LIABILITY AND THE INCENTIVE
TO OBTAIN INFORMATION ABOUT RISK

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Abstract: Opportunity often exists for parties to obtain information about the risks that they create and thereby to reduce the risks. The questions addressed in this article concern the incentives that the prospect of liability creates to obtain information about risks and whether these incentives are socially appropriate. Four forms of liability are considered: strict liability; the "complete" negligence rule, based on the adequacy of acquisition of information about risk as well as the adequacy of care; the negligence rule based on the adequacy of care, but presuming optimal acquisition of information; the negligence rule based on the adequacy of care, given whatever information a party actually possessed; and the negligence rule based on the adequacy of care, assuming that a party acquired information.

LIABILITY AND THE INCENTIVE TO OBTAIN INFORMATION ABOUT RISK

Steven Shavell[*]

1. Introduction

Opportunity often exists for parties to obtain information about the risks that they create and thereby to reduce the risks. Firms may study potential product defects and be able to ameliorate them; individuals may investigate various dangers and act on what they learn. The questions addressed in this article concern the incentives that the prospect of liability creates to obtain information about risks and whether these incentives are socially appropriate.[1]

In the model to be considered, information is of a simple character. It reveals either that there is risk or that there is not. (For example, the test of a product reveals whether or not it has a tendency to break apart at a suspected weak point.)

To determine if it is socially desirable for a party to acquire information about risk, the situation with information must be compared to that without information. If a party obtains information and there turns out to be a risk, it will be socially optimal for a party to exercise a "high" level of care, whereas if there does not turn out to be a risk, it will not be socially desirable for a party to exercise any care. If a party does not obtain information, it will be socially desirable for the party to exercise a "moderate" degree of care, reflecting both the possibility that there is a risk and that there is not.

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[1]These questions have not been studied systematically to my knowledge, although one may find suggestive discussions in Calabresi and Klevorick [1985], especially at 620 - 624 (on incentives to acquire new information under ex ante vs. ex post standards for liability); in Schwartz [1985], at 695 - 705 (on socially optimal discovery of information about risk and liability for failure to warn); and in Shavell [1987], at 77 - 79 and 93 (on socially optimal discovery of information and incentives under the negligence rule).

It follows that the social value of information is comprised of two probability-discounted benefits: the likelihood that there is a risk, multiplied by the reduction in total social costs associated with the exercise of the high rather than the moderate level of care; and the likelihood that there is no risk, multiplied by the cost of the moderate level care (for this cost is avoided if information that there is no risk is obtained). It is socially optimal for information to be acquired if the social value of information exceeds the cost of information.

The incentives of parties to obtain information about risk and to exercise care are examined in the model under different rules of liability. Under *strict liability*, where by definition a party is liable for losses caused regardless of whether he obtained information about risk or of his level of care,[2] parties make socially desirable decisions about obtaining information and about the exercise of care. This outcome is explained by familiar reasoning. Because a party bears the losses he causes and he incurs the costs of obtaining information and of exercising care, his problem becomes the social problem and he makes socially desirable decisions.

Under the other general form of liability, based on negligence, the outcome depends on which of several possible types of rule applies. The rules differ in whether liability is determined both by a party's decision to obtain information and by his decision about care, or whether liability is determined solely by a party's decision about care.

Under the *complete negligence rule*, a party is liable for losses if either he failed to obtain information when he should have done so, or he failed to exercise optimal care. Here optimal care means the level of care that is socially best given optimal acquisition of information about risk. (If information is optimal to acquire optimal care is high care when there turns

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[2]For simplicity, both victims' behavior and issues of causation are ignored in the determination of liability under this and other rules of liability.

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out to be a risk and is zero otherwise. If information is not optimal to obtain, optimal care is moderate care.) Parties make socially optimal decisions about obtaining information under this rule and also about the exercise of care. The reason that parties choose optimal care given optimal acquisition of information is the well known argument showing that the threat of negligence induces optimal care; but the demonstration that parties make optimal decisions about acquiring information is different from the standard argument about the negligence rule.

Under the other types of negligence rule, liability depends only on the level of care. One such rule is the *negligence rule based on the level of care that is optimal given optimal acquisition of information.* Under this rule, as under the complete negligence rule, parties are led to make optimal decisions both about obtaining information and the exercise of care. In particular, a party will obtain information if that is optimal -- even though he will not be found liable for failure to obtain information per se -- for if he does not obtain information, he will not know whether he needs to exercise (high) care to avoid liability or whether it is unnecessary to exercise care.

Another version of the negligence rule depending only on the exercise of care is the *negligence rule based on the level of care that is optimal given the information that a party actually possesses.* Under this rule, parties are led to exercise optimal care given their information, but they may decide not to obtain information when that is optimal because they can always escape liability if they do not obtain information by exercising moderate care.

A third type of negligence rule depending only on the level of care is the *negligence rule based on the level of care that is optimal assuming that a party has obtained information* (whether or not obtaining information is optimal). Under this rule, if parties do not obtain information about risk, they may exercise excessive (high) care to avoid liability; moreover, they may be

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induced to obtain information when that is not optimal.

After analyzing these rules, the article closes with several remarks.

2. The Model

Risk neutral parties are engaged in an activity that may involve a risk of accident losses for others. By making an expenditure on information, a party can determine whether or not there is a risk.[3] The exercise of care lowers this risk; if there is no risk, there will be no losses and care has no effect. Define the following notation.

c = cost of acquiring information -- of learning whether there is a risk; $c \geq 0$;

p = probability that there is a risk; $0 < p < 1$;

x = level (and cost) of care; $x \geq 0$;

$h(x)$ = expected accident losses given x *if* there is a risk; $h(x) > 0$; $h'(x) < 0$; $h''(x) > 0$.

The social welfare criterion is minimization of total costs: the sum of the cost of acquiring information (if that is done), the cost of care, and expected accident losses.

A. Socially optimal behavior. If information is not acquired, total costs are

$$(1) \quad x + ph(x)$$

because p is the probability that there is a risk and $h(x)$ are the expected losses if there is a risk. The socially optimal x, which shall be assumed to be positive, is determined by the first-order condition

$$(2) \quad 1 = -ph'(x).$$

This x will be denoted x_o^* (it is the "moderate" level of care mentioned in the Introduction). If information is acquired and it is learned that there is no risk, the optimal x is obviously 0. If it is learned there is a risk, total costs are

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[3]This formulation can be generalized by allowing different levels of expenditure on information and also multiple types of information given any level of expenditure. I comment on these generalizations in the concluding remarks.

(3) $x + h(x)$,

and the optimal x, to be denoted x*, is determined by

(4) $1 = -h'(x)$.

It is clear from (2), (4), and the assumption that $h''(x) > 0$ that

(5) $x^* > x_o^*$

(x* is the "high" level of care mentioned in the Introduction). The explanation for (5) is that if a party knows that there is definitely a risk, the exercise of care will be more worthwhile than if one faces the chance that there is no risk and that the cost of care will be a waste.

The value of information, denoted v, equals total costs if there is no information minus total costs if there is information. Thus

(6) $v = [x_o^* + ph(x_o^*)] - p[x^* + h(x^*)]$

$= p[(x_o^* + h(x_o^*)) - (x^* + h(x^*))] + (1 - p)x_o^*$.

The first term in the latter expression is positive and equals the advantage of having information when there is a risk: the difference between total costs when the level of care is only x_o^* and total costs when the level of care is x*. The second term is the advantage of having information when there is not a risk: the savings of x_o^* in the cost of care. It is socially optimal to acquire information when

(7) $v > c$.

B. Behavior under strict liability. Under strict liability a party is liable for any losses that may occur. Hence, a party will minimize the cost of obtaining information plus the cost of care and expected accident losses, which is the social objective. Therefore, an individual will act socially optimally.

Proposition 1. Under strict liability, a party's decision whether to obtain information about risk and his decision about the level of care to exercise will be optimal.

C. Behavior under negligence rules. As indicated in the Introduction, I consider the negligence rule depending on both the decision about acquisition of information and the exercise of care, and versions of the negligence rule depending only on the

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exercise of care.

Under the complete negligence rule, a party who causes losses[4] will be liable if and only if he either fails to obtain information when that is optimal or exercises less than the optimal level of care. Specifically, if it is not optimal to acquire information, a party will be liable if and only if $x < x_o^*$; and if it is optimal to acquire information, a party will be liable for an accident if he either does not obtain information or if he does, there is a risk, and $x < x^*$. Under this rule, we have

Proposition 2. Under the complete negligence rule a party will obtain information about risk if and only if that is optimal and will exercise optimal care given his information.

Remarks. That a party will exercise optimal care, given that he has made the optimal decision about obtaining information, follows from the standard argument that a party will be led to exercise optimal care under the negligence rule. That a party will be induced to obtain information if and only if that is optimal is explained by different reasoning from that in the standard argument.[5]

Proof. Suppose first that it is not optimal to acquire information, that is, $v \leq c$. If a party does not acquire information, then he will choose x_o^*, as is apparent from the standard proof about the negligence rule:[6] if the individual were to choose $x < x_o^*$, he would be liable for losses, meaning that he would choose x to minimize $x + ph(x)$; but this function is minimized at x_o^*; hence, he would be better off choosing x_o^*,

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[4]Hereafter, I will not repeat that for a party to be held liable under a negligence rule, he must cause losses.

[5]The standard argument about care under the negligence rule includes the obvious point that a party will not exercise more than optimal care, for he escapes liability merely by exercising optimal care. However, the analogue of this point with regard to information is not obvious because obtaining information when that is not optimal (that is, obtaining more than optimal information) does do a party good: it may reveal that there is no risk, in which case he need not exercise any care and need not fear liability.

[6]This proof is due to Brown [1973].

in which case he would not be negligent; and clearly he would not choose $x > x_o*$, for this costs more than x_o* but yields no benefit; hence he will choose x_o*. If a party does acquire information and learns that there is no risk, he will exercise no care (for he will cause no losses and therefore never be found liable). If he learns that there is a risk and chooses $x < x_o*$, he will face liability, so he will choose x to minimize $x + h(x)$; but since this function is strictly decreasing over the range $[0, x*]$, he will be better off choosing x_o* than being negligent, and certainly he will not choose $x > x_o*$; thus, he will choose x_o*. The value to him of information is thus $(1 - p)x_o*$. This is less than v because it excludes the reduction in expected total costs if there is a risk; see (6); and since $v \leq c$, the individual will not obtain information.

Now suppose that it is optimal to obtain information, so that $v > c$. If a party does not obtain information, he will be liable for failure to obtain information regardless of his level of care, so his expected liability will be $x + ph(x)$, which is minimized at x_o*; he will thus choose x_o*. If he obtains information, the standard proof about the negligence rule shows that he will choose $x*$ if there is a risk and that he will choose 0 if there is not a risk; thus he will act optimally. The value of information to him is therefore

(8) $p[x_o* + h(x_o*) - x*] + (1 - p)x_o* > v$.

The inequality follows from (6). The reason that the private value of information is higher than the social value v is that the individual, unlike society, escapes having to pay for losses if there is a risk and he chooses $x*$. Since $v > c$, the individual will obtain information.◄

Consider next the negligence rule based on the level of care that is optimal, given optimal acquisition of information about risk. That is, if information is not optimal to acquire, a party is liable for losses if and only if $x < x_o*$; and if information is optimal to acquire, a party is liable for losses if and only

if there is a risk and $x < x^*$.[7] Under this rule, we have

Proposition 3. Under the negligence rule based on the optimal level of care given optimal acquisition of information about risk, a party will obtain information if and only if that is optimal and will exercise optimal care given his information.

Remarks. Under this rule, as under the last, it is clear that a party will exercise optimal care given that he has made the optimal decision whether to obtain information about risk. The reason why he will obtain information about risk if that is optimal is not that he will be found negligent for failure to do so (which was the case under the last rule). Rather, it is that if he does not obtain information, he will not know whether there is a risk and thus whether he need not exercise care or must exercise x^* to avoid negligence. That he will not obtain information if this is not optimal is true for the reasons given in the proof of the previous result.

Proof. If it is not optimal to obtain information. Then, under this rule, a party's situation will be identical to his situation under the previous rule, so he will not obtain information and will choose x_o^*.

Now suppose that it is optimal to obtain information, so that $v > c$. If a party does not obtain information and chooses $x < x^*$, he will be liable if there is a risk. Hence, his expected liability will be $x + ph(x)$, which is minimized at x_o^*. If he chooses x^*, he will escape liability for sure (clearly he will not choose $x > x^*$). Since x^* may exceed or be exceeded by $x_o^* + ph(x_o^*)$, there are two cases to consider if he does not obtain information: where he chooses x^* and where he chooses x_o^*. If, on the other hand, a party obtains information, the standard argument about the negligence rule shows that he will choose x^* if there is a risk and 0 if there is not a risk. The value of information to him if he would choose x_o^* without information is

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[7]Note that a court knows from the fact that a loss occurred that there was a risk; the court need not know whether a party obtained information and what the information was to determine whether there was a risk.

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therefore the same as in the last case and exceeds v (see (8));
and since $v > c$, he would be led to obtain information. The
value of information to him is different if without information
he would choose x^*; it is $(1 - p)x^*$. But

(9) $(1 - p)x^* = (1 - p)(x^* - x_o^*) + (1 - p)x_o^* >$

$\quad p[(x_o^* + h(x_o^*)) - (x^* + h(x^*))] + (1 - p)x_o^* = v.$

The inequality in (9) clearly holds if $(1 - p)(x^* - x_o^*) > p[(x_o^*$
$+ h(x_o^*)) - (x^* + h(x^*))]$, which is equivalent to $x^* + ph(x^*) >$
$x_o^* + ph(x_o^*)$. The latter inequality is true because x_o^*
minimizes $x + ph(x)$. Since, then, the value of information to
the individual exceeds v and $v > c$, he would again be led to
obtain information. ◄

Consider now the negligence rule based on the level of care
that is optimal given the information about risk that a party
actually possesses. Thus, if a party does not obtain
information, he will be liable for losses if and only if $x < x_o^*$;
and if he does obtain information, he will be liable for losses
if and only if there is a risk and $x < x^*$. Under this rule, we
have

Proposition 4. Under the negligence rule based on the
optimal level of care given the information about risk that a
party actually possesses, a party will not obtain information
about risk when information is not optimal to acquire, and may
not obtain information when it is optimal to acquire. His level
of care will be optimal given his information.

Remarks. The standard argument about the negligence rule
again explains why a party will exercise optimal care given the
information that he possesses about risk. To understand the
conclusions about acquisition of information, observe that the
consequence of obtaining information is either that the party
will learn there is a risk and will be led to choose x^* rather
than the lower x_o^* -- in which case he will be worse off -- or he
will find that there is no risk and will not exercise care -- in
which case he will be better off because he will avoid incurring
the cost x_o^*. In the latter case, a party is made better off by

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just the amount that society is. But in the former case a non-negligent individual is worse off while society is better off. (Society, unlike a private party, bears losses and thus benefits by reducing them when it learns that there is a risk.) Evidently, then, the private value of information is less than the social value of information and, consequently, a party will not obtain information when that is not optimal and may decide not to obtain information when it is optimal to acquire. (Indeed, it will be seen from (10) that the private value of information may be negative. Thus a party may decide not to obtain information no matter how cheaply that can be done.)

Proof. If a party does not obtain information, the standard proof about the negligence rule shows that he will exercise optimal care of x_o^*; and if he does obtain information and there is a risk, the standard proof shows that he will exercise care of x^*, whereas if there is no risk he will exercise no care. The value of information to a party is therefore

(10) $p[x_o^* - x^*] + (1 - p)x_o^* < v.$

Thus, it is possible that $v > c$ but that a party will not obtain information; and if $v \leq c$, the party will not obtain information. (Note that the first term in (10) is negative; it is the extra cost of care borne if a party learns that there is a risk; this may make the private value of information negative.)◄

Finally, consider the negligence rule based on the level of care that is optimal, presuming that information about risk is obtained -- whether or not it is optimal to obtain the information. Under this rule, a party is liable for losses if and only if there is a risk and $x < x^*$. We have

Proposition 5. Under the negligence rule based on the optimal level of care, presuming that a party obtains information about risk, a party may obtain information about risk when that is not optimal. If he obtains information about risk, he will exercise optimal care given this information, but if he does not obtain information, he may exercise excessive care.

Remarks. The standard argument about the negligence rule

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explains why a party will exercise optimal care if he obtains
information about risk. A party may decide to obtain information
when that is not optimal because he needs to know if there is a
risk to know when he must choose x^* to escape liability. (More
precisely, his benefit from learning that there is a risk and
choosing x^* is escaping liability. This exceeds society's
benefit; if society learns that there is a risk, society does not
escape losses if x^* is chosen but only reduces them. Hence, the
private value of information exceeds the social.) When a party
does not obtain information, he may be led to exercise care of
x^*, which is excessive since it exceeds x_o^*, in order to be sure
to escape liability.

   Proof. If a party does not obtain information and chooses x
$< x^*$, he will be liable for losses if there is a risk, so he will
choose x to minimize $x + ph(x)$, which is minimized at x_o^*. He
will not choose $x > x^*$, since this can do him no good. If he
chooses x^*, he will not be liable if there is a risk. Hence, as
in the proof to Proposition 3, there are two cases to examine if
a party does not obtain information: where he chooses x_o^* and
where he chooses x^*. If a party obtains information, the
standard proof shows that he will choose x^* if there is a risk
and 0 otherwise. The value of information to a party exceeds v
in both cases; this is evident from (8) and (9). Therefore, a
party may obtain information even though $v < c$.◄

3. Concluding Remarks

   (a) The model of acquisition of information was special in
two respects: there was only one possible level of investment in
information; and the character of information was simple, being
either that there was a risk or that there was none. A
generalization of the model would relax both of these simplifying

assumptions.[8] Propositions 1, 2, and 3 would still hold true in such a generalization: optimality would still be achieved under strict liability, under the complete negligence rule, and under the negligence rule based on the optimal level of care given optimal acquisition of information.[9] However, the nature of suboptimality under the other two negligence rules might be different from what was described here.[10]

(b) It should be noted that the different liability rules considered in this article impose varying informational requirements on the courts. To employ strict liability, courts need only to ascertain the extent of losses. They do not need to make inquiries about whether information should have been

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[8] Specifically, suppose that there are n levels of investment in information: $0 < c_1 < \ldots < c_n$. Assume that associated with an investment of c_i in information is a partition of the set S of states of the world into $n(i)$ subsets $S(1, i), \ldots, S(n(i), i)$; what is observed is one of the $S(j, i)$. Let $p(j, i)$ be the probability of $S(j, i)$ and $h(x|j, i)$ be expected accident losses given x conditional on $S(j, i)$. Assume furthermore that higher levels of investment in information correspond to more information in the sense that the $S(j, i)$ constitute a finer partition of S than the $S(j, k)$ for any $i > k$.
  In this model, the optimal level of care given observation of $S(j, i)$ is the x minimizing $x + h(x|j, i)$, denoted $x^*(j, i)$; total costs given c_i are thus $E[x^*(j, i) + h(x^*(j, i))]$, where E is the expectation over j; and the optimal level of investment c_k^* minimizes $E[x^*(j, i) + h(x^*(j, i))] - c_i$ over i.

[9] It is clear that optimality results under strict liability, since the private problem is the same as the social problem under that form of liability. And straightforward modifications of the proofs of Propositions 2 and 3 show that they continue to hold.

[10] For example, in Proposition 4, it was shown that a party would acquire information less often than is optimal because the private value of information is less than the social. However, in the generalized model, the private value of information could exceed the social (so that a party might obtain information when that is not optimal). To demonstrate this possibility, suppose that there is one level of investment in information and two equally probable types of information: if information is of type 1, care is extraordinarily valuable in reducing risk and the optimal level of care is x_1^*; if information is of type 2, care is only moderately valuable in lowering risk, and the optimal level of care is x_2^*, where $0 < x_2^* \ll x_1^*$. Because care is so valuable if information is of type 1, optimal care in the absence of information, x_0^*, is close to x_1^*. The social value of information is $v = .5[x_0^* + h_1(x_0^*) - (x_1^* + h_1(x_1^*))] + .5[x_0^* + h_2(x_0^*) - (x_2^* + h_2(x_2^*))]$. ($h_i(x)$ is expected accident losses if information is of type i.) Since x_1^* is close to x_0^*, v is close to $.5[x_0^* + h_2(x_0^*) - (x_2^* + h_2(x_2^*))]$. The private value of informaation is $.5[x_0^* - x_1^*] + .5[x_0^* - x_2^*]$. Since x_0^* is close to x_1^*, this is close to $.5[x_0^* - x_2^*]$. But this is greater than v since $h_2(x_0^*) - h_2(x_2)$ is negative (for $x_0^* > x_2^*$). The explanation is that the private value of information involves the savings in care of $x_0^* - x_2^*$ if the type of information is 2, but the social value of information is smaller because expected losses increase when care is x_2^* rather than x_0^*.

obtained, whether it actually was obtained, or whether the level of care was appropriate. To apply the complete negligence rule, by contrast, courts must make all three of these inquiries. Yet to administer the negligence rule based on the level of care, assuming optimal knowledge of risk, courts need only make two of the inquiries. A court does not have to know whether information about risk was obtained in fact. (This can be a significant advantage; exactly what a defendant knew about risk may be hard to establish even when what he should have known and his level of care can be fairly well determined.) To employ the negligence rule based on the level of care that is optimal given information actually possessed, courts do not have to determine what information should have been obtained; and to employ the negligence rule based on the optimal level of care presuming that information about risk was obtained also does not require courts to determine whether the information should have been obtained.

(c) The theoretical results suggest that, other things being equal, decisions about obtaining information and about the exercise of care will tend toward the optimal if courts employ either strict liability, the complete negligence rule, or the negligence rule under which the level of care presumes optimal knowledge about risk. If courts base their findings on the negligence rule using the level of care that is optimal assuming either actual knowledge of risk or a degree of knowledge that may not be cost-justified, incentives to obtain information and to exercise care may be socially inappropriate.

(d) All but one of the rules of liability examined in this article are, or have sometimes been, employed by courts. In particular, strict liability determines liability in certain areas of accident (notably, for extrahazardous activities).[11] In most areas, the negligence rule governs, and in determining the level of care that should have been exercised, courts appear usually to assume that parties possess optimal knowledge of risk.

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[11]See Keeton et al. [1984], chaps. 5 and 13.

They state for example, that parties "know or should have known" certain facts or that they are "deemed" to know facts concerning risk when these facts were easily ascertainable or the cost of obtaining them was justified by the benefits that knowledge of them would bring about.[12] One supposes, though, that courts sometimes base negligence on actual rather than optimal knowledge of risk where they have difficulty in determining what level of knowledge about risk was optimal. And one also supposes that courts sometimes assume parties have a certain degree of information about risk, without inquiry into whether the information was optimal to obtain.[13] However, courts do not seem ever to apply the complete negligence rule. Under that rule, recall, a person is liable if he merely fails to obtain information about risk when he should have done so, but courts will not in fact find such a person liable if he exercised proper care.

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[12]See Keeton et al. [1984], pp. 182 - 185; Restatement (Second) of Torts 1965, sec. 290.

[13]For example, some commentators suggest that in determining liability for defective products, certain courts have employed ex post standards -- based on knowledge of risk and technology at the time of an accident -- rather than ex ante standards -- based on the possibilities for and costs of obtaining information at the time of manufacture of products. See Schwartz [1979] and Rabin [1985] for critical assessment of this view, and see Epstein [1980] at Chapter 7 for general discussion of design defects and product liability.

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