the independent contractor rule, firms may rationally eschew control, even when control is optimal, because they can avoid being held liable for all expected accident costs if they hire asset constrained agents as independent contractors instead of as employees (Arlen and MacLeod 2005b; see Sykes [1988], suggesting the independent contractor rule should depend not on the actual relationship but instead on whether the agent would optimally be hired as an independent contractor or an employee).

3.6. Conclusion

Tort liability is vital to our society’s ability to prosper because it deters excessive risk-taking by those seeking personal gain at the expense of others. Indeed, as our society has become more complex—with new technologies for risk-creation and risk-reduction emerging constantly—tort liability is likely to play an ever more central role. Rapid technological change, and globalization of production, has placed severe strains on efforts to deter risk through regulation. The more rapid the development of new risk-producing activities, and the farther flung the production locations, the more difficult it is for regulators to develop reasonable safety standards and oversee compliance. Tort liability with actions brought by private plaintiffs is needed to provide adequate deterrence to those who would benefit at a potential cost to others.

Tort liability can enhance welfare and protect safety if it is structured to optimally deter. Yet the tort systems must seek optimality in a sea of imperfection arising, in large part, from information costs. Indeed, the same information costs that justify the use of tort liability as a supplement to regulation also affect the operation of the tort system. They affect risk-imposers, victims, and courts in ways that alter the purposes and effects of tort liability. Each of these parties must invest in information to determine and implement optimal care. Accordingly, a tort system that seeks to optimally deter should treat optimal information acquisition and use by the parties and courts as a core goal of optimal deterrence to be taken into account when structuring liability and damage rules.

Information costs also are present in less obvious ways. Information costs produce the litigation costs that drive a wedge between optimal tort liability and our existing system. Contingency fees paid to obtain legal expertise and payments for investigation and experts reflect, in part, litigators’ asymmetric information (including expertise). Information costs help explain the numerous risk-imposing activities done by corporations through their own employees, instead of by hiring outsiders (Coase 1937). They also help limit the firm’s control over its own activities and introduce an additional role for the tort system.
ECONOMICS OF TORT LAW

Economic analysis of tort liability has provided considerable insights on how rules governing liability, damages, and procedures should be structured in order to optimally deter in a world of costly information, as this chapter has highlighted. This chapter also provides insights on productive avenues for both future scholarship and optimal tort reform. It suggests that optimal tort reforms may include measures that reduce the distortion of costly information, whether by lowering information costs or by extending liability to those (e.g., organizations) who can better address them. Finally, many fundamental and important questions about liability in a world of costly and dynamic information remain to be addressed by future scholarship.

Bibliography


