Chapter 2
An Economic Model of Tort Law

2.1. The Basic Accident Model

Unilateral Care Model.

Suppose first that only the injurer can take care. Let

> x = the dollar expenditure on care by the injurer;
> $L(x)$ = expected accident losses suffered by the victim; $L'<0$, $L''>0$.

Note that $L(x)\equiv p(x)D(x)$, where p is the probability of an accident, and D is actual damages in the event of an accident. Since both of these functions are decreasing at a decreasing rate, the product L is also decreasing at a decreasing rate.

The social problem is to choose x to minimize $x+L(x)$. The first order condition defining optimal care, x^*, is

$$1 + L'(x) = 0. \tag{2.1}$$

Under a rule of *no liability*, the injurer chooses x to minimize his private costs, which simply equals his cost of care. Thus, he chooses x=0. In contrast, under *strict liability*, he faces the victim's actual damages, so his private costs coincide with social costs, and he chooses x^*.

Finally, consider a *negligence rule* with a due care standard set at x^*. Under this rule, the injurer avoids liability if he meets or exceeds the due standard; that is, if he chooses $x\geq x^*$. To see that x^* is his optimal solution in this case, note first that he would never choose x strictly greater than x^* because that entails additional costs but no further benefits. At the same time, he would never choose $x<x^*$ because

$$x^* < x^* + L(x^*) \leq \min_{x<x^*} x + L(x). \tag{2.2}$$

Thus, x^* is his optimal choice.

Bilateral Care Model.

Now suppose that both the injurer and victim can take care. Let

> y = dollar spending on care by the victim;
> $L(x,y)$ = expected accident losses, $L_x<0$, $L_y<0$, $L_{xx}>0$, $L_{yy}>0$, $L_{xy}>0$.

The social problem in this case is to choose x and y to minimize $x+y+L(x,y)$. The first order conditions are

$$1 + L_x = 0 \quad (2.3)$$

$$1 + L_y = 0. \quad (2.4)$$

Equation (2.3) defines the function $x^*(y)$ and equation (2.4) defines the function $y^*(x)$. Jointly, they determine the social optimum (x^*,y^*), where $x^* \equiv x^*(y^*)$ and $y^* \equiv y^*(x^*)$. Differentiating (2.3) and (2.4) implies

$$\partial x^*/\partial y = -L_{xy}/L_{xx} < 0, \quad \text{and} \quad \partial y^*/\partial x = -L_{xy}/L_{yy} < 0. \quad (2.5)$$

These results reflect the substitutability of injurer and victim care, as shown in Figure 2.1. (This would seem to be the most likely circumstance.)

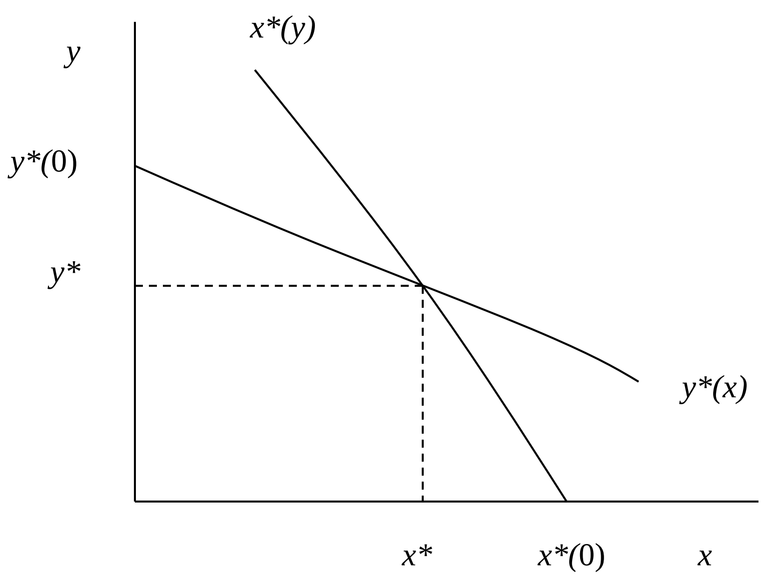

Figure 2.1. Bilateral care accident model.

Now consider the Nash equilibrium choices of x and y under the various liability rules. First, under *no liability*, the injurer will choose x=0 for any y. The victim thus faces her full damages and so chooses y to minimize $y+L(0,y)$, which yields $y^*(0)>y^*$. The victim therefore takes more than the first-best level of care to compensate for the injurer's lack of care (though her care is efficient given x=0). The situation is reversed under *strict liability*. Specifically, the victim is fully compensated and so chooses y=0, while the injurer faces full damages and so chooses x to minimize $x+L(x,0)$, yielding $x^*(0)>x^*$. Neither rule is efficient, but note that it is no longer true that strict liability is more efficient than no liability. In fact, either may result in lower costs, depending on the marginal effects of injurer versus victim care.

Now consider a *negligence rule* with the injurer's due standard set at x^* as defined above. We will show that (x^*, y^*) is a Nash equilibrium. First, suppose that $y=y^*$. The injurer will choose x^* because

$$x^* < x^* + L(x^*,y^*) \le \min_{x<x^*} x + L(x,y^*). \tag{2.6}$$

Next suppose that $x=x^*$. The victim bears her own losses and so chooses y to minimize $y+L(x^*,y)$, which yields $y^*(x^*)=y^*$. The Nash equilibrium is therefore (x^*,y^*), or the efficient outcome. Similar logic establishes that any of the various negligence rules—negligence with a defense of contributory negligence, strict liability with contributory negligence (with y^* set as the due standard for victims under the latter two rules), and comparative negligence with a due standard set at x^*—result in efficient Nash equilibria.

2.2. Sequential Care Accidents

The preceding assumed that both parties, the injurer and victim, made their care choices simultaneously, and in ignorance of the other party's choice. Thus, each had to form an expectation about the other party's behavior which, in equilibrium, had to coincide with their actual choices. Now we consider a situation in which one party moves first, and the other observes that party's choice of care before making his or her own choice. Note first that if the first mover chooses the efficient level of care, the standard negligence rules continue to achieve the first-best outcome. (This is easy to show using the above arguments.) Our interest here is in cases where the first mover is negligent, perhaps through inadvertence.

Injurer Moves First. Suppose the injurer moves first and chooses $x<x^*$. The socially optimal response of the victim is to choose a level of care along the $y^*(x)$ locus in Figure 2.1, where $y^*(x)>y^*$ for $x<x^*$. That is, the victim should take *compensating precaution*. Note that simple negligence with a due standard at x^* does not achieve this outcome because once the injurer violates the due standard, he is fully liable. The victim's optimal response is therefore to choose $y=0$. *Contributory negligence*, on the other hand, does give the victim an incentive to meet the due standard of y^* because by doing so, he or she avoids liability. Specifically, for $x<x^*$

$$y^* < y^*(x) < y^*(x)+L(x,y^*(x)) \le \min_{y<y^*} y + L(x,y) \tag{2.7}$$

The contributory negligence defense thus induces the victim to meet the due standard, but it does not generally compel compensating precaution (i.e., $y^*(x)$).

Victim Moves First. Now suppose that the victim moves first and chooses $y<y^*$. The optimal response of the injurer is $x^*(y)>x^*$. Again, this involves compensating precaution. Note that here, simple negligence is the better rule because the injurer at least has an incentive to choose x^* to avoid liability. That is,

$$x^* < x^*(y) < x^*(y)+L(x^*(y),y) \leq \min_{x<x^*} x + L(x,y) \qquad (2.8)$$

In contrast, contributory negligence will result in no care by the injurer because $y<y^*$ bars victim recovery.

Last Clear Chance (LCC). This doctrine can be interpreted as requiring compensating precaution by the second mover, whether that is the injurer or the victim. That is, the second mover must meet the applicable standard, $x^*(y)$ or $y^*(x)$, to avoid liability in the face of prior negligence. When the injurer moves first, LCC augments the contributory negligence standard by requiring the victim to take care of $y^*(x)>y^*$ to avoid liability, whereas when the victim moves first, LCC compels the injurer to take care of $x^*(y)>x^*$ to avoid liability. (In the latter case, we say that LCC "defeats" the contributory negligence defense.) This rule therefore attains the second best solution in sequential accident problems when the first mover is inadvertently negligent.

The problem with a rule compelling compensating precaution, however, is that it provides an incentive for the first mover to be strategically negligent. We illustrate this in the case where the injurer moves first. If the injurer knows that the victim will always have a duty to meet the due standard of $y^*(x)$ in order to avoid liability, he (the injurer) will choose x to minimize

$$x + L(x,y^*(x)),$$

which has the first-order condition

$$1 + L_x + L_y(\partial y^*/\partial x) = 0. \qquad (2.9)$$

And since $L_y<0$ and $\partial y^*/\partial x<0$ by (2.5) (the substitutability of care), the final term is positive, which implies that $x<x^*$. Thus, the injurer (and more generally, the first mover) has an incentive to be *strategically* negligent under LCC.

2.3. Activity Levels

Accident risk depends not only on care levels, but also on *activity levels*—that is, how intensively one participates in an activity (for example, miles driven as opposed to safety).

Unilateral Care Model

Let

z = injurer's activity level;

$B(z)$ = benefit of the activity, which is maximized at $\hat{z}$ (i.e., $B'>0$ for $z<\hat{z}$, $B'<0$ for $z>\hat{z}$, and $B''<0$);

zx = total cost of injurer care;

$zL(x)$= total accident costs.

Thus, costs of care and damages both increase linearly in activity. The social problem is to

$$\max_{x,z} B(z) - z(x + L(x)), \tag{2.10}$$

which yields the following first order conditions for *x* and *z*, respectively:

$$1 + L_x = 0 \tag{2.11}$$

$$B' - (x+L(x)) = 0. \tag{2.12}$$

Optimal care is thus x^*, as in the model above: given linearity of accidents costs in activity, optimal care is independent of the scale of the activity. Optimal activity, z^*, equates the marginal benefit of the activity to the marginal increase in overall accident costs. Note, therefore, that $z^*<\hat{z}$.

Outcome under the various liability rules. First, under no liability, the injurer will underinvest in care (i.e., x=0), and overinvest in activity ($z=\hat{z}$). In contrast, under strict liability, he will choose both efficient care and the efficient activity level. Finally, under negligence with the due care standard set at x^*, he will choose the efficient level of care, but, because he avoids any damages by choosing x^*, he will choose a level of activity that maximizes $B(z)–zx^*$, which results in a first order condition

$$B' - x^* = 0. \tag{2.13}$$

Thus, he will choose too much activity relative to the social optimum, but less than under no liability. Specifically, $z^* < z_N < \hat{z}$, where z_N is the solution to (2.13). In this case, strict liability is more efficient than negligence.

Bilateral Care Model

Now suppose that victims can also choose an activity level. Let

w = victim's activity level;

$V(w)$= victim's benefit of the activity, which is maximized at $\widehat{w}$;

wy = victim's total cost of care;

$zwL(x,y)$ = total accident costs.

The social problem is now to choose *x*, *y*, *z*, and *w* to maximize

$$B(z) + V(w) – (zx + wy + zwL(x,y)). \tag{2.14}$$

Without going into detail, it is easy to prove that none of the standard liability rules will induce an efficient level of care and activity for both parties. Although all of the negligence rules were able to induce efficient care by both parties, that is not true for activity levels because the court does not set a due standard for activity. Thus, in order for a party to choose his or her optimal activity level, he or she must bear the full damages in equilibrium. Thus, the injurer will choose the optimal activity level under strict liability and strict liability with contributory negligence, while the victim will choose the optimal activity level under no liability, simple negligence, and negligence with contributory negligence. At most, three out of the four variables can be chosen efficiently in equilibrium. The optimal rule therefore depends which rule maximizes expected net benefits as defined in (2.14).