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Product and Occupational Liability

W. Kip Viscusi

Increased liability for risks posed by jobs and products has transformed the cost structure of these markets. Premiums for general liability insurance, which provides protection for injuries and property damage to others, mushroomed from \$6.5 billion in 1984 to \$19.4 billion in 1986. The increase in workers' compensation premiums has been slightly less dramatic, rising from \$11.3 billion in 1978 to \$26.1 billion in 1988. In each case, these costs are in addition to any legal fees and self-insurance costs incurred by the firm (Insurance Information Institute, 1990). Moreover, although these institutions have separate functions—product liability remedies are for product-related injuries and workers' compensation is for job injuries—their responsibilities have begun to overlap increasingly, as workers file product claims for job injuries against the producers of products used in the workplace (such as the asbestos manufacturer).

Liability costs used to be an incidental expense; now they are a factor of substantial economic consequence. Some markets, such as pharmaceuticals and private aircraft, have been hit particularly hard. Liability costs now account for 17 percent of the fares paid by riders on the Philadelphia mass transit system and from 15–25 percent of the purchase price of a new ladder. In addition, as insurance coverage decreased, some products have simply disappeared, such as certain amusement park rides and diving boards at many motel swimming pools.

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The costs associated with a more active economic role of liability are not necessarily undesirable. However, examination of the economic objectives of the liability system will indicate that the current structure is not ideal. The first objective is that of providing efficient incentives for job and product safety. Empirical evidence indicates that workers' compensation does provide strong safety incentives. But while product liability also may provide safety incentives, the low level of court awards often makes these incentives inadequate, if we assume that only these awards provide firms with safety incentives. A competing danger is that of excessive penalties on innovative product designs. The current systems for product and job safety each perform more satisfactorily in terms of their second objective, providing efficient levels of insurance. The principal policy choices for these programs involve the scope of injuries and illnesses that will be covered and the relative weight that will be placed on the objectives of deterrence and insurance.

Perhaps the most noteworthy feature of the emerging role of liability is that it has been contemporaneous with an expansion in governmental risk regulation. Although regulation of some products, such as food and drugs, has been long-standing, most job and product risk regulation emerged in the 1970s. In the workplace, this regulation took the form of technological specifications of workplace design and hazardous exposure limits, whereas regulation of products focused both on design standards and on recalls of defective products. Unfortunately, the role of tort liability has not been coordinated with these new forms of regulation, with the result being an inefficient allocation of responsibilities and excessive incentives for risk reduction. The government is well-suited to making society-wide product design judgments and providing risk information. However, this superior capacity has not been recognized by the tort liability system. The subsequent sections explore the performance of product and occupational liability with respect to the objectives of efficient deterrence and insurance, in the context of seeking an optimal mix between legal and regulatory institutions.

Sources of Change: Liability Doctrines and Toxic Torts

If individuals systematically underestimate the risks they face on the job or in buying products, or err in their decisions under uncertainty in a manner that leads to underprovision of safety, then liability rules can enhance market performance. An early treatment of this class of issues appears in Spence (1977). The interested reader might also check more recent work by Landes and Posner (1987), Polinsky (1989), Posner (1986), Shavell (1987), or Viscusi (1991b). It is noteworthy that in many contexts, the inadequacies in risk perception and individual decision are associated with an overreaction to risk. For example, individuals tend to overestimate many small risks and risks that are highly publicized. In such instances, market risk levels may be lower than is

efficient. The existence of market failure consequently does not necessarily imply that safety levels are too low.

Doctrinal Change for Product Liability

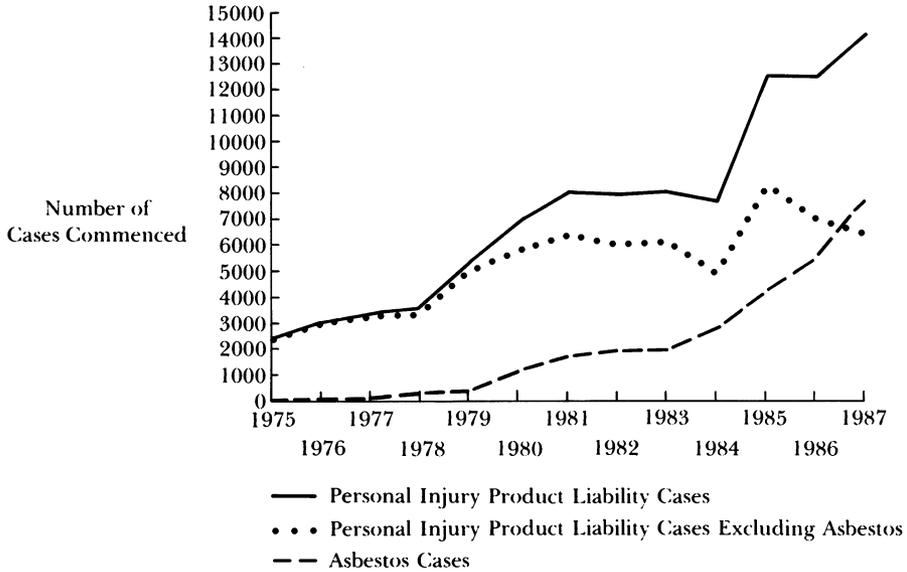
The most prevalent product liability doctrine has traditionally been that of negligence, whereby the producer is “required to exercise the care of a reasonable person under the circumstances.” The increased adoption of strict liability over the past three decades, where producers are held responsible for any product-related injuries regardless of negligence, shifted a greater burden toward producers. The impetus for this change was the courts’ belief that manufacturers could assume product risks and spread these risks across all consumers.

The standard criterion for deciding whether products are defective under a strict liability regime is risk-utility analysis.¹ The risk-utility test is somewhat similar to a cost-benefit test for a product, except that these concerns are expressed in a qualitative manner: the usefulness and desirability of the product, the safety aspects of the product, and so on. The risk-utility test is not well-specified, and the categories can overlap. Moreover, the risk-utility test includes a separate insurance objective. Although producers can effectively serve as insurers in the case of isolated manufacturing defects, this insurance role is often infeasible for design defect cases involving an entire product line because of the magnitude of the loss. Similarly, when there is a substantial lag time between the purchase of a product and the emergence of a risk, firms cannot necessarily incorporate the price of this insurance into the price of products currently sold, if these new products involve a different level of risk. In a competitive market, consumers will not pay for product risk insurance based on earlier risk levels. Insurance through the legal system also has high transactions costs since much of the award is devoted to legal expenses.

The application of this strict liability doctrine to claims involving long-term product effects, such as cancer, has led to a surge in litigation. This increase has been exacerbated by the application of retroactive liability on firms that could not anticipate the extent of the cancer risk or of future liability. Asbestos cancer hazards, well-known now, were not well-understood at the time of the exposure. Firms also could not anticipate the future changes in liability doctrine that they would face, so that these toxic torts represent a situation where there is little deterrent effect of the awards. The scale of this litigation has been enormous: there are 275,000 asbestos claimants, 210,000 Dalkon Shield claimants, and 125,000 Agent Orange claimants, as documented in Viscusi (1991b). Mass toxic torts overwhelmed the capacity of the courts to address these claims.

¹The most widely-cited articulation of the risk-utility test is Wade (1973). I provide an extensive critique and an alternative and economically sound reformulation of the risk-utility test in Viscusi (1990b, 1991b). Priest (1987) and Schwartz (1988) also provide critiques of this test. Also see Priest’s paper in this symposium.

Figure 1
Product Liability Cases in Federal Courts



The expansion in liability doctrine is reflected in the increased number of product liability cases in Federal courts, which are illustrated in Figure 1. Although product liability suits clearly represent a growth industry, the composition of the growth varies by case type. Asbestos litigation exploded in the 1980s; in fact, asbestos cases constituted a majority of all such cases in the federal courts by 1987. Product liability cases of other kinds exhibited more gradual growth, showing a surge in 1985 and a subsequent stabilization. Overall, the level of liability litigation has increased substantially.

Although many commentators assign a pivotal role in the liability crisis to the emergence of strict liability, the timing of the pattern in the rise of insurance premiums suggests that other forces were more influential.² As Priest's paper in this symposium explains, the rise of strict liability occurred largely during the 1960s, the period of the *Henningsen* decision, which created an implied warranty of safety for manufacturers, and Sec. 402A of the *Restatement of the Law (Second)—Torts*, which systematically articulated the new strict liability doctrine for products. However, the greatest increase in the liability insurance premiums occurred in the 1970s and 1980s. The real annual growth rate in general liability insurance premiums was 4.6 percent from 1958–1968, 12.6 percent from 1968–1978, and 5.3 percent from 1978–1988 (Viscusi, 1991b).

This timing suggests that the rise in liability can be traced to something other than the emergence of strict liability. Two likely candidates are the

²A more extensive discussion of the insurance premium patterns below and their relationship to shifting liability doctrines appears in Viscusi (1991a, 1991b).

extensions of the concept of a design defect and the increased role of hazard warnings in design defect cases. While hazard warnings should shift more of the responsibility for accidents to workers and consumers by eliminating market failures arising from inadequate information, they have instead expanded overall enterprise liability.

These and other aspects of liability law structure have a pivotal impact on the performance of product liability insurance. Table 1 provides information on product liability insurance in 1980–1984 for different groups of states based on the nature of their product liability statutes.³ A large number of states have enacted product liability statutes with provisions intended to restrict the growth in liability costs that took place in the 1960s and 1970s. The breakdowns appearing in the table are whether states had statutes that included product liability definitions (which is largely a proxy for whether there was a statute), and whether the statute included provisions for state of the art defenses, statutes of limitation, collateral source rules, or damages rules. State-of-the-art defense provisions free the company of liability for a product design that meets the standard industry practice or industry custom. Statutes of limitation establish time limits for filing a claim based on the time after the injury occurs, the useful life of the product, or the time after the product was delivered to the original consumer. Collateral source rules are intended to prevent plaintiffs from obtaining a multiple recovery of damages so that, for example, medical costs will be reimbursed by only one source. The damages provisions are broader in scope, as they pertain to concerns such as the sharing of damages in complex cases with multiple parties.

As the data in the first column of Table 1 indicate, the most common provisions, other than product liability definitions, are damages rules and statutes of limitations. These provisions almost always reduce legal uncertainties, which are of substantial concern to firms making long-term decisions. Most of these provisions also should restrain liability. Enactment of a statute of limitations, for example, frees firms of liability for an injury after a specified period of time.

With a 38 percent growth in GNP for the years 1980–1984 covered by insurance data, one would have expected a substantial increase in insurance coverage over that period since the usual measure of exposure (that is, the total risk coverage under the policy) in this context is the value of the product sales covered. Depending on the context, policies comprising from half to three-fourths of the total exposure for product liability policies experienced an increase in exposure. It is also noteworthy that in every instance in which there are specific provisions under states' product liability statutes, the increases in exposure levels over that period are greater than in states without these

³The results in this table reflect patterns similar to those appearing in the multivariate regression results reported in Viscusi (1990a). For simplicity of exposition, only the mean differences by state group will be considered here.

Table 1
**Exposure Changes and Bodily Injury Premium Levels
 for State Liability Law Groups**

	<i>Percentage of Total Premiums in 1980</i>	<i>Percentage of 1980 Premiums w / Increase In Exposure 1980–1984</i>	<i>Average Loss Ratio 1980–1985</i>
Product Liability Definitions			
States with	44.8	68.7	0.81
States without	55.2	54.5	0.97
State of the Art Defense			
States with	16.7	70.5	0.79
States without	83.3	54.3	0.93
Statute of Limitations			
States with	28.6	76.6	0.93
States without	71.4	49.4	0.90
Collateral Source Rules			
States with	8.4	64.4	0.79
States without	91.6	56.0	0.92
Damages Rules			
States with	38.1	69.3	0.86
States without	61.9	53.2	0.93

Source: Based on computer files for product liability insurance (bodily injury) of Insurance Services Office. For a fuller discussion of the empirical procedure, see Viscusi (1990a).

provisions. Sales of liability insurance were more likely to continue at their previous levels if the state had enacted the product liability provisions listed in Table 1. These patterns are consistent with the view offered by some observers that in states with very uncertain liability regimes there was a crisis in availability.

The principal measure of insurance profitability is the average loss ratio; that is, the ratio of losses to premiums. Reducing the loss ratio will raise industry profits, and the inverse loss ratio serves as a measure of profitability—the price per dollar loss. The loss ratios appearing in the final column of Table 1 reflect a pattern similar to that of exposure levels. The loss ratios are lower in states with product liability provisions in four of the five cases listed, which implies that insurance coverage is more profitable to the insurance company in these states. Loss ratios for states without liability statutes are above 0.9. By way of comparison, the social insurance effort under workers' compensation has a loss ratio of 0.8, which is more profitable to the insurer (assuming a comparable time distribution of claims).

The discrepancy in loss ratios across state groups is of substantial economic interest, since a competitive market should equalize these loss ratios. Insurance losses will be higher in states with more liberal liability regimes, and the price per dollar sales insured should be higher as well. However, the ratio of losses to

premiums should be consistent. Even if liability rules differ by state, insurance prices should adjust to fully reflect these variations. A more detailed examination of the time trends suggests that the state differences are narrowing, but very slowly. This pace may be a consequence of the fact that information needed to alter insurance rates is acquired slowly, as claims come in over time. Another possible explanation is that the rate-setters for product liability insurance do not fully recognize the role of state differences.

Doctrinal Changes for Workers' Compensation

In an effort to provide more certain compensation for job injuries and to reduce the tort litigation burden, the states established an administrative compensation system, workers' compensation, as workers' exclusive remedy against their employer. There has been little change in the basic approach of workers' compensation for most of this century. Workers' compensation continues to be an administrative compensation system based on no-fault principles.⁴

However, a job-relatedness test whereby the victim must link his injury with his job has become increasingly influential, particularly for the substantially rising category of occupational disease claims, where employers argue that the disease was caused by an off-the-job exposure. Employers are six times as likely to litigate such claims as they are accident claims, and they win in two-thirds of the cases. Even in the case of asbestos, with its strongly established disease linkage, compensation is either reduced or not awarded at all in almost two-fifths of the cases (Viscusi, 1991b).

This surge in disease-related claims has also created pressures that threaten to undermine workers' compensation's role as the exclusive remedy for job injuries. Workers seeking compensation for asbestos claims have turned increasingly to the courts; as shown earlier, over half of all federal product liability litigation now consists of asbestos claims. Workers have attempted to circumvent the stipulation of workers' compensation that the employers have no additional tort liability for the accident (other than workers' compensation) by filing suits against manufacturers of products used in the workplace. However, the difficult problems of ascertaining causality coupled with the lag of several decades since the original asbestos exposure have greatly impeded the efficacy of compensation through either product liability or workers' compensation. Moreover, the deterrence arguments supporting liability are quite weak in the asbestos cases, since the companies did not anticipate this future liability exposure and take these costs into account decades ago, and imposing costs now will not alter past risk incentives. In fact, current government regulations for the asbestos industry may actually go too far toward avoiding risk; the cost of such regulations now approaches \$100 million per statistical life saved, one of the highest figures for any federal regulation (Morrall, 1986). Tort liability

⁴A detailed discussion contracting workers' compensation and product liability is provided by Weiler (1986).

penalties will send a signal to companies marketing similarly risky products, but the substantial legal uncertainties may also lead to the withdrawal of products that should be marketed.

Setting the Level of Workers' Compensation

A second major source of increasing costs of workers' compensation stems from the attempt of states over the past decade to increase the income replacement role of benefits. As might be expected, this increased replacement of earnings has also made returning to work less attractive and extended the duration of workers' compensation spells. Recent estimates suggest that the elasticity of spell duration with respect to benefits is at least 0.3 (Meyer, Viscusi, and Durbin, 1990). From 1978 to 1988, workers' compensation premiums increased by 48.4 percent due to benefit changes, and an additional 30.1 percent due to change in worker behavior arising from the altered benefit structure.⁵ The increase from changes in the benefit structure alone exceeds the 40.1 percent rise in average hourly earnings over that period. Thus far, little progress has been made in addressing this moral hazard problem.

The deterrence effects of product liability and workers' compensation will be governed not only by when compensation is paid, but also by the amount of compensation that is awarded. Compensation systems that are based on full earnings replacement in the case of product liability or substantial but incomplete replacement in the case of workers' compensation will tend to generate inadequate safety incentives, at least in the absence of any other market forces promoting safety. This is because the estimated value of life for the average worker exceeds the present value of lifetime earnings by roughly an order of magnitude. Evidence on the value of life ranges from \$2 million to \$3 million, using Bureau of Labor Statistics death risk data, to more recent estimates using current death risk data developed by the National Institute of Occupational Safety and Health, which suggest a value of life figure on the order of \$5 million to \$6 million (Moore and Viscusi, 1990).

Recent years have seen some preliminary efforts to bring the value of life concept from regulatory contexts into the courtroom.⁶ Setting damages in this manner is appropriate from a deterrence standpoint, but it will usually provide excessive levels of insurance.⁷ If the accident will lower one's marginal utility of income, as in the case of death, insurance coverage after the accident will be less than the expected value of preventing the accident, which will also prevent

⁵These estimates are based on differences in the cumulative index for workers' compensation premium levels in 1988 and 1978 reported in the National Council on Compensation Insurance (1989).

⁶These efforts have been termed the "hedonic" value of life, where the objective is to compensate the victim for the lost pleasures of living. This terminology is used somewhat differently than in the hedonic wage literature, where the objective is to obtain a quality-adjusted estimate of the risk-dollar tradeoff.

⁷This result has been derived by a number of authors for a variety of contexts, but Spence (1977) first outlined the essential principles.

the loss in one's health status. Ultimately, the courts must address the trade off between the competing objectives of deterrence and insurance. De-coupling the insurance and deterrence functions by augmenting a benefit payment with a fine paid by the company is more feasible for job injuries than product injuries, for which the parties' out-of-court settlements would capture part of the fine that would have been levied if the case had been litigated. Moreover, society must also consider the appropriate allocation of institutional responsibility since governmental regulation, if properly designed and enforced, may be more efficient in promoting the deterrence objective.

The goal of setting compensation in such a way that it leads to appropriate deterrence must depend, in part, on whether there are demonstrable safety incentives generated by liability costs. From a theoretical standpoint, of course, any cost positively related to risk levels will foster added safety incentives. The best documented incentive effects pertain to the liability incentives created by workers' compensation. The empirical evidence on the deterrence effects of workers' compensation has been mixed, since many studies have focused on nonfatal injuries for which there are reporting problems relating to moral hazard. Workers receiving more generous benefits are more likely to claim that injuries occurring off the job were actually job-related; for example, Smith (1990) provides a detailed exploration of the problems with back injuries. The 1987 *Economic Report of the President* correctly summarized the prevailing academic view: "A growing body of research has found that workers' compensation benefits have unfavorable effects on safety. Higher benefits appear to increase both the frequency of work injuries and the number of compensation claims filed." The problem is not that improved workers' compensation worsens occupational safety: this is nonsense. Rather, when workers' compensation is limited, workers often would rather stay on the job than suffer the loss of being out of work. More generous benefit levels also may lead to moral hazard in terms of reporting and injury duration.

Studies that restrict attention to fatalities can eliminate these reporting problems. This new evidence indicates that death risks in the United States work force would be 20–27 percent higher than they are now in the absence of workers' compensation (Moore and Viscusi, 1989, 1990). By comparison, analysis of the linkage between enforcement of federal safety regulations and industry injury rates over time indicates that the regulatory effects on risk levels are 2–4 percent or less (Viscusi, 1986b).

Compensation amounts for product-related accidents will have the same objectives of insurance and deterrence as workers' compensation benefits. The conventional practice for setting damages in product liability cases is to base compensation on the amount needed to replace a victim's lost earnings as well as to compensate for non-economic damages (pain and suffering), and some other categories of damages such as lost services and loss of consortium. In the case of fatal accidents, the share of the income that would have been consumed by the deceased is subtracted from the award. Legal fees must be paid from the

award as well. Although the methodology for calculating the present value of lost earnings is straightforward, calculation of non-economic damages, chiefly for pain and suffering, is more problematic. In the absence of any well-defined legal criteria for setting pain and suffering awards, this matter has been left to the jury's discretion.

Many critics have argued that jury determinations of pain and suffering lead to an uncertain, arbitrary, and expensive system of compensation. It is certainly true that pain and suffering awards are of considerable consequence, since non-economic damages constitute roughly one-half of all compensation and, in cases in which there are non-economic damages awarded, one-half to two-thirds of all compensation is for this damages component (Viscusi, 1988b). However, the level of pain and suffering damages does vary systematically with injury type. Brain damage cases and paraplegics receive more pain and suffering compensation than victims of minor injuries, such as bruises and nonfatal poisonings. The elasticity of pain and suffering compensation with the size of the economic loss is also substantial—on the order of 0.6. Proposals to cap pain and suffering damages would install some discipline, but would have little practical effect since most pain and suffering compensation is in small rather than large awards. Moreover, caps would introduce inequities by, for example, limiting the pain and suffering compensation of brain-damage victims but not constraining pain and suffering awards for minor skin burns.

The total value of compensation for economic losses and pain and suffering leads to an average rate of replacement of financial losses for all product liability cases, including those which are dropped, of 1.05 (Viscusi, 1986b). For those cases receiving some positive compensation level, the average replacement ratio is 1.0 for cases that are settled out of court, and 1.74 for cases that reach a court verdict.

The degree of financial loss replacement varies considerably depending on the size of the loss. For out-of-court settlements, the replacement ratio averages 7.09 for losses under \$10,000 and .26 for losses in excess of \$1 million. This pattern is also borne out by court verdicts. Distinctions between product liability cases arising from consumer products or workplace hazards also do not alter the relationship. The fact that loss replacement declines as the size of the loss increases contradicts the popular view that the million dollar awards are most out of line; indeed, it is the small awards which display the greatest discrepancy between the size of the pecuniary loss and the amount of compensation.

Workers' compensation formulas have a less ambitious objective, since they are focusing only on the pecuniary loss of the accident victim. Moreover, while there is a desire to provide earnings replacement, there is also concern with providing adequate income. As a result, workers' compensation combines elements of earnings insurance and welfare assistance. Most of the workers' compensation benefit formulas provide for two-thirds earnings replacement

(subject to various caps and floors), but since the benefits are not taxable, the effective rate of replacement is somewhat higher. For a typical national sample of workers, the mean replacement rate is .55 ignoring the favorable tax status of benefits and .83 once taxes are considered (Viscusi and Moore, 1987).

The optimal rate of income replacement from an insurance standpoint is not obvious. The accident may alter a person's utility function and lower the marginal utility of money. Further, recognition of moral hazard effects arising from the effect of higher benefits on injury duration also complicates this assessment. A determination of the optimal replacement rate for social insurance efforts, such as workers' compensation, can be made in two ways. One method is to calculate whether worker's compensation provides the level of insurance workers would select under actuarially fair insurance. The second is to attempt to calculate the worker utility functions, and use that information to determine the optimal amount of insurance they would desire. Moral hazard considerations must be addressed separately.

If workers' compensation is to provide optimal insurance, the marginal wage reduction workers are willing to accept for higher expected benefit amounts should reflect the terms of trade for insurance (Viscusi and Moore, 1987). In particular, at the optimal insurance level, a worker in good health should be willing to give up $p/(1-p)$ in wages for a \$1 increase in benefits, where p is the probability of an injury. The term $p/(1-p)$ is a familiar insurance pricing term for actuarially fair insurance, whereby the price of insurance is governed by the relative odds of an accident. If, for example, the worker faces a .05 probability of injury, he should be willing to sacrifice .05/.95, or \$.06, in wages when healthy for each additional dollar of post-accident benefits. The extent of the wage offset rises with the value of p because the expected benefit amount rises as well. With actuarially unfair insurance, the formula becomes $ph/(1-p)$, where h is the insurance loading factor. These administrative costs make insurance more expensive to obtain so workers will desire less of it; they will stop purchasing insurance at a lower insurance amount for which their wage offset from workers' compensation is higher.

The exact amount of wage replacement has been approached using different samples and methods. The three studies of this issue are the Viscusi and Moore (1987) study using the 1977 Quality of Employment survey; Moore and Viscusi (1990) using the 1982 Panel Study of Income Dynamics; and Viscusi and Evans (1990) using a survey of chemical workers. The first two studies use wage equations to estimate how much wages are reduced by higher workers' compensation benefits. The final set of results is based on estimates of worker utility functions for good health and in the post-injury state, where we derived the rate of wage tradeoff from these utility function values. From 1976 to 1982, the time period of the samples on which these estimates are based, the generosity of workers' compensation benefit levels was expanding. As a reference point for comparison, these studies first found that the actuarially fair

expected reduction in wages from an additional \$1 in workers' compensation benefits ranges from \$0.04 to \$0.09, with the variations stemming from the differences in riskiness of the samples. Taking into account insurance loading, the expected wage offsets with optimal insurance range from \$0.05 to \$0.11.

However, all three studies found that the actual reductions in wages that were occurring exceeded the value needed for optimal social insurance by multiples ranging from 1.6 to 3. The data suggest that when compensation increases, wages in the no-accident state decline by more than $ph/(1-p)$, indicating that income is more highly valued in the compensation state than in the no-accident state. The wage reductions are so substantial that the wage decreases more than cover the workers' compensation premiums. In all cases, however, the rate of income replacement is below the optimal insurance amount. The three studies also suggest that the increases in workers' compensation benefits during the early 1980s have also caused workers' compensation to move toward its optimal value.

Although the empirical evidence suggests that workers' compensation is self-financing on average, the marginal rates of tradeoff for recent benefit increases are much less. It would not currently be in firms' financial interest to augment workers' compensation benefits even in the absence of moral hazard. In the era before workers' compensation, firms also would not have had an economic incentive to provide compensation on their own because firms were formerly subject to tort liability suits as well as the costs of any compensation they provided. The state workers' compensation laws eliminated tort liability as a remedy against employers.

Of course, there may be legitimate economic reasons why a level of insurance that is optimal from the standpoint of the individual facing actuarially fair insurance opportunities may not be socially optimal in practice. The main source of difficulty is moral hazard. Higher levels of insurance extend the duration of injury spells and increase the false reporting of injuries. As a result, some apparent underinsurance will consequently be optimal for social insurance.

A second procedure to assess the optimal level of social insurance is to estimate worker utility functions and use these estimates to calculate the optimal insurance amount. This procedure is undertaken in Viscusi and Evans (1990), who estimate a parameter for the marginal utility of income in the injury state using worker survey data pertaining to two points on a constant expected utility locus. They estimate that the optimal income replacement rate after an injury is .85 with actuarially fair insurance and .68 based on current insurance loading rates. Less insurance is desirable if the price of insurance also reflects administrative expenses. Since the actual average earnings replacement rate for the chemical worker study was 0.64, the discrepancy between the actual and optimal insurance amounts under workers' compensation in 1982 is not substantial. Moreover, as mentioned a moment ago, concerns about moral hazard might lead to some underprovision of insurance.

The Litigation Process

The costs of product liability arise from a litigation process that has attracted considerable attention from economists (Polinsky, 1989; Posner, 1973, 1986; Landes and Posner, 1987; Shavell, 1987). Personal injury product liability cases in the federal courts rose from 3,366 in 1977 to 14,145 in 1987. Moreover, the share of all federal civil cases that were product liability cases increased over the same time period from 2.58 percent to 5.92 percent (Viscusi, 1991a, b).

Economic models of the litigation process generally take the view that litigation outcomes result from rational decisions on the part of plaintiffs and defendants who are engaged in a bargaining process. The bargaining structure of this game is sequential: plaintiffs must choose whether to drop a case at various stages, and both parties must decide whether to settle a case out of court, the amount they will ask or offer for any out-of-court settlement, and whether to litigate the case.

Many predictions of economic models of litigation have been borne out in product liability claims. For example, the likelihood of dropping a case is reduced as the expected payoff to the plaintiff increases.⁸ In particular, the decision to drop a claim is negatively related to the size of the bodily injury loss. Characteristics of the injury that enhance the chances of the plaintiff's success (like regulatory violations) also reduce the frequency of dropped claims. The size of the out-of-court settlement rises with the dollar value of the stakes, which one would expect since the plaintiff's ask amount and the defendant's offer amount will each increase with the stakes involved. A structural estimation of the ask and offer equations by Lillard and Viscusi (1990) indicates that both the ask and the offer amounts are increasing functions of the plaintiff's probability of prevailing in court as well as the expected court award. Characteristics of the accident and legal doctrine make a difference: strict liability has the predicted positive effect on plaintiff success rates. These results provide strong evidence that parties anticipate the impact of court outcomes and incorporate these expectations in their earlier bargaining decisions.

Perhaps the key feature of the litigation process is the relative bargaining power of the two parties when negotiating an out-of-court settlement. The estimates in Lillard and Viscusi (1990) yield the striking result that the bargaining power is evenly divided. This result implies that the parties in effect split the economic rents associated with the bargaining game, where this rent equals the difference between the defendant's maximum offer amount and the plaintiff's minimum ask amount.

Table 2 provides a breakdown of the distribution of product liability claims outcomes for all products claims as well as for product liability claims arising

⁸This discussion is based on the results reported in Viscusi (1986a, 1988d, 1989). More generally, see Viscusi (1991b).

Table 2
Distribution of Litigation Characteristics

	<i>All Products Claims</i>	<i>Claims for Job Injuries</i>
Claim dropped (fraction)	.19	.24
Claim settled out of court (fraction)	.77	.68
Claim settled, conditional on not being dropped (fraction)	.95	.89
Claim goes to court verdict (fraction)	.04	.08
Plaintiff success rate in court (fraction)	.37	.31
Average bodily injury loss (\$)	13,723	51,800
Average bodily injury payment (\$)	9,995	25,645

Source: Based on calculations by the author using the Insurance Services Office (1977), *Product Liability Closed Claims Survey*. For further discussion of the sample and statistical procedures, see Viscusi (1986a, 1989, 1991b).

out of on-the-job injuries. In each case roughly one-fifth of the claims are dropped, and from two-thirds to three-quarters of the claims are settled out of court. The rate of out-of-court settlement is higher in the case of overall products claims, as 95 percent of all of these claims that are not dropped lead to a positive out-of-court settlement.

Job-related claims in Table 2 have some particular characteristics. Although few of these claims were asbestos cases in 1977, the preponderance of all job-related liability claims are now asbestos-related. Since workers' compensation is the more prominent remedy for job-related claims, these claims are weaker in character. More of these claims are dropped, fewer are settled out of court, and fewer succeed in winning when litigated. Because of the more speculative nature of job-related product liability claims, the stakes must be particularly high to offer a sufficiently high expected payoff to warrant undertaking a third-party lawsuit, which will have a lower probability of success. Indeed, job-related injuries are associated with approximately three times the loss level and three times the payment level as products injuries overall. These high stakes reflect the results of the selection of the claims that are filed, not the severity distribution of all job accidents, which is much less. Claims due to on-the-job injuries have a somewhat lower settlement rate and a higher litigation rate, both because of the possible inappropriateness of product liability as a remedy for job injuries and the higher stakes involved.

Several additional aspects of the litigation process are noteworthy. First, there is strong evidence that plaintiffs are risk-averse. Risk-neutral plaintiffs

should only be concerned with the expected court award, not its variance. Viscusi (1988d) used the variance of the award for different injury classes to measure the amount of risk, but found that the expected award has from two to nine times the influence on litigation behavior as does this plaintiff risk aversion measure. There is evidence of plaintiff risk aversion in the expected direction, but the expected payoff has a dominant influence.

A second interesting area of the litigation literature attempts to explain why the plaintiff success rate is so low; as Table 2 indicates, the rate of plaintiff success in court is only about one-third. Suppose the payoffs for the plaintiff and defendant are symmetric. Then the selection models of Priest and Klein (1984), which assess the parties' decision to settle out of court or to be part of the mix of litigated cases, hypothesize that all factors affecting court outcomes should be incorporated by the parties at the settlement stage. The result is that there should be a 50–50 split of court cases since parties should anticipate any differences in the stringency of the liability regime and modify their settlement behavior accordingly.⁹ However, Lillard and Viscusi (1990) show that the payoffs are not in fact symmetric. Companies face larger losses than simply the payoff of the plaintiff because any adverse court outcome sets a precedent for the entire product line. Plaintiff risk aversion also makes the certainty equivalent of plaintiffs' expected award less than the expected cost to the firm. As a result of these differences, the manner in which the probabilities of success are incorporated in earlier decisions differ between plaintiffs and defendants.

Finally, it is interesting to note that the pattern of court verdict success rates is also influenced by economic factors. Lawyers taking cases on a contingency fee basis will require a higher expected probability of success as the stakes shrink. For example, product liability claims in the \$1 to \$10,000 range have a probability of a successful court verdict of .37, as compared with a .21 probability for claims from \$200,001 to \$500,000 (Viscusi, 1986a; Wittman, 1985). This pattern accords with what one would expect with a rational selection process.

Institutional Interactions

Liability remedies frequently interact with each other and with other risk management institutions. For job-related claims, workers have the option of obtaining workers' compensation benefits or, in some cases, filing third-party lawsuits against manufacturers of products used in the workplace. Thus, there is not a complete institutional separation of job and product claims. In 1977, 13 percent of all products claims and 26 percent of all litigated claims were for claims arising from injuries incurred on the job. The rise in product-liability

⁹Further discussion of case selection issues appears in Lillard and Viscusi (1990), Viscusi (1986a), and Wittman (1985).

asbestos cases, many of which arise out of exposure that happened through employment, has doubtless increased the overlap.

The complexity of these interactions is considerable. Almost one-fourth of all job-related product liability claims arise when the employer or the insurer responsible for the workers' compensation payment seeks reimbursement from a producer for the workers' compensation losses (Viscusi, 1989). Such claims are called "subrogation" actions. Moreover, in one-third of the cases, the insurance firms that are the defendants in product liability cases have initiated similar actions to obtain compensation from another party. In one-fourth of all job-related product liability claims, there are cross complaints involved, as two parties may be suing each other to recover some job-related damages. One interesting result of these statistics is that the majority of job-related product liability claims are not initiated by injured workers, but instead represent efforts by insurers or employers to recoup the losses from paying workers for job injuries.

Some commentators have proposed simplifying this structure by abolishing subrogation rights and eliminating these interactions. Of course, this sort of simplicity would also sacrifice attempts to link the cost of the injury with the party generating the risk, thus sacrificing some deterrence effect.

Perhaps the most striking institutional interaction is that between liability and regulation (Stewart, 1987; Shavell, 1987; Viscusi, 1988c, 1991b). One might expect that additional regulation would lessen the need for litigation, but in fact, the establishment of many federal regulatory agencies in the early 1970s to control product and job risks occurred in the same period in which the role of liability expanded. These simultaneous events cannot be explained by increased societal riskiness, as risk levels of all kinds have been steadily declining. There may, however, have been increased societal awareness of risk and decreased willingness to face risks because of our greater societal wealth.

The interactions between regulation and tort liability are substantial. Nineteen percent of all product claims and 28 percent of all claims arising from on-the-job injuries involve alleged regulatory violations. In the case of product injuries, these are often Consumer Product Safety Commission (CPSC) standards, while standards of the Occupational Safety and Health Administration (OSHA) are more consequential for on-the-job injuries (Viscusi, 1988c). The existence of an alleged regulatory violation raises the chance of a positive payoff either through settlement or a court victory from .76 to .81 for product claims and from .60 to .72 for product injuries arising on the job. Similarly, it reduces the chance that a case will be dropped from .20 to .13 for product claims, and from .28 to .15 for product injuries arising on the job. In the case of on-the-job injuries, a regulatory violation also leads to an increased probability that the claim will win in court from .25 to .40.

Although regulatory violations increase the likelihood that the firm will be found liable for an injury, compliance with a regulation has had less influence on how courts treat the case. In contrast, I have advocated in Viscusi (1991b)

that if a firm can demonstrate compliance with a specific regulatory standard, it should be immune from design defect and hazard warning suits. Such provisions would reflect the comparative advantage that regulatory agencies have in making judgments that are necessarily society-wide in scope. Under such a regulatory compliance defense, firms that meet specific government safety standards (such as, say, OSHA design requirements for punchpress guards) would be free of future liability. The underlying rationale is that meeting these standards establishes an efficient level of safety—often requiring more safety than is required on efficiency grounds.

Lawsuits may be well-suited to assessing cases of manufacturing defects, which are often idiosyncratic. In the case of design defects, however, regulatory agencies are much better suited to addressing the societal risk-benefit tradeoffs that extend across a product line. Indeed, the very fact that court cases focus on a particular consumer's problem with a product appears to reflect a mismatch, if what is at issue is the overall design of the product for the entire market. Juries in design defect cases currently function as regulatory agencies, using risk-utility analysis in much the same manner as agencies use regulatory analysis and benefit-cost tests. The main difference is that juries lack the technical expertise and the society-wide perspective to determine the efficiency of a design change that will affect the entire market.

However, before the promotion of safety can be delegated entirely to risk regulation agencies, both the enforcement and comprehensiveness of these standards must be increased. For the foreseeable future, tort liability will continue to play a safety incentive role. But the role of regulation is increasing, and some better mechanism for recognizing the interdependence of the two institutional systems will be required.

Liability, Stock Markets, and Innovation

Liability issues will have repercussions in stock markets, for two reasons. First, if product liability suits impose costs on the firm that were unanticipated by investors, the value of the firm will decline. Second, the liability suits may serve as a signal to consumers of low product quality and, to the extent that these suits provide new product information to consumers, demand will be depressed.

The magnitude of such stock market effects varies with the nature of the legal claim. Product liability claims have a larger impact than litigation arising from product regulation violations, since fines for regulatory violations are typically less than court awards for bodily injury. Regulatory violations also tend to be limited in scope, whereas a successful product liability claim will establish a precedent for similarly injured victims to obtain compensation. Cases involving bodily injury also involve larger stock market impacts than those involving property damage, controlling for the size of the economic loss.

Bodily injury cases receive additional compensation for pain and suffering and loss of consortium that are not components of property damage awards.

The extent of the impacts is reflected in the patterns arising out of the Agent Orange litigation. Thousands of Vietnam veterans exposed to the potent herbicide Agent Orange filed claims against the producers of this chemical for the cancers and genetic damage they suffered after the war. The leading producer of Agent Orange was Dow Chemical Company. Viscusi and Hersch (1990) estimated how various events in the Agent Orange case affected the stock market value of Dow Chemical, the leading producer of Agent Orange.¹⁰ The original announcement of the Agent Orange class action suit in the *Wall Street Journal* led to a 10-day loss for Dow Chemical of \$221 million. Three subsequent adverse events in the case imposed additional losses of almost \$400 million on Dow Chemical. Eventually, a judge in the case decided that the plaintiffs had not established causality conclusively, and he fashioned a settlement that provided for only a token level of compensation. Although the plaintiffs won the case, the settlement amount was far below the previously anticipated level, leading the value of Dow Chemical Company to increase by over \$300 million. Both adverse and favorable legal effects affected stock market prices in the expected direction.

The financial ramifications of product liability will affect the products introduced and the riskiness of those products. The substantial uncertainty regarding the extent of future liability, coupled with the potentially enormous scale of the losses, have a particularly chilling effect on product innovation. The mix of products and working conditions will change, and the firm may terminate particularly risky products and activities. Small markets, such as those for vaccines, will be especially sensitive to this change in legal regimes. An avalanche of anecdotal evidence, primarily involving vaccines and pharmaceutical products pertaining to contraception or birth, has led many observers to conclude that product liability stymies innovation. A Conference Board (1988) survey found that liability costs led to the discontinuation of product lines (36 percent of all respondents), decisions against introducing new products (30 percent), and discontinuation of product research (21 percent). Such withdrawals may reflect an appropriate shift away from risk, or they could represent excessive caution given the prospect of substantial liability. The Conference Board also found that liability costs led to improved safety of particular products (35 percent) or the product line (33 percent), and improved warnings (47 percent).

Given these mixed impacts, how can one tell if the avoidance of risk has become socially excessive? Estimates by Viscusi and Moore (1991) link the product liability costs with various measures of innovation such as patents, new product introductions, and research and development, thus providing a more comprehensive assessment of the relationships. For firms with significant prod-

¹⁰A detailed discussion of the Agent Orange case appears in Schuck (1986). A similar analysis of the adverse effect of airplane crashes on airplane company returns is provided by Broder (1990).

uct patents, the average ratio of product liability insurance premiums to firm sales is 5 percent greater than for firms without such patents. Firms that introduce new products also have a higher product liability burden. These results are consistent with the widely held belief that there is a positive relationship between liability costs for design defects and product innovation. In the case of process patents, however, the reverse is true, as firms in industries without process patents have a 15 percent higher product liability cost rate. Manufacturing defect cases have a different incidence than design defect cases, as they primarily affect the firms that have done little innovation in the manufacturing process. The two aspects of innovation most directly related to expansions of the design defect doctrine—product patents and new product introductions—both indicate somewhat higher product liability costs for innovators.

These patterns also show that the shift in liability doctrines over the past three decades to include design defects has made liability a major concern for all firms, not simply the older and less innovative enterprises long believed to be the main source of manufacturing defects.¹¹

Liability Reform and the Role of Economic Research

Litigation over product liability has escalated because of shifting liability standards, and the role of workers' compensation has increased both because of the changing injury mix and the provision of more generous benefit levels. The rise in these costs does not necessarily signal that the systems are in need of retrenchment, since the earlier institutional roles may not have been adequate. However, they do signal a need for reassessment.

In the case of product liability, the major shortcoming is that the courts' treatment of design defects is overly ambitious. Regulatory agencies are better suited than the courts in making judgments about design defects, and establishing the role of insurance for all product defects is not feasible. Similarly, in the case of workers' compensation, it is not feasible to have an administrative compensation scheme for all diseases with some possibly remote link to the workplace. The cost of covering all such diseases is simply too great. Moreover, raising benefit levels to provide better earnings replacement is desirable, but additional research is needed to find ways of limiting the problem of moral hazard which appears to be substantial.

Economic analysis has an extensive role to play in analyzing liability reform. Litigation behavior accords with an economic model of the bargaining process in which both the plaintiff and defendant behave rationally given the

¹¹More detailed statistical analysis of these data indicates that overall product liability fosters product innovation except at very high levels of liability, where on balance there is a net discouraging effect. These results do not, however, necessarily imply that the new products introduced provide an efficient product mix.

economic stakes involved. Moreover, analysis of the appropriate role of the product liability and workers' compensation remedies hinges on issues that can be examined with the aid of empirical studies. Empirical evidence on workers' compensation suggests that income replacement rates are near the optimal amount, abstracting from the role of moral hazard. Further application of empirical tests to ascertain the optimal level of insurance for specific classes of injuries will further illuminate the key concerns in the tort liability reform debate.

Perhaps the main insight economists have brought to the tort liability reform debate is that incentives matter. Workers' compensation costs substantially affect workplace safety, and product liability expenses influence the safety of product designs and the rate of new product introductions. What is missing from this analysis is a determination of the optimal level of safety. Eliminating all risks is not desirable, and we currently have no precise estimates of the direction or extent of the departure from the optimal amount of safety.

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