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How Liability Distorts Incentives of Manufacturers to Recall Products

Omri Ben-Shahar
University of Michigan Law School, omri@uchicago.edu

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Omri Ben-Shahar
University of Michigan Law School
Ann Arbor, MI 48104
(734) 668-9387
omri@umich.edu

Abstract

The nature and likelihood of harms associated with products may be revealed over time. As more information is gathered, a manufacturer must decide whether to continue selling the product as is, or to recall it. The paper shows that existing products liability law gives the manufacturers bad incentive to recall products. It shows, counter-intuitively, that as the post-recall liability becomes more severe, manufacturers would be more likely to leave products in the market longer and more often than is socially desirable. It also demonstrates that the law hurts the incentives of manufacturers to acquire better information about the riskiness of products already in use. The paper discusses several ways in which liability can be designed in a way that would produce more efficient recall and safety-research decisions, to the benefit of society in general and of consumers in particular.

> *"Vioxx's abrupt withdrawal from the market, after a clinical trial linked the drug to heart attacks and strokes, is expected to open the floodgates on lawsuits against Merck."*
>
> Wall St. Journal, Oct.5, 2004.

Introduction

The riskiness involved in using products is often not known when the products are initially launched. Usually, it is only over time, as experience mounts and as aggregate data becomes reliable, that specific risks and harms can be assessed, and precautions can be taken. This is true even for products that undergo significant examinations and require government licensing prior to their distribution, such as pharmaceuticals. Since the process of information accumulation is gradual, it is important to understand how the emergence of new information affects the safety decisions of manufacturers.

The type of dilemma facing a manufacturer can be illustrated by the events that led to the recent recall of the Vioxx pain medication by its producer, Merck. Initially, when the product was launched in 1999, the risks associated with it were considered negligible, and it was granted a swift FDA approval. Over the first couple of years of its distribution, evidence from tentative studies began to suggest that Vioxx may be associated with an increased cardiovascular risk. With this new information surfacing, Merck had to decide whether to recall the product—which was already being prescribed to millions of patients—and/or whether to invest more heavily and urgently in additional studies. The product was kept on the market (with updated warning labels) until September of 2004, when the results of a new study substantiated the risk, leading

Merck to withdraw the product. Soon after the recall announcement, thousands of law suits were filed; a plaintiffs' lawyers convention was held to coordinate the litigation strategies and to increase the plaintiff pool; and Merck suffered a dramatic decline in its market capitalization. The legal question has now come to the fore: should Merck's decision to keep the product on the market (after it supposedly had some information about the risk) affect the scope of its liability?

This paper examines how the prospect of liability affects the incentives of manufacturers like Merck to recall products already in the market. Admittedly, a recall is but one—perhaps the most extreme—safety action the manufacturer can take. A more common post-sale safety action is the issue of new warnings and instructions. Warnings are less costly for the manufacturer, often less effective in terms of added safety (due to the use of boilerplate language), and usually have a lesser impact on the scope of liability. By focusing on recalls, which are costlier to undertake and more likely to have liability consequences, the analysis aims to identify the incentives for post-sale safety actions in general and how they are affected by products liability.

Does the fear of costly liability encourage manufacturers to act too cautiously and recall products too early and too often? It may be plausibly conjectured that the effect of an expanded scope of liability is to induce *excessive* recalls. The intuition is the following: the longer the manufacturer keeps the product on the market, the heavier the latent liability, and the more likely it is that he would be considered culpable, deemed to be pursuing greed rather than consumer safety. To reduce this ex-post exposure to liability, the manufacturer would be overly defensive and recall products that may still

be socially valuable. Good products would be pulled out too often.[1]

The analysis in this paper shows that indeed the prospect of costly products liability may distort the manufacturer's post-sale safety decisions, but—in contrast to the excessive recall conjecture—the distortion may in fact be the opposite. Products liability provides incentives for manufacturers to issue *too few* recalls relative to the social optimum, often later than desirable, and to invest too little in post-sale research of the possible risks. The more severe and costly is the liability, the more reluctant would the rational manufacturer be to recall the product that ought to be recalled from the shelves. Products liability law, it turns out, undermines the goal it sets to promote, of optimal safety.

The reason for this counter-intuitive effect is the following. Typically, the initial information received by the manufacturer about potential harm is not publicly known. Even if the information turns out to be true, it is difficult to discern whether there is a causal link between the product and the harm victims suffered ("Did my heart attack result from taking Vioxx or from eating greasy burgers?") From the manufacturer's perspective, recalling the product would have the upside of preventing some future harm and thus decreasing future liability for these prevented harms, but it would also have the downside of "bursting the floodgates" and inviting suits, some of which would otherwise not be filed. Since the recall announcement is taken as a public "confession" on behalf of the manufacturer that the product is harmful, it attracts the attention of

[1] A conjecture in this spirit was voice, for example, by a former commissioner of the FDA, Wayne Pines, cited in the Press saying that "if we see products liability emanating from Merck's decision to withdraw Vioxx, and class action suits, then it will continue to encourage drug companies to disclose the maximum amount of a drug's risk in their advertizing." See Brian Steinberg and Suzanne Vranica, *Not Such a Beautiful Morning,* Wall St. Journal B1, (Oct. 1 2004.)

victims, plaintiffs' lawyers, and juries, and operates to increase the scope of liability for harm suffered by victims who previously used the product, victims who might otherwise not sue, and even victims whose harm was possibly caused by other sources.[2] It is this downside that induces the manufacturer to hold back and refrain from issuing some socially desirable recalls.

An immediate recall in response to the new information is one possible strategy for the manufacturer. Another important decision he has to make at this interim stage in which information begins to arrive is how much to invest in additional studies and additional research that could improve the information about risk (and could be the basis for a more informed recall decision). For example, when problems with the Vioxx drug became a possibility, what type of studies and experiments should the manufacturer Merck have ordered? Here, too, the paper shows that existing products liability law hurts, rather than improves, the incentives of the manufacturer to research the risks and to acquire more accurate information. Because the incentive to use the information—even highly accurate information—is distorted, the incentive to acquire the information is also distorted.

After showing the distortion under existing law, the paper turns to explore ways

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[2] This floodgates eruption is illustrated phenomenally in the Vioxx case. In the wake of the recall, lawyers have organized a coordinated effort to identify Vioxx users through mass email, advertisements of 1-800 numbers ("1-800-LAW-SUIT). Currently, the number of suits already filed, few months after the recall announcement, is [UPDATED FIGURE]. A similar abrupt increase in liability exposure occurred following other drug recalls. For example, Bayer's cholesterol drug, Baycol, was recalled less than two years after it was launched. Prior to the recall, 0 suits were filed (although the warning concerning the risk already appeared on the label.) Within a year, close to 15,000 law suits were filed. See J.F. Szaller, *Litigation Update: Baycol*, ATLA-CLE 495 (2003). The results in these cases, and in the settlements reached in their shadow, is affected by the recall decision because, in the words of Judge Posner, "[...] juries are believed to overreact to evidence of subsequent remedial measures..." See Flaminio v. Honda Motor Co., 733 F.2d 463, 471 (7th Cir., 1984)

in which liability rules can be designed to provide more adequate incentives to recall. Not surprisingly, since the distortion arises from the "floodgates" effect of the recall—the increase in the number of suits occurring as a result of the recall—the solutions aim to offset this effect, by limiting the magnitude or the scope of liability in other ways. The analysis shows what the ideal solution would be—how much liability has to be "discounted" in order to generate optimal incentives—but recognizes that the implementation of such a solution would require courts to know or be able to verify factors that are often non-verifiable. Accordingly, the analysis proposes partial solutions, based on evidentiary and preemption doctrines, that have the potential to improve the manufacturer's incentives. These legal solutions share the feature of restricting and lowering the manufacturer's liability relative to the level the legal system might otherwise set.

This paper joins other studies that have shown how ex-post liability for defective products that were considered safe when initially launched can undermine one of the basic goals of products liability regime, to guarantee that safer products reach and remain on the market (e.g, Calabresi and Klevorick (1985), Calfee and Craswell (1984), Ben-Shahar (1998).) Specifically, it provides an additional insight on how an increase in the scope of liability can *weaken* the incentives to make products already on the market safer. The idea that post-sale safety measures may be discouraged if courts deem such measures as grounds to increase the ex-post scope of liability has been widely recognized (e.g., Calabresi and Klevorick (1985, p. 624), V. Schwartz (1983, p. 897), Allee (1983, p. 631).) This paper formalizes that notion, explores how it plays out in the context of product recalls, develops it further to study the incentives to acquire

information, and analyzes possible solutions to the distortion. While different solutions can have varying desirable effects, the paper concludes that a reduction in the existing scope of liability—perhaps a significant reduction—is necessary to guarantee that products in the market place are safer.

The paper is structured as follows. Section I provides a brief background on the law of products liability as it is applied to post-sale safety. Section II develops the formal analysis that demonstrates the gap between the socially optimal levels of post-sale safety and the private decisions of manufacturers under the liability system. Section III analyzes legal solutions to the distortion. Section IV provides a short informal discussion of the implications of the analysis. Section V concludes and discusses some additional factors pertaining to the incentives to recall.

I. LEGAL BACKGROUND

In products liability law, the question whether a product's design is defective and gives rise to liability is generally governed by a fault regime. For the manufacturer to be liable, the product must be "unreasonably unsafe" (Restatement 3d of Products Liability § 2; Restatement 2d of Torts §402A, cmt k). But verifying whether a design choice was reasonable and whether the manufacturer's actions were negligent are complicated tasks for courts. As a result, a manufacturer may be held liable even if the product was reasonably safe in terms of the state of the art at the time of its initial distribution.

One factor that undermines the operation of a pure negligence regime in product design liability is the hindsight test. Some courts make the determination concerning reasonableness of design or the failure to take post-sale care on the basis of all available information, including information that was not part of the state of the art when the

product was designed and sold, and only became available later.[3] Even courts that do not openly embrace a hindsight standard are nevertheless influenced by what they learn during trial about the shortcomings of the product, and scrutinize the design on the basis of information that the manufacturer did not have ex ante (Henderson, 1983).

The effect of a negligence regime implemented in hindsight is, of course, to increase the scope of liability. Even if the manufacturer acted reasonably at the time, he would not escape liability when the product turns out to be defective. A manufacturer that does not recognize or anticipate the type of defect that would eventually materialize can do little to avoid liability. Effectively, then, his liability for design defect becomes strict.

This transformation of a fault-based regime into a regime with "pockets" of strict liability is even more powerful when recalls are implicated. In the common law, there is no duty to recall unsafe products, such that—if fulfilled—the manufacturer would be exonerated (Allee, p. 637). The question is always whether, prior to its recall, the product was unreasonably unsafe to have been placed on the market. When the answer to this question concerning the product's design comes from the manufacturer himself, in the form of a "confession" that the product was defective and unsafe, judges and juries are even more likely to condemn the design (Henderson 1983). Recognizing this, and trying to protect their reputation in the market for future products, manufacturers have an incentive to settle the (class action) lawsuits brought by users of the product, without thoroughly mounting a legal defense that the product was reasonable. Thus, in the

[3] See Beshada v. Johns-Manville Products Corp., 447 A.2d 539, 549 (NJ 1982) ("We impose strict liability because it is unfair for the distributors of a defective product not to compensate its victims."); V. Schwartz (1983, pp. 901-905).

existing legal system, a recalled product is highly unlikely to be considered reasonably safe, and liability is strict.

The formal analysis below will therefore proceed under the assumption of strict liability. It will be shown, however, that similar results to those applying to the strict liability regime would also apply to a negligence regime.

II. FORMAL ANALYSIS

A. Framework of Analysis

A risk-neutral manufacturer sells a product to risk-neutral buyers. The value of the product to the consumers, and its price, is V. The product may cause harm, and it is assumed that the harm may be either 0 or H, with H > V. The risk of the product being harmful is unknown, and is revealed in the following way.

Initially, at time 0, when the distribution of the product begins, the product is perceived to be risk free by the manufacturer and by the consumers (based, say, on state-of-the-art tests, FDA approval, etc.). At time 1, the manufacturer receives casual and discrete information that a systematic harm H may be associated with the product.[4] The manufacturer's estimate of the probability of harm, based on this information, is q. That is, there is a likelihood q that the product is defective and an average consumer will suffer H, and a likelihood of (1-q) that the product is not harmful. At this time, the manufacturer can do one or both things. First, he can spend a discrete cost of k to deliberately acquire perfect information about the safety of the product—to know

[4] This information arrives without the manufacturer deliberately researching the risk. For example, in the Vioxx recall case, the information about the product's potential cardiovascular hazards came from a study aiming to identify the cancer preventative effects of the drug.

whether the harm is H or 0 (say, by running a large scale testing procedure.) Second, and whether or not he acquires the perfect information, the manufacturer can decide to recall the product and discontinue its distribution. If he does not recall the product, additional sales will take place.

If the manufacturer continues to distribute the product beyond time 1, it will eventually become known, at time 2, whether the product is safe. Unlike the information privately acquired at time 1, this information would be more publicly known, and liability may be imposed on the manufacturer.

Two parameters play an important role in the analysis below. The first is a time parameter that measures how long the product was in circulation before the new information, or "suspicions", came up that some defect is causing systematic harm. Specifically, let $\alpha > 0$ measure the intensity of product sales prior to period 1, relative to the sales that would occur at time 1 (which are assumed to equal a unit). α close to zero means that the period prior to time 1 was short, namely, that the time-1 suspicions arrived soon after the product was launched. The greater α is, the longer was the pre-period 1 phase in which the product was sold and consumed.

The second parameter measures the information that others—consumers, the court—might have about the *cause* of harm, based on publicly available data. Specifically, let us assume that the same harm H can occur from other sources as well, so that the fact that a consumer who used the product suffered the harm does not indicated conclusively that the harm was caused by the product. Let $0 \leq \pi \leq 1$ denote the likelihood that the product is the cause of the harm. That, among all consumers who used the product and suffered H, $1-\pi$ of them would have suffered the harm anyway, due

to other risk exposures. Thus, at time 2, if the product turns out to be harmful (with probability q), a π-fraction of those suffered this kind of harm are victims of the use of the product.[5]

Finally, it is assumed that any information the manufacturer receives casually or acquires deliberately at time 1, which forms the basis for his decision whether to recall the product, is private and cannot be verified by court.

B. When Should the Product Be Recalled?

This section explores the socially optimal outcome. Ideally, since the product either causes a harm of H or 0, the product should be recalled if and only if the harm is H (since by assumption H > V), and not otherwise.[6] At time 1, if the information about risk is imperfect and the likelihood of risk is q, and if the same harm H can be caused by other sources, then the product should be recalled whenever the expected cost from continuing its consumption exceeds its value, iff:

$$V < qpH \qquad \textbf{(1)}$$

But the recall decision at time 1 need not be based on the probabilistic assessment of harm. The manufacturer can invest in acquiring better information. This information would reveal whether the harm is H or 0, thus enable the manufacturer to recall the product only when the information indicates that the harm is certain to be H.

[5] For example, in the Vioxx case, the number of possible heart attacks caused by the drug is now estimated to be 7.5 per 1000 users. With at most 2 million patients taking the drug (although many taking low doses), the number of heart attack fatalities is at most in the single thousands, compared to 950,000 victims of heart attack annually. See Andrea Petersen, *Putting Side Effect in Perspective*, Wall St. Journal D1 (Oct. 5, 2004).

[6] The other case, in which H ≤ V, is not interesting because it is a case in which even if the harm is certain to be H, it still does not make social sense to recall the product or acquire better information about it.

The social value of this information depends on what can best be accomplished in the absence of information, as follows:

- Case I: $V < q\pi H$. Here, in the absence of information, the best thing to do is to recall the product. Thus, the value of information is $(1 – q)V$, namely, the social gain that would otherwise be squandered (V), multiplied by the likelihood that the information would show the product to not be harmful (1–q). Information should be acquired in this case if and only if

$$k < (1-q)V \qquad \textbf{(2)}$$

- Case II: $V \geq q\pi H$. Here, in the absence of information, the best thing to do is not to recall the product. Thus, the value of information is $q(H – V)$, namely, saving of net social loss ($\pi H–V$) multiplied by the likelihood that the information would show the product to be harmful (q). Information should be acquired in this case if and only

$$k < q(pH - V) \qquad \textbf{(3)}$$

The conjunction of conditions (2) and (3) can be illustrated graphically:

*** FIGURE I HERE ***

Figure I depicts the relation between the value the product V and the investment in information k. The shaded area represents the cases in which information is cost-worthy. It conforms to the following intuitive scenario. Initially, when V is very low, the product is not marketed and it would be justified to invest in information about it only if k is very low. As V rises, it is worth to spend more on information, to potentially confirm that it is not risky and thus bring the more valuable product to the market. The value of

information is maximal when V is at an intermediate level, high enough to be worth marketing even without information. Here the value of information is no longer the value of the product if marketed, but the harm eliminated if the information reveals that the product is harmful and it is taken off the market. The more V rises beyond that level, the less the value of the information because even if the information shows that the product is harmful, it would benefit society less to withdraw such a valuable product.

C. Strict Liability

Under a strict liability regime, the manufacturer is liable for all the harm caused by the product, before and after he acquires information about the riskiness. This section examines the benchmark case in which the strict liability regime operates in an environment of symmetric information: any information the manufacturer has about the riskiness of the product is also available to courts and to consumers.

1. *The Recall Decision*

Under a strict liability regime, once he perceives there to be a risk associated with the product (at time 1), the manufacturer expects to be liable for all past and future harm. Without more information, the manufacturer will recall the product iff:

$$V - q(1+a)pH < -qapH \qquad \textbf{(4)}$$

The left hand side denotes the manufacturer's payoff if he continues to distribute the product. He will continue to capture the revenue V, but there is a chance q that the product will turn out to be harmful, in which case the manufacturer will be liable to past and future consumers (recall that α measures the proportion of past consumers), and his liability will extend to the harm H suffered only in cases in which he is the cause (π). If,

instead, the manufacturer recalls the product, he will forgo the revenue and his liability will be restricted to harms he caused to consumers who purchased the product in the past. Rearranging terms, the manufacture will recall the product under a strict liability regime iff $V < q\pi H$, which is socially optimal.

This is a familiar property of the strict liability regime with perfect information. The passage of time and the gradual accumulation of information does not disrupt the efficiency of the system because at time 1, when the risk becomes known, no matter what the manufacturer does with future products he cannot escape full liability for past-distributed products, if they turned out to be harmful. The manufacturer's decision whether or not to recall the product affects solely the future, preventable, harm. Since he is assumed to reap the entire surplus from the product, he will distribute it only if this surplus exceeds the expected future cost.

It is sometimes perceived that manufacturers greedily delay a recall of a product in attempt to protect their profits, not wanting to kill a hen that lays golden eggs.[7] The analysis here shows that this perception is misguided. It is true that by continuing to market the product rather than recalling it the manufacturer secures ongoing sales and profits, but this is as much a socially valuable decision as it is privately so. Since the product has also a benefit, not just a potential harm, society would want the manufacturer to take this benefit into account and recall a product only when the benefit is lower than the harm. In fact, if we relax the assumption that the product's price equals the entire consumer surplus (V), the manufacturer might recall the product too often. As long as he cannot price the product to extract the entire consumer surplus,

[7] Cite press on Vioxx.

the manufacturer's decision to recall does not take into account the benefit that consumers forgo if the product is recalled.

2. *The Information Acquisition Decision*

Before deciding whether to recall the product, the manufacturer can spend a cost of k and acquire perfect information about the harm. Of course, the decision whether to acquire information depends on the value of such information, which in turn depends on what the manufacturer would do without such information. If, in the absence of perfect information, the manufacturer would not recall the product ($V \geq q\pi H$), then he would acquire information iff:

$$(1-q)V - qapH - k > V - q(1+a)pH. \quad \textbf{(5)}$$

The left hand side denotes the manufacturer's payoff when he acquires information. He would either find out (with probability 1–q) that the product is not harmful and continue to distribute it and accrue V, or he would find out that the product is harmful (with probability q) and stop distribution and face liability for past harm, αH. The right hand side denotes the payoff in the absence of information acquisition, under the assumption that the product would not be recalled. Rearranging, the manufacturer would acquire information iff $k < q(H - V)$, which is identical to the socially optimal condition (expression (2).)

If, alternatively, the manufacturer's optimal action in the absence of perfect information would have been to recall the product, then he would acquire the information iff:

$$(1-q)V - qapH - k > -qapH. \quad \textbf{(6)}$$

Here, the payoff for information has to be compared to the payoff from uninformed recall, which is liability for all past harms. Rearranging, the manufacturer would acquire information iff $k < (1 - q)V$, which is again identical to the socially optimal condition (expression (3).)

The observation that strict liability provides optimal incentives for information acquisition decisions goes back to Shavell (1992). The reason that it holds in this context is somewhat different, though. Shavell's claim rests on the feature that under strict liability the decision maker bears the entire social cost and would thus act socially optimally. Here, it was noted, the manufacturer bears more than the social cost: at the time of the safety and information decisions, he already stands to bear liability for past products, which thus exceeds the social cost of his present actions. However, since this "excess" liability is invariant to his time 1 decisions, it does not distort the incentives.

To summarize the analysis of the full-information strict liability regime:

Proposition 1 (Strict Liability): *Under a strict liability regime, the manufacturer's decisions whether to recall a product and how much to spend on new information about risks of a product are socially optimal.*

D. Strict Liability with Imperfect Information about the Cause of Harm

Under a perfectly operating strict liability regime, the manufacturer's decisions to acquire information and to recall the product are optimal. This section explores the same decisions under a strict liability that operates with incomplete information. Specifically, consider an environment in which, at time 1, when the manufacturer receives the new information about the possible defect/risk, this information is not widely shared. Further, given the fact that the same type of harm that may be caused by

the product may also be caused by other sources (e.g., heart attack may be caused by Vioxx or by high cholesterol), it is not certain that—even if the product is harmful—consumers and courts will be able to observe and verify the source of harm and attach liability only in those case where the product caused the harm.

Thus, at time 1, given consumers' imperfect information , the manufacturer perceives a probability $\pi < 1$ that—conditional on the product being harmful and the consumer suffering harm—liability would be imposed. When a manufacturer recalls a product, however, it is assumed that the recall decision is taken by the public (and by courts) as evidence—in fact, as an explicit admission—that the product is harmful, thus raising the likelihood that suits would be filed and succeed.[8] For simplicity, then, assume that when a manufacturer issues a recall, all consumers who suffered the harm H would file suits, even if the true cause of their harm is elsewhere, and impose liability on the manufacturer (the probability of liability rises from π to 1.)

1. *The Recall Decision*

In this setting the manufacturer will recall the product iff:

$$V - qp(1+a)H < -qaH. \qquad (7)$$

The left hand side denotes the manufacturer's payoff if he continues to distribute the product. He will continue to capture the revenue V and, if the product is harmful, his liability will extend to past and future harms, and yet there is only a likelihood π that

[8] Recalls often alert past consumers (and plaintiffs' lawyers) to the risk to which they were exposed thereby "inviting" lawsuits. For example, the drug Baycol was recalled by its manufacturer, Bayer, in August 2001, after the risk of a muscle disease was substantiated. Soonafter, the first lawsuit was filed, with thousands to follow. See James F. Szaller, *Litigation Update — Baycol*, Association of Trial Lawyers of America Convention Reference Materials (2003). Thus, the event of a recall raises the likelihood that a suit would be filed.

consumers will find out about the harm. If, instead, the manufacturer recalls the product, he forgoes the revenue V and his liability will be restricted to harms occurring to consumers who purchased the product in the past, but due to the publicity of the recall announcement all these consumers—not just a fraction π of them—will sue.

Rearranging terms, the manufacture will recall the product iff:

$$V < qH\left[p\left(1+a\right)-a\right] \qquad \textbf{(8)}$$

The term in the bracket, [π(1+α) – α], which in short will be denoted as Δ, measures the proportional difference in liability between continued distribution of the product and its recall. Continued distribution of the product exposes the manufacturer to potential suits from more victim (1+α) but only a fraction π of them would succeed; a recall limits the pool of victims to α, but all of them would sue. The critical thing to notice is that the term Δ is always smaller than π (for all α > 0 and π < 1).[9] This means that the condition for the manufacturer to issue a recall has a smaller right hand side than the socially optimal condition. In other words, the manufacturer might not issue a recall when it is socially desirable to do so. For values of V that lie in the range between πqH and ΔqH the product would not be recalled, even though it should be. The following result can be stated:

Proposition 2a (Imperfect Information): *When victims have imperfect information about the harm from the product, some socially desirable recalls would not be issued.*

Remarks. (i) *Intuition*. The manufacturer has inefficiently low incentive to issue a recall because the recall decision increases his relative exposure to liability to past

[9] For all π < 1, Δ = [π(1+α) – α] = π + α(π – 1) < π.

consumers. Since past losses are not affected by the recall decision, his liability for them should not be affected by his decision to recall, yet it rises from π to 1.[10]

(ii) *Exacerbating Factors*. The distortion identified by proposition 2 is exacerbated if, in the absence of a recall, some of the harms caused by the manufacturer would go undetected. Given the uncertainty over causation, it is very plausible that consumers would be unable to detect the product as the source of the harm they suffered. Thus, the fraction of suits brought in the absence of a recall would be less than π. If a recall occurs, however, this fraction of undetected harms decreases, again raising the relative liability of the manufacturer who issues a recall.

(iii) *Comparative statics*. The magnitude of the distortion in the model is $\Delta - \pi = \alpha(1-\pi)$. Thus, the greater α is, the more severe this distortion. Intuitively, greater α means that there is a greater pool of past consumers whom would be "invited" to bring suit by a recall. That is, the earlier the manufacturer has to make the recall decision, the smaller the distortion. The longer the manufacturer waits, the more difficult it becomes to issue a socially desirable recall. Likewise, the greater π is, the smaller the distortion. Intuitively, the greater the fraction of harmed consumers who can detect the source of their injury without reference to a recall and who would sue irrespective of a recall, the less the manufacturer's concern about "inviting" suits.

(iv) *Negligence Regime*. A similar distortion arise under a negligence regime,

[10] A similar effect has been recognized before in the analysis of negligence regimes. Calabresi and Klevorick (1985, p. 624) and Henderson (1983) noted that an injurer may decided not to take a cost-worthy safety action if that would increase the likelihood that he would be found negligent in distributing older products. The analysis here showed that even under strict liability, where the manufacturer is already liable for past harms, the chilling effect occurs because of the increase in the *scope* of liability.

when there is imperfect information about the cause of harm. When a recall occurs, a court is more likely to determine, in hindsight, that the manufacturer's decision to market the product was negligent. This increase in the likelihood of liability provides a disincentive for the manufacturer to recall the product.

2. *The Information Acquisition Decision*

The decision whether to acquire perfect information about harm for a cost of k depends, again, on what the manufacturer would do with such information. If the information shows that the product is safe, that could be valuable to a manufacturer that otherwise would have decided to withdraw the product. And if the information shows that the product is certain to cause harm H, it would be valuable if the manufacturer would decide, as a result, to recall the product, and would not have made such a decision otherwise.

Begin, then, with the case in which, in the absence of perfect information the manufacturer would continue to distribute the product, that is, $V \geq \Delta qH$. Unlike the perfect information case, though, here it is not certain that—even if the information shows the product to be harmful—the manufacturer would recall it. If the manufacturer knows the product to be harmful, he would only recall it iff:

$$V - (1+a)pH < -aH. \qquad \textbf{(9)}$$

This expression denotes the comparison between payoff in the absence of recall (on the left) and payoff with recall (on the right), if the manufacturer were to know for certain that the product is harmful (this expression is identical to expression (7), with q = 1.) Rearranging, if the information shows that the product is harmful, the manufacturer would recall the product iff $V < \Delta H$. Note that even in this case there is too little recall

relative to social optimum,[11] for the same reasons underlying Proposition 2a—the fear that a recall would invite suits that otherwise might be left out.

The possibility that even with perfect information the product would not be recalled (when $V \geq \Delta H$) is of less interest because in this case the manufacturer would never want to acquire information in the first place. When V is high enough, the manufacturer knows that no matter how likely the harm, it is still beneficial to keep the product in the market. Thus, he can always do better simply be continuing to distribute the product without spending any cost on information, saving the expenditure of k.

Accordingly, focus on the situation in which condition (9) holds—where $V < \Delta H$. A manufacturer who would otherwise distribute the product, would acquire the information and act in accordance with it iff:

$$(1-q)V - qaH - k > V - q(1+a)pH. \qquad \textbf{(10)}$$

The left hand side is the payoff if information is acquired, in which case there is a chance q that the product will be recalled and all past victims would sue. The right hand side denotes the payoff if the product is distributed without more information, in which case the expected payoff is the liability conditional upon the product being harmful and the harm being detected. Rearranging, information would be acquired iff:

$$k < q(\Delta H - V) \qquad \textbf{(11)}$$

Since $\Delta < \pi$, the right hand side is always smaller than $q(\pi H - V)$. Compared to the social optimum in this region (whereby the manufacturer should acquire information iff k <

[11] Optimally, a recall should occur whenever V < H. Since $\Delta < 1$, there is a region of V (between ΔH and H) where a recall should optimally take place, but it doesn't.

q(πH–V)), we see that the manufacturer has too little incentive to acquire information.

Consider now the second scenario, in which the manufacturer's optimal action in the absence of more information would have been to recall the product (the case where V < ΔqH.) The manufacturer would acquire the information iff:

$$(1-q)V - qaH - k > -qaH. \qquad \textbf{(12)}$$

Here, the payoff for information has to be compared to the payoff from uninformed recall, which is liability for all past harms. Rearranging, the manufacturer would acquire information iff k < (1 – q)V. In this region, then, the manufacturer has socially optimal incentives to acquire information (compare to expression (2): when V < qH, it is socially optimal for information to be acquired when K < (1 – q)V.) Combining the two scenarios, we can now state the following proposition:

Proposition 2b. *When victims have imperfect information about the harm from the product, the manufacturer who decides to continue and market the product has inadequate incentives to acquire information about the riskiness of the product.*

Remarks. (i) *Combining the Recall and the Information Decisions.* The following figure helps understand the overall distortion.

*** FIGURE II HERE ***

The region OAD represents the cases in which it is socially optimal to acquire information and act upon it. Under the existing regime, information would be acquired only in the shaded region OEC, clearly too little relative to the social optimum. The distortion arises from the conjunction of two effects. First, as Proposition 2a states, the

cutoff value for recalling a product shifts downwards, from $q\pi H$ to $q\Delta H$. Second, as Proposition 2b states, the incentive to acquire information in the region where the product would be sold ($V > \Delta qH$) shifts downwards, from $q(\pi H - V)$ to $q(\Delta H - V)$.

Thus, the distortion is the following: area AECD represents cases in which optimally the manufacturer would have acquired information and recalled the product if the information showed harm, but now chooses not to acquire information and to continue market the product despite the potential harm. There are two types "losses" in this area. First, in area ABCD the social loss is in forgoing the opportunity to acquire cheap enough information. Second, the area in ABE, the social loss is not only in forgoing the opportunity to acquire cost-worthy information but also in the decision to keep the product in the market instead of recalling it. These are cases of the combined distortion: the value of the product is too low to keep it in the market given the potential risk, yet the product is not recalled; and the cost of further research is low enough to justify more research into the likelihood of harm, yet the manufacturer does not invest it.

(ii) Courts have at times speculated that ex-post liability for harms that were discovered after the sale of the product would create an incentive to "invest more actively in safety research."[12] The analysis here demonstrates that this conjecture is not valid. More liability, it turns out, spoils the incentives of manufacturers to invest actively in safety research, because manufacturers expect that even if the research would reveal new risks, they will not readily withdraw the product from the market.

(iii) While it is the manufacturer rational cost-benefit analysis that explains why

[12] Beshada v. Johns-Manville Products Corp., 447 A.2d 539, 548 (NJ 1982).

products are not recalled often enough, it would be misguided to interpret this analysis as requiring a harsher legal sanction on the manufacturer to correct the distortion. As the analysis below shows, since the distorted incentive is the result of excessive liability for recalls, it can best be corrected by making it cheaper for manufacturers to recall products.

III. LEGAL SOLUTIONS

A. The Optimal Liability Regime

This section derives the optimal magnitude of liability that should be leveled on a manufacturer who issued a recall, such that would correct the distortion identified above. The distortion, remember, occurs because a recall increases the fraction of victims that sue. To address this distortion, an optimal legal regime would have to set the liability for the time 0 products invariant to whether the product was recalled.

One way to design such a system is to simply multiply the manufacturer's liability when he does not recall the product by $1/\pi$, to offset the benefit of the smaller probability of suit. The problem with this solution is that it requires courts to know what π is—a parameter that is only revealed over the population of cases. It also requires courts to apply such a multiplier only in cases in which the manufacturer has information about the possible harm that victims or courts do not have. But the existence of this superior information on part of the manufacturer is precisely the feature that courts cannot verify. Of all suits brought against manufacturers for product-related harm, how can courts distinguish those that involve products for which the manufacturer had private information about this type of harm? (If they could, a fault-

based standard could be implemented for design defects.)[13] Finally, while this solution would eliminate the distortion in the recall decision, liability would exceed the harm caused by the product and could have crushing effect on the "activity level," namely, on the decision to launch products in the first place (Shavell 1985).

There is another way to resolve the distortion: reduce the manufacturer's liability when he does recall the product, to offset the "floodgates" effect and thus eliminate the advantage for the manufacturer of leaving the product on the market too long. The analysis below shows that by using the correct liability "discount" in suits brought after the recall announcement, courts can generate optimal recall incentives.

Denote by θ the "discount" coefficient—the fraction of the harm H for which the manufacturer should be liable—when suits are brought after a manufacturer issues a recall. $\theta = 1$ is the case of no discount. $\theta = 0$ is the case of no liability. The manufacturer would recall the product iff:

$$V - q\pi(1 + \alpha)H < -\alpha q(\theta H) \qquad \textbf{(13)}$$

The left hand side denotes the payoff if the product remains on the market: liability would be imposed only if the product is harmful (q) and only for a fraction of the harms (π), but would apply to time 0 and time 1 sales ($1 + \alpha$). The right hand side denotes the payoff if the product is recalled, in which case it is limited to time 0 sales

[13]Another way to design a system that would similarly offset the distortions is to make the manufacturer liable only for a fraction π of the harms caused at time 0 even when he recalls the product (as would be his liability when he does not recall the product), and at the same time to increase his liability for harm caused by time 1 sales to offset the under-detection problem. The problem is that the law would have to treat similar victims differently, depending on whether they are time 0 victims or time 1 victims, a characteristic that is not readily verifiable (only time 1 victims would be subject to a liability multiplier of $1/\pi$, time 0 victim would not.)

(α), and discounted by θ. For this decision to be socially optimal, θ must be such that condition (13) holds if and only if V < πqH. This would be the case when

$$V - q\pi(1 + \alpha)H - (-\alpha q(\theta H)) = V - \pi qH,$$

which yields θ = π. Since the manufacturer's incentives are distorted by the rise of the scope of liability from π to 1,they can be corrected by a reduction of the magnitude of liability from 1 to π.

The problem with the optimal discount is that, like the optimal multiplier, it requires courts to assess π, which they likely cannot. Still, the discount approach has an advantage over the multiplier approach, since it might be easier to assess the value of π in the context of a recall, than otherwise. When a recall occurs, the rise in the stream of suits can be loosely estimated, and can give courts an assessment by how much liability ought to be discounted. The next two sections describe ways in which the discount-in-liability regime can be implemented without requiring courts to assess the value of π.

B. Rule 407

The above analysis showed that the distortion in the recall decision is owed to the fact that consumers who might otherwise not sue are "invited" by the recall announcement to file suits. One of the reasons that explains this "floodgates" effect is the expectation on part of consumers or plaintiffs' attorneys that the recall decision would be deemed by juries as a confession by the manufacturer that the product is defective and that it was wrong to have marketed it in the first place.

Given this effect that the recall decision might have at trial, and recognizing that it can discourage manufacturers from taking the proper steps after the initial

occurrence of harm,[14] most states adopted Rule 407 of the Federal Rules of Evidence, which makes evidence of any post-accident measures taken by the manufacturer inadmissible to prove liability.[15]

Rule 407 could be used to curtail the manufacturer's liability in the event of a recall. In the analysis above, it was assumed that the recall increases the fraction of harmed consumers that sue from π to 1. However, with the evidentiary bar of Rule 407, some harmed consumers would not be able to prove causation and would thus not sue. Many of the consumers that, but for a recall, would not have sued, are ones that supposedly do not have hard evidence that their harm was caused by the product. If they cannot point out to the recall as such indirect evidence—or if Rule 407 otherwise alerts courts that an affirmative proof of causation is necessary—these allegedly harmed consumers may not be able to prove liability. True, it may still be the case that the recall alerts many consumers to the link between the product and the harm they suffered, and as a result their lawyers spend more effort on generating evidence. Still, if the recall decision per se is not admissible as evidence of culpability or causality, less suits would be sustained.

Thus, without loss of generality, assume that the effect of Rule 407 is to keep the fraction of consumers that sue even after a recall at π. As will be explained in the remarks, even if this assumption is relaxed and the probability of suit after a recall is

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[14] See, e.g., Ault v. International Harverster Co., 528 P.2d 1148 (1974)

[15] "When, after an injury or harm allegedly caused by an event, measures are taken that, if taken previously, would have made the injury or harm less likely to occur, evidence of the subsequent measures is not admissible to prove negligence, culpable conduct, a defect in a product, a defect in a product's design, or a need for a warning or instruction." (Fed. R. Evid. 407).

greater than π, as long as it is smaller than what it would be without Rule 407 in place, the qualitative results are robust. With Rule 407 in effect, the manufacturer will recall the product iff:

$$V - p(1+a)qH < -paqH \quad \textbf{(15)}$$

The only change effected by Rule 407 is on the right hand side. (The left hand side—the manufacturer's payoff if he continues to distribute the product—does not change: he expects to be liable only to a fraction π of past and future consumers.) If the manufacturer recalls the product, he expects that only a fraction π of the consumers that bought the product and want to sue him will succeed in litigation. Rearranging, we see that the manufacture will recall the product iff:

$$V < pqH \quad \textbf{(16)}$$

which is equal to the social optimum condition.

Proposition 3 (Rule 407): *Under Rule 407, a manufacturer's incentive to issue a recall are optimal.*

Remarks. (i) *Why is the distortion vanish under Rule 407?* In the absence of Rule 407, a recall would have increased the fraction of past consumer that sue, from π to 1. With the rule in place, this fraction remains π, so recall does not affect the pool of past consumer that would sue. Since recall no longer increases the pool of suits, this burden is lifted and the manufacturer is less reluctant to issue it.

(ii) *Rule 407 as partial bar.* The analysis here assumed that Rule 407 has the effect of reducing the probability of successful suit back to π, as it would have been in the absence of a recall. But while evidence about the recall is barred, it is still possible

that more consumers will be alerted by the recall and sue than without the recall. This would weaken the result of Proposition 3, but would not change it qualitatively. Specifically, if the probability of suit following a recall is $\pi + \epsilon$, in the range between π and 1, then a recall would take place iff $V < qH(\pi - \epsilon\alpha)$. That is, amongst the past consumers α, a recall would induce an additional increment of ϵ to sue, and the incremental cost of liability $qH(\epsilon\alpha)$ represents the reduced incentive to recall. Still, as long as not all past consumers sue, Rule 407 improves the manufacturer's incentives.

(iv) *Incentives to Acquire Information under Rule 407*. Because the incentives to recall products are optimal under Rule 407, the incentives to acquire information are also optimal..

C. Preemption

Another way to limit the manufacturer's liability is to set liability for time 0 harms equal to zero. Doctrinally, this can be achieved by preemption doctrine. Assume that prior to time 0, the product was approved by a Federal regulatory agency as safe. Should this approval preempt State product liability law and shield the manufacturer from liability?

Surely, the preemption shield should not apply to all harms, arising both from time 0 and from time 1 products. If preemption applied to liability for products marketed after the new information arrived (or could have been acquired), the manufacturer would have no incentive to take any post-sale safety action, nor invest in additional research. But, to the extent that the boundary between time 0 and time 1 can be verified by court, preemption could apply with respect to liability for time 0 products

in the event that the manufacturer issues a recall. In that case, the manufacturer would recall the product iff:

$$V - \pi qH < 0$$

The left hand side is the payoff if the product is not recalled; the manufacturer might face liability, if detected, but would enjoy immunity with respect to the time-0 portion of harms. The right hand side denotes the manufacturer's liability if the product is recalled, which—if the preemption shield applies perfectly—equals 0. Thus, the manufacturer would recall the product whenever $V < \pi qH$, which is optimal. Intuitively, the preemption shield eliminates the distortive effect of the flood of time-0 suits by setting the level of such suits at 0, irrespective of whether there is a recall. Similar to Rule 407, the level of time-0 suits is invariant to the recall decision; but unlike Rule 407, this level is 0, rather than π. However, whereas Rule 407 did not require courts to verify any of the parameters, the preemption rule requires courts to be able to identify the boundary between time 0 and time 1.[16]

IV. INFORMAL DISCUSSION

The formal analysis identified patterns in the behavior of manufacturers within the assumptions of the model. This section discusses the implications of these results "outside" the model and the implications they may suggest for products liability.

[16] The preemption rule would provide the same incentives even if courts made errors in verifying the boundary between time 0 and time 1, as long as these errors were the same whether or not a recall was issued. Let $\grave{\alpha}$ denote the "error" in setting time-o liability. $\grave{\alpha}$ is distributed randomly with mean 0. $\grave{\alpha} > 0$ is a case where the court mistakenly assigns liability to time-0 sales; $\grave{\alpha} < 0$ is the case where the court mistakenly fails to assign liability to some time-1 sales. As long as the same error distribution applies to the recall and the no-recall cases, the manufacturer would recall a product if and only if $V - E[\pi(1+\grave{\alpha})qH] < E(\grave{\alpha}qH)$, which is identical to $V < \pi qH$.

1. "π" — *The Probability of Suit*

The main distortion formalized in the model is the "floodgates" effect—the intuitive notion that a recall, like other decision to repair a previously unsafe feature, invites victims that used the pre-recall product to sue the manufacturer for the harm they suffered. This increase in the rate of suits is an assumption of the model, and it was shown to have the effect of diminishing the incentives to issue recalls. The more robust this assumption is, the more powerful the distortion. The recent Vioxx recall by Merck provides anecdotal but strong confirmation of the validity of this assumption. While there was a thin trickle of suits prior to the recall, in two months after the recall the number of suits ballooned rapidly, growing daily as plaintiffs' attorneys solicit new plaintiffs.[17]

Within the model, the probability of suit absent a recall, π, reflected the problem of uncertainty over causation. It was also this uncertainty that explained why a recall can significantly increase the legal attribution of the harm to the product. Alternatively, π can represent a problem of under-detection, where the public (and the courts) fail to recognize how harmful the product is, and allow the manufacturer to evade some liability. Interestingly, if π is indeed a measure an under-detection phenomenon, the distortion in the recall incentives is further increased. Now, a recall announcement not

[17] Mass mailings to millions of Americans invite them to join the law suit. One plaintiffs' attorneys website distributed email inviting recipients to "get your free case evaluation today" explaining that "if you have taken Vioxx and have suffered any side effects, please complete our short form and one of our experienced Vioxx Lawyer Network Members will contact you for your free case evaluation. Our goal is to provide current information on VIOXX® lawsuits and to provide you with a specialized, qualified attorney that has successfully settled these type cases in your area." See http://www1466.vioxx-legalhelpcenter.org/ (visited on Dec.15, 2004).

only bursts the floodgates, it also deprives the manufacturer of the benefit of under-detected harms. True, the under-detection problem suggests that absent a recall, the manufacturer would take too little post-sale care measures. But the results in the model suggest that the way to correct this distortion is to *reduce* the manufacturer's liability in case of a recall even further, to offset the benefit of remaining silent and enjoying under-detection. Note the difference between this result and the standard solution of under-detected harms, which requires a liability multiplier (e.g., Polinsky and Shavell, 1998). A multiplier of liability here would only aggravate the incentive problem, because it would give the manufacturer an added reason to refrain from taking any post-sale safety action that could trigger the incidence of liability.

2. "α" — *The Time Dimension*

In the model, the magnitude of the distortion depends on how long the product has already been in the market before the new information arrived and the decision whether to recall had to be made. The longer the product was already in circulation—the greater is α—the worse the distortion. This results confirms some conjectures made in the legal literature, and refutes other. In a landmark case, the California Supreme Court speculated that the longer the product remains in the market, the greater the manufacturer's exposure to liability, and thus the greater his incentive to take action.[18] Others disagreed; Henderson (1983, p. 774) conjectured that the longer the product was in the market, the less likely is the manufacturer to make safety improvements "because of their possible negative implications for tort claims

[18] Ault v. International Harvester Co. 528 P.2d 1148, 1152 (Cal. 1974).

involving older designs." The analysis here confirms Henderson's view. The California Court's view would be correct in an environment in which the manufacturer's liability for past and future harms is invariant to the recall decision. But as long as a recall increases the scope of liability, the manufacturer is better off holding back.

The timing of the manufacturer's decision—the boundary between "time 0" and "time 1," was exogenous in the model, and reflected the moment of arrival of new, casually acquired information. While this new information may indeed arrive exogenously, it may also be a result of efforts taken by the manufacturer. We saw, though, that the manufacturer has weaker than optimal incentives to generate any new information. Thus, if the manufacturer were the principal or the only source for new information about risk, the parameter α would be greater than it ought to be: the new information would "arrive" later than socially optimal. This suggests that the distortion is further compounded. Not only does the manufacturer not recall products fast enough when he has new information and not only does he not acquire more reliable information that is cost worthy, but also he contributes too little to the generation of the initial information about possible risks.

V. CONCLUDING REMARKS

Summary of Results and Policy Implications. The analysis showed that manufacturer do not recall products often enough, to correspond to new information that shows that the product is associated with greater risks than previously perceived. It also shows that the diluted incentive to recall make it less urgent for manufacturers

to spend in the acquisition of more accurate information about the risk, and thus the overall investment in understanding the risk of products that are already on the market is sub-optimal.

The source of the distortion in this model is not the desire of the manufacturer to protect the revenues from profitable sales (this motive is socially desirable), but rather the imperfect application of products liability. The paper showed that the way to correct this distortion is not by increasing liability—it is already too high. An increase in the magnitude or incidence of liability would only exacerbate the distortion, slowing down even further the speed or recall and reducing even more the incentive to acquire information. Instead, the law should decrease the scope of post-recall liability, to offset the wave of suits that usually follow a recall announcement.

Consumer Welfare. The social objective examined in this paper maximization of total welfare from products sold on the market. Products that cause greater harm than their value should be recalled, and information that improves the recall decision and costs less than the value it helps create should be acquired. This social objective is not equivalent to maximizing the welfare of consumers. Within the model, under the more efficient regimes that improve the recall decision, consumers are harmed less often, but also receive less compensation, with the decline in compensation being greater than the decline in the harm. It would be misguided, however, to understand the analysis here, with its focus on total welfare (efficiency), as sacrificing the interests of potential victims (fairness). While the model does not capture other consumer effects such as products' prices, an inefficiency in the decision to recall would ordinarily have a direct

impact on consumers. In a system in which products are not recalled in time, even if consumers are fully compensated for all the excessive harms, the social costs of products are inefficiently high, and manufacturers either charge higher prices or introduce positive products into the market less often. If the price of the product was realistically assumed to be somewhere between the cost to the producer and the value to the consumers, this negative effect on consumer welfare would have been captured by the model.

The Decision to Launch Products. The analysis assumed that the product was already on the market at time 1, when the new information arrived, and that the only safety decision for the manufacturer was to be made at that time. Realistically, of course, there are decisions that the manufacturer makes at time 0: whether to launch a product, to acquire information about its risks prior to launching, to install more safety measures, and the like. Clearly, liability based on information that arrived after the product was launched affects these time-0 incentives. It has been shown elsewhere that applying liability in hindsight on the basis of the new information would distort the time-0 choices of the manufacturer (see Ben-Shahar (1998). See also V. Schwartz, Calabresi and Klevorick...)

The analysis here suggests that products liability can create another ex ante distortion. If the manufacturer expects at time 0, when a product is ready to be launched, that if a new risk were to materialize he would not make the cost minimizing recall decision, his decision to launch a product can be distorted. For one, the marketing of the product may be excessively delayed (as is often the case with pharmaceuticals), to

investigate the potential (yet unknown) risks. Additionally, since the social costs of the product would not be minimized, and since some of these excess costs would be included in the manufacturer's expected liability, valuable products would fail to reach the market permanently, or fail to be priced in their most efficient way. Thus, in situations in which, say, it is desirable to launch a new drug and react soon after according to the type of risks that materialize (or not), a manufacturers who understands that recalling the drug may expose him to floodgate-liability would have an added reason to refrain from launching the drug and withhold it too long. Put differently, since the floodgates effect identified here is less costly the shorter the product has already been in the market when the new information arrives, the manufacturer would have the incentive to shorten this period. The longer he delays the launching of the product, the shorter is this "dangerous" period.

Punitive Damages. This paper focused on modes of liability reduction as means to correct the manufacturer's distorted incentives. Alternatively, a manufacturer's incentive to make the correct recall decision may be adjusted by punitive damages. If the manufacturer delayed a recall deliberately—if he breached a duty to recall a dangerous product—he can be subjected to punitive damages that would offset the benefit he tried to secure by delaying the recall. The problem with punitive damages is that courts would have to base a decision to grant them on factors that are not verifiable. Specifically, courts would have to determine what information the manufacturer obtained and when, what was the magnitude of risk that this information indicated, and what was its likelihood. For the same reasons that a pure negligence

regime concerning design defects and post sale care is subject to judicial errors, a punitive damages regime would make similar judicial errors. This prospect—if it generates any systematic type of judicial errors—would cause its own type of distortion. For one, it could lead to rash recalls, reflecting over-caution by manufacturers. Alternatively, when a manufacturer fears that any recall, however early, would expose him to punitive liability, this would only exacerbate the floodgates distortion identified above, and further slow down the pace of recall.

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FIGURE I

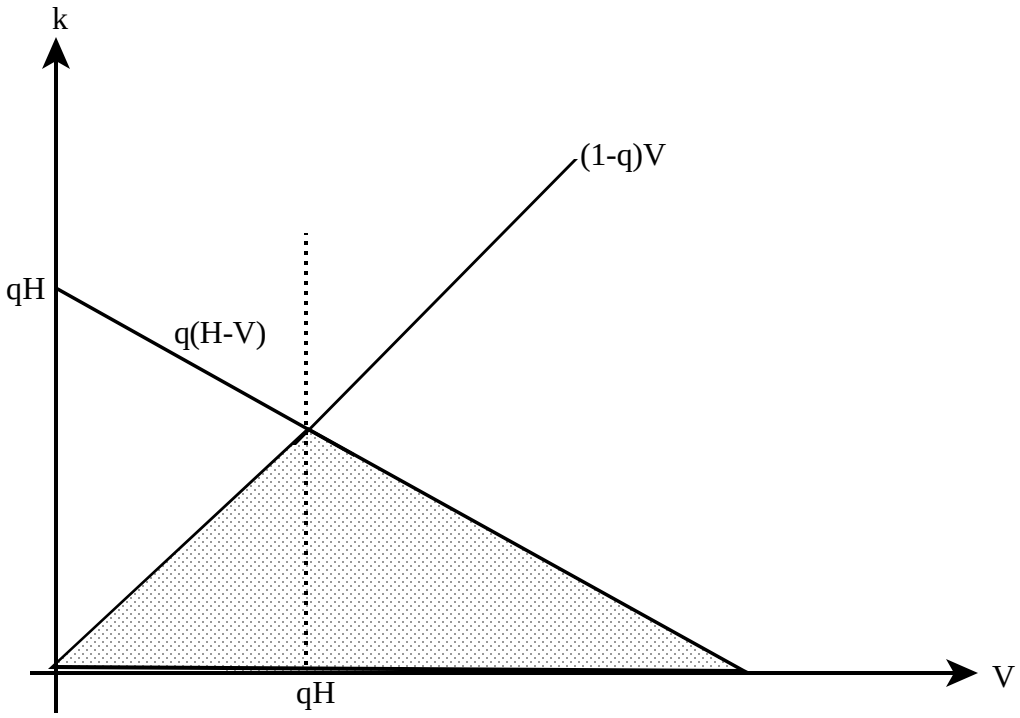

FIGURE II