

Toward a Diminished Role for Tort Liability: Social Insurance, Government Regulation, and Contemporary Risks to Health and Safety

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Society approaches health and safety risks in a piecemeal fashion. Regulators attempt to control the risks in their domain as if regulations were the only factor preventing injuries at home, in the workplace, and on the highways. Similarly, the courts address accidents with rules that not only discourage, but sometimes also forbid, consideration of norms and institutions outside the tort system. Academic commentators share this blind spot, focusing on only one method of managing risks and recommending, for example, an optimal tort liability structure¹ or an appropriate level of stringency for an administrative regulation.²

These methods and analyses are valuable, but they do not consider the complexities arising from the overlap of market forces, tort law, social insurance, and government regulation.³ Each of these institutions influences the management of risks in important ways. And each has effects that, when combined, create dissonance between risks and societal responses. Without coordination of these risk-reduction systems, society will rarely invest optimally to achieve the goals of creating efficient incentives and providing appropriate compensation to injured parties. Further, even if society is not over- or under-responsive to risks as a whole, it may

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1. For discussions of optimal tort liability structures, see generally W. LANDES & R. POSNER, *THE ECONOMIC STRUCTURE OF TORT LAW* (1987); A.M. POLINSKY, *AN INTRODUCTION TO LAW AND ECONOMICS* (1983); S. SHAVELL, *ECONOMIC ANALYSIS OF ACCIDENT LAW* (1987). Shavell also provides an excellent discussion of the choice between regulation and tort liability. See also R. POSNER, *ECONOMIC ANALYSIS OF LAW* §§ 6.1-6.16 (3d ed. 1986).

2. See, e.g., R. CRANDALL, *CONTROLLING INDUSTRIAL POLLUTION: THE ECONOMICS AND POLITICS OF CLEAN AIR* 32-57 (1983); W.K. VISCUSI, *RISK BY CHOICE: REGULATING HEALTH AND SAFETY IN THE WORKPLACE* 114-35 (1983) [hereinafter W. K. VISCUSI, *RISK BY CHOICE*].

3. Exceptions include Stewart, *Crisis in Tort Law? The Institutional Perspective*, 54 U. CHI. L. REV. 184 (1987); Viscusi, *Structuring an Effective Occupational Disease Policy: Victim Compensation and Risk Regulation*, 2 YALE J. ON REG. 53 (1984) [hereinafter Viscusi, *Structuring a Disease Policy*].

still react inefficiently to certain large risks. The solution to the problem lies in finding an appropriate mix of market incentives, tort liability, social insurance, and regulation.⁴

The recent increase in the number of mass product liability suits and toxic tort claims arising from exposure to carcinogens and other harmful substances makes more evident the necessity of finding the appropriate mix of risk-management institutions. The tort system does not address these accidents as well as the ones it has traditionally encountered.⁵

This Article argues that the optimal mix of risk-reduction institutions requires a diminished role for the tort system. Markets and government regulations generally can create more efficient risk-reduction incentives; social insurance generally provides more appropriate compensation to the injured. There are good reasons to retain the tort system, but its role should diminish as risks to health and safety increase in number, duration, and complexity. The new practical and analytical question about tort liability is how to make it an effective adjunct to more efficient regulatory and insurance schemes.

This Article compares four risk-management systems: the market, tort liability, social insurance, and regulation. It discusses their relative merits and deficiencies and shows why regulation and insurance deserve larger roles in addressing health and safety risks. This Article uses examples of both product-related and work-related risks because both are addressed by each of the four institutions analyzed. Part I considers the scope of risk coverage of each regime. Part II analyzes each institution's information needs and capabilities with respect to risk-reduction incentives. This Part finds that government regulation is appropriate for gathering data and disseminating clear standards, even if it may be less flexible than the other institutions discussed. Part III examines the adequacy of each institution's risk-reduction incentives and demonstrates that although regulatory mechanisms can generate these incentives, the current tort system does not do so efficiently. Part IV addresses the level of compensation available under each regime. Part V synthesizes the analyses of the four institutions and discusses the structural problems of institutional overlap in the current approach to managing risks. It advocates minimizing this overlap by revitalizing doctrines that bar tort liability and by viewing remedial possibilities more broadly. This Article concludes that the tort system should

4. I have recently addressed the problem in more limited contexts. See, e.g., Viscusi, *Product Liability and Regulation: Establishing the Appropriate Institutional Division of Labor*, 78 AM. ECON. REV. 300 (1988) [hereinafter Viscusi, *Product Liability and Regulation*]; Viscusi, *Liability for Occupational Accidents and Illnesses*, in *LIABILITY: PERSPECTIVES AND POLICY* 155 (1988).

5. See *infra* notes 18-23 and accompanying text.

occupy a secondary role in addressing the distinctive and challenging health and safety risks that confront society.

I. The Scope of Risk Coverage

It is impossible to determine what role a risk-reduction mechanism should play without first determining what types of events it can address. This Part describes the scope of risk coverage of four mechanisms—the market, tort liability, social insurance, and regulation—and lays a foundation for a discussion of the optimal relationship among them.

A. *Markets*

The current approach to risk management generally limits markets to addressing injuries resulting from voluntary transactions. Although parties do not explicitly trade health and safety risks, they do so implicitly because these risks are attributes of market-traded commodities. For example, workers accept potentially hazardous jobs only if there are compensating factors that make the job as attractive as safer alternatives.⁶ Such offsetting advantages include higher wages and compensation for income loss due to injuries.⁷

Although most of the literature on market premiums for risk focuses on wage rates and occupational risks,⁸ similar differentials accompany other hazards implicitly traded in markets. For example, consumers demand some offsetting advantage to smaller automobiles, such as greater fuel economy, to compensate for the cars' lower crashworthiness. Depending upon consumer preferences, these tradeoffs may be substantial.

Perfect markets for risk provide efficient compensation and incentives to operate safely. However, markets often do not operate in an ideal fashion.⁹ The strongest departure from a perfect market occurs when even implicit markets for risk do not exist. For example, the current depletion of the ozone layer in the atmosphere imposes risks on future generations. Although our descendants might be willing to pay us to alter our behavior, there is no means for them to do so.

The inadequacy of the insurance market aggravates the effects of the

6. These differentials are calculated with reference to the marginal worker, *i.e.*, the worker least willing to accept risky employment. Those who are more willing to accept risks receive a windfall because they are paid the wage necessary to entice the marginal worker to engage the relevant risks. Several studies demonstrate that as risks to health and safety increase, wages must increase to attract employees. For a review of these studies, see W.K. VISCUSI, *RISK BY CHOICE*, *supra* note 2, at 37–58. Typically, empirical studies focus on differences in wages, holding constant other attributes of the occupations.

7. *See id.* at 37–39.

8. *See id.* at 98–102.

9. For a more complete discussion of the sources of market failure, see *id.* at 59–75.

lack of implicit risk markets. A number of factors impede the development of efficient insurance agreements. First, adverse selection, whereby only high-risk customers purchase insurance, can prevent the emergence of any insurance coverage for important classes of risk.¹⁰ Second, adverse incentives, or moral hazard, can impede the growth of insurance markets by reducing incentives to avoid injuries.¹¹ Third, even when insurance markets do exist, the premiums charged are actuarially unfair because they necessarily include a reasonable profit for insurers.¹²

Finally, inaccuracies in risk perception also impede the development of efficient markets.¹³ People tend to overestimate low probability risks,¹⁴ such as the chance that a child might be poisoned from household chemical products,¹⁵ or that someone might have tampered with a bottle of medicine.¹⁶ When individuals overestimate a risk, the price they demand to engage the risk is too high. Conversely, if they underestimate a risk, the price they demand is too low. In both cases, the imperfect market produces inefficient incentives to reduce risk and inappropriate compensation to those engaging the risk.¹⁷

10. For a cogent explanation of the impact of adverse selection on the "insurance crisis" of the 1980s, see Priest, *The Current Insurance Crisis and Modern Tort Law*, 96 YALE L.J. 1521 (1987).

11. For a discussion of moral hazard, see Pauly, *The Economics of Moral Hazard: Comment*, 58 AM. ECON. REV. 531, 535 (1968).

12. Insurance is actuarially unfair because of loading factors, or the gap between premiums and expected payments. The social insurance programs that suffer least from this phenomenon are state workers' compensation schemes. Nevertheless, even under those systems, workers receive only 80 cents in expected benefits per dollar contributed. See generally Viscusi & Moore, *Workers' Compensation: Wage Effects, Benefit Inadequacies, and the Value of Health Losses*, 69 REV. ECON. & STATISTICS 249 (1987). Loading factors are even higher for private insurance. These aspects of insurance market coverage imply that people will tend to be underinsured, as compared to the perfect market case.

13. For a discussion of the literature on the psychological aspects of taking risks, see B. FISCHHOFF, S. LICHTENSTEIN, P. SLOVIC, S. DERBY & R. KEENEY, *ACCEPTABLE RISK* 28-30 (1986).

14. These systematic overreactions to risks are discussed by Magat, Viscusi & Huber, *Risk-Dollar Tradeoffs, Risk Perceptions, and Consumer Behavior*, in *LEARNING ABOUT RISK: CONSUMER AND WORKER RESPONSES TO HAZARD INFORMATION* 83 (W.K. Viscusi & W. Magat eds. 1987) [hereinafter *LEARNING ABOUT RISK*] (essays discussing effects of risk on consumer and worker preferences) (1987).

15. *Id.* at 93-96.

16. Sales of Extra-Strength Tylenol capsules dropped 87% after seven people died from ingesting Tylenol laced with cyanide. For a discussion of the Tylenol tragedy, see Viscusi, *Market Incentives for Safety*, HARV. BUS. REV., July-Aug. 1985, at 133. Although a well-designed label or other means of providing information might mitigate this problem, additional information does not address the fundamental matter of consumer psychology.

17. It has been suggested that because of these aspects of risk perception, markets can function effectively for safety risks but not for health risks. See, e.g., W.K. VISCUSI, *EMPLOYMENT HAZARDS: AN INVESTIGATION OF MARKET PERFORMANCE* 264-67 (1979) [hereinafter W.K. VISCUSI, *EMPLOYMENT HAZARDS*]. While this is often a valid simplification, it is not always the case, and it does not reflect the contribution of recent research with respect to risk perception. See generally *LEARNING ABOUT RISK*, *supra* note 14. Not all safety risks are evident, and many health risks may be quite well known, particularly those that have been publicized. To the extent that safety risks are visible and health risks are hidden, a health/safety dichotomy is useful. However, a more appropriate basis for making distinctions than the health/safety dichotomy is whether there are opportunities to acquire

B. Tort Liability

Whereas the market's inability to affect anything other than voluntary transactions limits its use as a risk-management institution, the tort system's relative inflexibility restricts the reach of that institution as well. The tort system requires injured parties to comply with formal legal rules before they receive any compensation. For example, under the broad theory of negligence, the plaintiff has the burden of proving by a "preponderance of the evidence" that the defendant's "negligent conduct" was the "legal cause" of the "injury" suffered by the plaintiff.¹⁸ Similarly, in an action based on a theory of strict liability, the plaintiff has the burden of proving that the "defective product" in question was the "legal cause" of plaintiff's injuries.¹⁹ In both of these formulations, every word and phrase is filled with meanings and interpretations that act as hurdles in the plaintiff's effort to receive compensation.²⁰ Therefore, the tort system provides compensation for only a subset of all injuries: those that meet these restrictive criteria.²¹ In contrast, market forces generate compensating differentials for all additional risks imposed by particular products or activities.²² Plaintiffs can often experience extreme difficulty demonstrating that a particular defendant caused an injury, especially for injuries with multiple potential causes that pose long-term health risks.²³ Furthermore, even if causal relationships are fully understood, which is seldom the case, the history of individual exposures to the diverse causes of a disease is rarely

information about the risk without substantial cost.

18. RESTATEMENT (SECOND) OF TORTS § 328A (1965) [hereinafter RESTATEMENT].

19. *Id.* § 402A.

20. In addition to negligence and strict liability, a plaintiff can demonstrate liability on a number of other theories. For an overview of liability in tort, see W.P. KEETON, D. DOBBS, W. KEETON & D. OWEN, PROSSER AND KEETON ON THE LAW OF TORTS §§ 28-81 (5th ed. 1984) [hereinafter PROSSER & KEETON]. For a discussion of product liability, see R. EPSTEIN, MODERN PRODUCTS LIABILITY LAW: A LEGAL REVOLUTION (1980).

21. Thus, for example, all surgical patients whose operations have adverse outcomes will not receive compensation through the tort system.

22. See *supra* text accompanying notes 6-8.

23. Striking examples of these problems are the asbestos and Agent Orange debacles. For a general discussion of the unique difficulties in determining causation in these types of situations, see P. SCHUCK, AGENT ORANGE ON TRIAL: MASS TOXIC DISASTERS IN THE COURTS 29-30, 185-86, 268-72 (1987); see also Kelman, *The Necessary Myth of Objective Causation Judgments in Liberal Theory*, 63 CHI.-KENT L. REV. 579 (1987); Viscusi, *supra* note 3, at 66-68; see *infra* Part II.B.

Judicial doctrines and remedies can provide relief to plaintiffs suffering ailments of uncertain origin. However, wariness about forcing the role of general insurer on manufacturers necessarily limits this trend. A good example of a creative remedy to overcome the difficulties of multiple and probabilistic causation is found in *Sindell v. Abbott Laboratories*, 26 Cal. 3d 588, 607 P.2d 924, 163 Cal. Rptr. 132 (1980). In *Sindell*, the plaintiff, a victim of birth defects allegedly caused by diethylstilbesterol (DES), was unable to identify the source of the DES ingested by her mother. The California Supreme Court apportioned liability among the codefendant manufacturers of DES according to their respective market shares and shifted the burden of proof to the defendant manufacturers. To escape liability, a manufacturer had to prove that it could not have supplied the DES that allegedly caused the injuries.

known. The tort system can handle only hazards with discrete, easily traceable causes.

C. *Social Insurance*

The scope of social insurance is potentially all-inclusive. Except for scarcity of funding, there is no inherent barrier to providing general coverage of risks. For example, compensation for disability under the Social Security program is extensive, but the level of benefits is low²⁴ due to the program's comprehensiveness and its limited resources.²⁵ Targeted social insurance programs, such as workers' compensation, share some of the tort system's impediments to coverage. To receive compensation, the claimant must show "by a preponderance of the evidence"²⁶ that an injury occurred and that the injury arose "out of and in the course of employment."²⁷ In contrast to tort liability, however, social insurance programs award benefits regardless of fault.²⁸

D. *Regulation*

The potential scope of regulation is limited only by the imaginations of regulators.²⁹ The government can influence a range of outcomes that supplements or displaces both the market, which operates largely *ex ante*, and tort liability, which operates *ex post*.

Current regulatory efforts differ in their scope of coverage. The National Highway Traffic Safety Administration (NHTSA) and the Nuclear Regulatory Commission (NRC) can regulate only particular activities,³⁰ whereas the Environmental Protection Agency (EPA) has a

24. The main effect of the program is to provide a benefits floor; the degree of income replacement is a declining function of the risk level. See Social Security Act of 1956, 42 U.S.C. § 423 (1982 & Supp. IV 1986).

25. W.K. VISCUSI, WELFARE OF THE ELDERLY 233-39 (1979).

26. See, e.g., CAL. LAB. CODE § 3202.5 (West Supp. 1988). But cf. N.Y. WORK. COMP. LAW § 21 (Consol. 1982) ("[T]he contents of medical and surgical reports introduced in evidence by claimants for compensation shall constitute prima facie evidence of fact as to the matter contained therein.").

27. See, e.g., CAL. LAB. CODE § 3208 (West Supp. 1988); N.Y. WORK. COMP. LAW § 10 (Consol. Supp. 1987); VA. CODE ANN. § 65.1-7 (1987). See also Note, *Compensating Victims of Occupational Disease*, 93 HARV. L. REV. 916, 918 (1980) (quoting Riesenfeld, *Contemporary Trends in Compensation for Industrial Accidents Here and Abroad*, 42 CALIF. L. REV. 531, 541 (1954)).

28. PROSSER & KEETON, *supra* note 20, § 84. See, e.g., CAL. LAB. CODE § 3600 (West 1971 & Supp. 1988); N.Y. WORK. COMP. LAW § 10 (Consol. Supp. 1987). But see N.J. STAT. ANN. § 34:15-1 (West Supp. 1988) (requiring "actual or lawfully imputed negligence" on part of employer).

29. In some instances, however, the Constitution may restrict one's imagination. See, e.g., *Industrial Union Dep't v. American Petroleum Inst.*, 448 U.S. 607, 671 (1980) (Rehnquist, J., concurring).

30. See, e.g., 49 U.S.C. § 105(c)(1) (1982) (granting authority to carry out National Traffic and Motor Vehicle Safety Act of 1966, 15 U.S.C. §§ 1381-1431 (1982)); 42 U.S.C. §§ 5841-5851 (1982) (outlining duties of Nuclear Regulatory Commission).

broader mandate encompassing a wide range of hazards.³¹ The form of the regulations promulgated reflects the flexibility of the administrative apparatus. For example, most government regulations focus on design aspects of technologies³² or on externalities that the regulated activity generates.³³ In some cases, however, regulations emphasize defective aspects of the initial design³⁴ or defects arising from errors in the manufacturing process.³⁵ This flexibility gives regulation the broadest potential scope of any of the risk-management institutions, combining the coverage of the market with that of tort liability.

II. Risk-Management Institutions and the Problem of Information

No risk-management institution can function without basic information concerning the event, the type of injury, and the extent of damages. This Part assesses the performance of each institution with respect to its information requirements and its ability to generate and to integrate data that are relevant to risks.

A. Information Requirements: Variations Among the Institutions

Each institution requires different information. The choice among institutions in a particular case depends in part on the costs of acquiring the appropriate data. Markets, for example, require *ex ante* information about risks. In response to this information, consumers form perceptions about risks. These, in turn, generate wage and price differentials that reflect consumers' valuations of safety.³⁶ An individual firm must consider these differentials and compare them with the cost of risk-reduction measures. Provided that it correctly perceives information about risk, the normal functioning of the market satisfies other key information requirements of firms. Under tort liability, *ex post* knowledge about the relative contribution of each party to the final outcome is more important than precise knowledge of *ex ante* risk levels.³⁷ Because an injured individual must

31. Reorg. Plan No. 3 of 1970, *reprinted in* 42 U.S.C. § 4321 (1982) *and in* 84 Stat. 2086 (1970) (creating and outlining duties of EPA).

32. *E.g.*, 29 C.F.R. §§ 1910.211-.222 (1987) (OSHA machinery and machine guard standards).

33. *E.g.*, Clean Air Amendments of 1970 § 112, 42 U.S.C. § 7412 (1982) (regulating emissions as an externality).

34. Consumer Product Safety Commission (CPSC) recalls usually focus on problems that extend across an entire product line rather than on manufacturing defects that arise sporadically. For a discussion of the emphasis of consumer product safety regulation, see generally W.K. VISCUSI, *REGULATING CONSUMER PRODUCT SAFETY* (1984).

35. For example, auto recalls by NHTSA often occur after accidents arising from a defect are reported to the Agency. Auto safety regulation is analyzed generally in G. BLOMQUIST, *THE REGULATION OF MOTOR VEHICLES AND TRAFFIC SAFETY* (1988).

36. *See supra* text accompanying notes 6-8.

37. In the case of probabilistic causation, however, these require similar knowledge about risk.

prove a theory of liability,³⁸ he also requires some information about the costs of safety measures that the risk-producing party might have taken. In addition, the amount of damages might involve substantial uncertainties regarding the amount of lost future earnings and medical expenses.³⁹ Finally, when available, scientific information regarding the risk generation process can play a central role in the context of the tort system.⁴⁰

Social insurance systems typically have far fewer information requirements than either the market or the tort system. The insuring agency generally needs to know only the nature of the injury and its effect on the victim.⁴¹ Targeted social insurance, such as workers' compensation, may require information about the claimant's earnings, the severity of the injury, and other variables. Typically, however, information needs are modest because these systems provide benefits without requiring that the recipient demonstrate fault.⁴²

Government regulations generally have the greatest information requirements because they attempt to control risks on a centralized basis. The government must assess a risk, measure it using existing economic estimates of risk-benefit values, and calculate the cost of compliance.⁴³ Narrowly specified legislative mandates can simplify these tasks, however. The great benefit of regulation is that every party covered by the regulation does not incur information costs. In contrast, the tort system imposes information costs for every case.⁴⁴

For example, in *Sindell v. Abbott Laboratories*, 26 Cal. 3d 588, 607 P.2d 924, 163 Cal. Rptr. 132 (1980), the amount of damages each defendant was ordered to contribute *ex post* could have been determined *ex ante*. For a discussion of *Sindell*, see *supra* note 23. See also *infra* Part II.B (general discussion of determining multiple and probabilistic causation).

38. See *supra* notes 18-21 and accompanying text.

39. These problems arise not from legal doctrine but from economic uncertainties. For instance, one does not know what the cost of medical care will be in two decades.

40. Such information can be used to establish causation where multiple potential factors are involved. See P. SCHUCK, *supra* note 23, at 8-9.

41. Consider, for example, the provision of the federal disability insurance benefit payment program that specifies who may qualify for benefits under the program. Social Security Act of 1956 § 223, 42 U.S.C. § 423 (Supp. IV 1986).

42. See *supra* note 28.

43. An ideal market accomplishes all these tasks automatically. See *supra* text accompanying notes 6-8.

44. The plaintiff need not prove every fact relevant to his case in all circumstances. But even "facts" that seem self-evident, or nearly so, will usually have to be established to the satisfaction of the trier of fact. See, e.g., *Hardy v. Johns-Manville Sales Corp.*, 681 F.2d 334 (5th Cir. 1982) (trial court erred in taking judicial notice of cause-effect relationship between exposure to asbestos and development of respiratory disease); *Laster v. Celotex Corp.*, 587 F. Supp. 542 (S.D. Ohio 1984) (refusing to take judicial notice of same "fact" because of complex etiology of asbestosis).

B. Problems with Multiple and Probabilistic Causation

The case of an illness with multiple possible causes illustrates the differences in information requirements among the risk-management institutions.⁴⁵ In the market, individuals must acquire information about the probabilistic linkages between their activities and the potential for injuries. This approach stands in marked contrast with targeted social insurance, in which the insuring (governmental) entity establishes causal links, and government regulation, in which agencies use long-term studies to estimate causal probabilities. Although social costs arise in each regime, placing the burden of analyzing causation on the government rather than on injured individuals meets efficiency and equity concerns.

The greatest inefficiencies occur in the tort system because the claimant must establish liability through an evidentiary showing.⁴⁶ The information required is much greater than that for simply assessing a probability distribution for an outcome, as is the case with markets.⁴⁷ Multiple classes of causes, all of which have probabilistic effects and none of which can be conclusively determined *ex post* to have been the cause of the disease, exacerbate these difficulties.⁴⁸ Courts must obtain some *ex post* information about the size of the *ex ante* risk caused by the injurer's action and the relative role of this risk within the context of all risk exposures. Courts can ease the difficulty of determining liability by holding an act to be the legal cause of an injury only if that act was a "substantial factor" in bringing about the harm.⁴⁹ In these cases, the magnitude of the risk itself is not the dispositive economic factor.

This backward-looking procedure reverses the approach of government agencies that examine prospective risks associated with exposure to hazards. Although specific aspects of the plaintiff's physical condition and

45. Multiple and probabilistic causation is characteristic of toxic tort cases. See P. SCHUCK, *supra* note 23, at 268.

46. See *supra* notes 18-21 and accompanying text.

47. Although some courts have apportioned liability based on market share when a disease can be linked to a particular product class, this approach has been applied primarily to DES cases. See *supra* note 23. On occasion, market share liability has also been applied in asbestos cases. *Hardy v. Johns-Manville Sales Corp.*, 509 F. Supp. 1353 (E.D. Tex. 1982), *rev'd on other grounds*, 681 F.2d 334 (5th Cir. 1982).

48. For example, if exposure to pesticide residues in beef were to pose a risk of stomach cancer of only one in one million, and if this were the only such risk faced by an individual, then the beef producer should bear full liability even though the risk was not great. Alternatively, if the stomach cancer risk from pesticides in beef were one in ten thousand, but an individual's risk from all exposures were ten in ten thousand, then to set the damage amounts efficiently, each of the sources should be assigned liability in proportion to its respective contribution to the injury. Otherwise, a defendant who is but one of the many producers of the risk will be penalized as though the defendant produced the sole cause of the adverse outcome.

49. See PROSSER & KEETON, *supra* note 20, § 41. See also *Hill v. Edmonds*, 26 A.D.2d 554, 270 N.Y.S.2d 1020 (1966). See generally RESTATEMENT, *supra* note 18, § 431 comment a.

activities may be important and difficult to assess in some cases,⁵⁰ the overall task of adjudication is not intrinsically harder than that faced by regulatory agencies. There is, however, a fundamental difference in scope. Except within the context of multiple plaintiffs, such as a class action for a toxic tort, courts must analyze cases individually, with experts presenting their views on the underlying scientific facts. Government agencies, on the other hand, devote considerable resources to funding long-term analyses assessing the merits of the regulation.⁵¹

Increases in scientific complexity generally reduce the tort system's effectiveness because the individual case approach is not well-suited to broad scientific inquiry. Courts do have an advantage when the relevant information is highly case-specific. However, as toxic tort cases and large-scale product liability claims become more common, the judicial system will become an increasingly inefficient forum for risk management.

C. *Incentives to Generate and Integrate Risk Information*

Because risks evolve in number and complexity, an effective risk-management institution must continually generate and integrate new risk information. For hazards with well-known risks, such as the dangers posed by motor vehicles, this issue is not particularly relevant. There may be little information, however, about the potential risks involved in newer products or activities. This section evaluates each institution's ability to generate and integrate new risk information.

1. *Markets*

Market forces do not create strong incentives to generate risk information for several reasons. First, private incentives to generate information are less than socially optimal because information is a public good that can be repeatedly transferred regardless of its producer's assent or compensation.⁵² Second, there is little incentive for the producer of a risky product to generate risk information. Indeed, the real incentive may be to conceal information because it is difficult to sell consumers dangerous products or to find workers for risky jobs if risks are well known.⁵³

50. For example, any assessment of the contribution of asbestos exposures to an individual lung cancer case will depend on the individual's smoking history. See Viscusi, *Structuring a Disease Policy*, *supra* note 3, at 54.

51. For an example of such a study, see Kolp & Viscusi, *Uncertainty in Risk Analysis: A Retrospective Assessment of the OSHA Cotton Dust Standard*, in 4 *ADVANCES IN APPLIED MICRO-ECONOMICS* 105 (1986).

52. This fundamental point was first made by Kenneth Arrow. K. ARROW, *ESSAYS IN THE THEORY OF RISK-BEARING* 171-74 (1971). The special characteristics of risk information are explored in W.K. VISCUSI, *EMPLOYMENT HAZARDS* *supra* note 17, at 113-33.

53. Although market incentives to perform risk-related research and to provide information are

The most striking aspect of markets for risk is how rapidly they integrate new information. New risk information has been identified as a major source of employee turnover,⁵⁴ and the wage rates workers demand are demonstrably sensitive to changes in employee knowledge about risks.⁵⁵ Consumers respond in a similar fashion because they quickly integrate risk information into their purchasing decisions.⁵⁶ Indeed, experimental evidence strongly suggests that consumers overreact to low-probability risks brought to their attention.⁵⁷

Overall, although markets create relatively weak incentives to engage in formal risk research, consumers' and workers' experiences become data in their risk-taking calculus. In this way, markets do provide risk-reduction incentives.

2. Tort Liability and Social Insurance

Neither the tort system nor social insurance programs undertake any fundamental risk-related research. Court proceedings can, however, induce firms and claimants to conduct risk research to document their cases.⁵⁸ Subsequent publicity surrounding the case can often be an additional source of general risk information.⁵⁹

In tort litigation, plaintiffs present information to link an injury with some product or activity. The efficacy of the judicial system in producing risk-related information decreases as the complexity of the link increases. For example, although courts can analyze injuries involving mechanical defects,⁶⁰ judges and jurors are simply not trained to make decisions about

not efficient, consumers and workers can acquire information in other ways. For example, they learn about risky products and activities through both their own experiences and those of others. Other nonpersonal sources of information also provide data about risks less expensively. Hazard warnings represent one prominent source of information. In addition, some occupations and products impose obvious risks. See generally W.K. VISCUSI, *EMPLOYMENT HAZARDS*, *supra* note 17, at 113-43; Viscusi & O'Connor, *Hazard Warnings for Workplace Risks: Effects on Risk Perceptions, Wage Rates, and Turnover*, in *LEARNING ABOUT RISK*, *supra* note 14, at 98, 119-24 (1987).

54. See W.K. VISCUSI, *RISK BY CHOICE*, *supra* note 2, at 63-69.

55. See generally Viscusi & O'Connor, *supra* note 53. Workers with substantial seniority may be locked into their positions. However, this is not a significant problem because job risks tend to be concentrated among new hires.

56. See generally Viscusi, Magat & Huber, *The Effect of Risk Information on Precautionary Behavior*, in *LEARNING ABOUT RISK*, *supra* note 14.

57. See *supra* notes 13-17 and accompanying text.

58. An area of concern, however, is the probable asymmetry of available funds. If the risk producer is better able to conduct the risk-related research, the information may not be made public because, although the risk producer will have an incentive to conduct research, it will not have an incentive to divulge negative findings. See *supra* text accompanying notes 52-53.

59. E.g. *Firms Must Share Blame in DES Suit*, N.Y. Times, Oct. 19, 1980, § 4 (Week in Review), at 8, col. 2 (discussing *Sindell v. Abbott Laboratories*, 26 Cal. 3d 588, *supra* note 23, and risks associated with DES).

60. Manufacturing-defect or design-defect cases involve issues that are much easier to resolve than those in toxic torts cases.

complex and conflicting scientific evidence.⁶¹ This inability to make accurate decisions may be no greater than that of the average consumer, but tort liability does not attach without proof of a strong causal link.⁶² In contrast, individuals make decisions using inconclusive, even fragmentary, evidence every day.

3. *Government Regulation*

Government regulation is the most effective institution for generating new risk information. Because information is a public good, one can argue that information costs should be shared broadly. In addition, public funding of risk-related research is an efficient method of generating risk information because it eliminates free riders.

The government generates different types of risk information. First, agencies such as the National Institute of Health (NIH) and the National Institute of Occupational Safety and Health (NIOSH) fund specific research.⁶³ Second, agencies such as EPA sponsor research within a more targeted regulatory agenda.⁶⁴ Third, agencies such as the Food and Drug Administration (FDA) require detailed research regarding specific product risks.⁶⁵

In addition to having a superior capacity to generate risk information, the government also disseminates risk information to assist private decisionmaking⁶⁶ and hires a technically trained staff to make decisions based on scientific evidence. The benefits of government involvement increase with the degree of specialization and complexity of data and with the greater general need for the information in the economy.⁶⁷

61. See P. SCHUCK, *supra* note 23; Kelman, *supra* note 23.

62. See *supra* notes 18-23 and accompanying text.

63. All OSHA rulemakings are based on such externally provided medical research since the research function in the job safety area was delegated to NIOSH in 1970. 29 U.S.C. §§ 669-671 (1982).

64. EPA has funded a substantial amount of research on communication to workers about hazards. See, e.g., W.K. VISCUSI & W. MAGAT, ANALYSIS OF ECONOMIC BENEFITS OF IMPROVED INFORMATION: PROJECT PERIOD TWO REPORT (Mar. 1986).

65. Federal Food, Drug, and Cosmetic Act, 21 U.S.C. § 355 (1982 & Supp. IV 1986); see also, H. GRABOWSKI & J. VERNON, THE REGULATION OF PHARMACEUTICALS 14-28 (1983).

66. See, e.g., U.S. DEP'T HEALTH AND HUMAN SERVICES, THE HEALTH CONSEQUENCES OF SMOKING: CANCER (1982).

67. Conversely, idiosyncratic information that is not technically advanced can be generated through experience in market contexts, see *supra* notes 6-8, or through *ex post* assessments in judicial proceedings, see *supra* notes 37-40 and accompanying text. These institutions may have an advantage for more narrowly defined information acquisition and transmission.

D. *Institutional Dynamics: The Response to Change*

A change in risk information necessarily affects how risk-management institutions operate. An institution may be effective in a situation of unchanging risks but may not adapt well to dynamic situations. For example, consider how each regime would respond to new information indicating that the health risk from some environmental hazard is much greater than was originally thought.

The market would respond fairly rapidly as the new information about risks affects risk perceptions. Changed perceptions would then create financial incentives for firms; the market would respond as quickly as it would if the cost of pollution control equipment were to drop. In both cases, the new information would enhance the financial incentive for more stringent pollution control. The corporate response might lag, however, because of the capital-intensive nature of pollution reduction. That is, the firm will not replace existing machinery until the cost of operating it exceeds the cost of purchasing new capital. Therefore, firms are more likely to invest in building new facilities than in modifying existing facilities.⁶⁸

In general, the tort system is inflexible. New risk information is not of great relevance except with respect to hazards that are a dominant cause of illness or injury. Moreover, the tort system is relatively stable and does not respond rapidly to changes in its environment.⁶⁹ However, it is noteworthy that the market more readily incorporates changes in a firm's pollution control costs than do the courts because the firm presumably has private information about these costs. To demonstrate negligence by proving that a firm failed to meet an appropriate standard of care, the plaintiff would need access to the data used to make production decisions within the firm. Thus, the market system reacts better than the tort system in this example; the party responsible for making the relevant investment has superior knowledge of the costs of different safety improvements.

The tort system might adapt well in limited situations, especially when the environmental hazard in question is central to adjudication of the claim. Furthermore, large-scale, high-profile litigation, such as the asbestos cases, can promote publication of information about the risks involved and provide an impetus for societal action against the hazard.⁷⁰

The adaptability of social insurance varies widely according to legisla-

68. In the long run, firms will find it easier to adapt to changing regulatory requirements as new facilities are constructed. Indeed, it is often desirable to incorporate environmental control regulation at the time of new plant construction rather than to use add-on technology that may be more expensive.

69. For a discussion of the stability of the common law, see R. POSNER, *supra* note 1, § 20.4.

70. See *supra* notes 23, 58-59.

tors' risk perceptions. In this sense, social insurance is similar to the market. To the extent that the main goal of social insurance schemes is to provide compensation, however, this problem is not relevant. In any case, the rigidity created by the necessity of formal legislative action in changing the statutory insurance scheme makes this institution relatively stable; it will not typically be as flexible as the market.

This rigidity similarly limits the effectiveness of regulation, despite its superiority to the tort system in other categories. First, changing economy-wide regulations is administratively costly.⁷¹ Second, the sheer number of firms that must comply with new standards imposes significant private and social costs. Third, special interest groups resist amendments to regulations if they do not preserve existing benefits.⁷²

In addition to the problems of administration and implementation, there are practical difficulties in changing regulations. Firms respond poorly to changes in standards that specify compliance technologies. For example, over the almost two decades since OSHA promulgated its first safety standards, it has made few substantive changes in the original regulations until 1989.⁷³ In addition, regulations that require firms to meet particular exposure or emissions levels foster innovation only up to the level of the standard and not beyond.⁷⁴

The weakness of regulation in responding to changes in risk information can be overcome by incorporating a price-oriented system that penalizes risky behavior, such as a pollution tax.⁷⁵ The combination of regulation and a price-oriented system promotes greater responsiveness and adaptability to changes in risk information.⁷⁶ The pricing mechanism

71. To make such changes, regulatory agencies must repeat the stages of the rulemaking process. See *infra* note 126 and accompanying text.

72. These may include the segment of the industry that has already complied with the regulation. Textile mills in compliance with OSHA's cotton dust standard opposed the later relaxation of the regulation. See Viscusi, *Cotton Dust Regulation: An OSHA Success Story?*, 4 J. POL'Y ANALYSIS & MGMT. 325 (1985).

73. OSHA recently promulgated a new regulation that "limits worker exposure on 164 substances for the first time and strengthens the limits on 212 substances that are already regulated." Molotsky, *New Limits Imposed on Many Substances Found in Workplace*, N.Y. Times, Jan. 14, 1989, at A1, col. 1. Although John A. Pendergass, the Assistant Secretary of Labor who heads OSHA, claims that the regulation "make[s] a 20-year leap forward in the level of worker protection", *id.* at A6, col. 5, the effect of the new exposure limits remains to be seen. For a review of recent OSHA efforts to promulgate regulations, see Viscusi, *The Structure and Enforcement of Job Safety Regulation*, LAW & CONTEMP. PROBS. Autumn 1986, at 127. For a discussion of the reasons for OSHA's inability to promulgate more regulations, see Shapiro & McGarity, *Reorienting OSHA: Regulatory Alternatives and Legislative Reform*, 6 YALE J. ON REG. 1, 4-14 (1989).

74. See *supra* note 68 and accompanying text. This problem can be addressed in part by adopting technology-forcing regulations. See, e.g., Clean Air Act, 42 U.S.C. § 7521(a)(3)(iii) (1982) (requiring "greatest degree of [automobile] emission reduction achievable").

75. Magat, *The Effects of Environmental Regulation on Innovation*, LAW & CONTEMP. PROBS. Winter-Spring 1979, at 1, 4.

76. Proportional liability in the tort system could serve a similar function.

reduces the government's information requirements because it does not require knowledge about the costs of compliance, only the benefits. One potential drawback is that firms still must generate information when making compliance decisions. While this means that the costs of information acquisition will likely remain the same, injury-producing entities must bear these costs instead of the government.⁷⁷

III. Adequacy of Risk-Reduction Incentives

This Part evaluates each of the aforementioned institutions with respect to the general goal of creating incentives to reduce risky activity.⁷⁸ Efficient deterrence of risky activity means that the marginal cost of the incremental reduction in risk equals the benefit of the reduction to society. The efficient level of risk is typically nonzero, because the risk-dollar tradeoff values are finite and additional risk reductions tend to become increasingly expensive.⁷⁹

A. *Risk-Reduction Incentives and the Market*

In perfect markets, risk-reduction incentives are adequate and efficient. As the risks associated with any product become known, the market price adjusts to reflect the price of persuading individuals to engage the risk.⁸⁰ The market is in equilibrium when the cost of decreasing risk equals the benefit of additional risk reduction.

The market for employment is a good illustration. Risk-producing employers are deterred from risky activity by the premium amounts they must pay workers to engage the risk. The risk-dollar tradeoff of the marginal worker engaging the risk determines the risk premium that must be paid to all workers engaging the risk. Risk-reduction investments allow lower risk premium payments. This creates financial incentives to reduce risk until the marginal cost of risk reduction equals the marginal benefits measured in terms of reduced risk premiums.

The risk-dollar tradeoffs reflected in market decisions vary widely because of different worker perceptions of and attitudes toward risk.⁸¹ Table 1 summarizes the results of a number of studies that estimate labor markets for risk.

77. Savings in social costs will accrue if the efficient risk-reduction strategies are highly firm-specific and hence could not have been effectively prescribed by regulators.

78. Because injuries can result from risky activity by either the producer or the injured person, risk-reduction incentives apply to both parties.

79. This occurs because of diminishing marginal returns from risk-reduction investment. As investment increases, at some point it will cease to reduce risky activity.

80. See *supra* notes 6-8 and accompanying text.

81. See *supra* notes 6-8, 13-17 and accompanying text.

Table 1⁸²
Summary of Labor Market Studies of Risk Tradeoffs

Investigator	Sample	Implicit Value of Life	Implicit Value of Injuries
1. Brown	National Longitudinal Survey, 1967-73	\$1.2-\$1.8 million	
2. Olson	Current Population Survey, 1973	\$8.6 million	---
3. Smith	Current Population Survey, 1967	\$8.8 million	---
4. Thaler and Rosen	Survey of Economic Opportunity, 1967	\$676,000	---
5. Viscusi	Survey of Working Conditions, 1970-71	\$3.4-\$4.6 million*	\$26,500-\$39,000
6. Viscusi	Panel Study of Income Dynamics, 1976	\$8-\$12 million*	\$37,000-\$41,000
7. Viscusi and O'Connor	Survey of Chemical Industry Workers, 1982	---	\$12,000-\$15,000
8. Viscusi and Moore	Quality of Employment Survey, 1976	---	\$39,000-\$48,000
9. Moore and Viscusi	Quality of Employment Survey, 1977	\$189,000 per life year	---
10. Moore and Viscusi	Panel Study of Income Dynamics, 1982	\$5-\$6 million	---

All values are in 1987 dollars. The results for the Viscusi studies marked with an asterisk are evaluated at the mean risk level for the sample for a model in which the heterogeneity in wage-risk tradeoffs was assessed.

82. Sources (referenced by Study number): (1) Brown, *Equalizing Differences in the Labor Market*, 94 Q.J. ECON. 113 (1980); (2) Olson, *An Analysis of Wage Differentials Received by Workers on*

The most recent study indicates that the average worker values life from \$5,000,000 to \$6,000,000.⁸³ In addition to measuring the implicit value of life, studies have also shown that the implicit value per year of life lost is about \$180,000 and the estimated value of nonfatal job-related accidents is about \$30,000 to \$40,000.

These estimates reflect how individuals value small incremental changes in risk, but not how they would demand to be compensated in terms of risk premiums. An individual who values life at \$5,000,000 would be willing to accept a risk premium of \$500 to engage a fatality risk of one in ten thousand, but he would generally be unwilling to accept proportionally larger risk premiums for greater risks.⁸⁴ At some point, risk premiums are inadequate to compensate the magnitude of risk the individual engages. Therefore, because individuals are reluctant to accept risk premiums for very high fatality risks, market incentives for producers are efficient only within a range of moderately risky activities.⁸⁵

Creating market incentives for product users is not a matter of concern if all risk compensation is *ex ante* and if markets ignore the influences of other risk-management institutions. Once an individual purchases an item, he alone bears all of the loss. Shifting the full cost of the injury to the product user internalizes the cost of safety. It also causes the producer to incorporate consumer valuations of risk into the market price. As long

Dangerous Jobs, 16 J. HUM. RESOURCES 167 (1981); (3) R. SMITH, THE OCCUPATIONAL SAFETY AND HEALTH ACT: ITS GOALS AND ACHIEVEMENTS (1976); (4) THALER & ROSEN, *The Value of Saving a Life: Evidence from the Labor Market*, in HOUSEHOLD PRODUCTION AND CONSUMPTION (N. Terleckyj ed. 1976); (5) W.K. VISCUSI, EMPLOYMENT HAZARDS: AN INVESTIGATION OF MARKET PERFORMANCE (1979); (6) W.K. VISCUSI, RISK BY CHOICE: REGULATING HEALTH AND SAFETY IN THE WORKPLACE (1983); (7) Viscusi & O'Connor, *Adaptive Responses to Chemical Labeling: Are Workers Bayesian Decision Makers?* 74 AM. ECON. REV. 942 (1984); (8) Viscusi & Moore, *Workers' Compensation: Wage Effects, Benefit Inadequacies, and the Value of Health Losses*, 69 REV. ECON. & STATISTICS 249 (1987); (9) Moore & Viscusi, *The Quantity-Adjusted Value of Life*, 26 ECON. INQUIRY 369 (1988); (10) Moore and Viscusi, *Doubling the Estimated Value of Life: The Implications of New Occupational Fatality Data*, 7 J. POL'Y ANALYSIS & MGMT. 476, 485 & Table 5 (1988).

83. Moore & Viscusi, *Doubling the Estimated Value of Life: Results Using New Occupational Fatality Data*, 7 J. POL'Y ANALYSIS & MGMT. 476, 486 (1988). This is the most reliable of studies in the field because it is the only one that uses a new set of death risk statistics developed by NIOSH. Moreover, these data are the result of a detailed census of all occupational fatalities rather than a partial sampling based on certain occupations. These deficiencies skewed the results of earlier studies, summarized in Table 1, suggesting that the typical worker implicitly values life from under \$1 million to as much as \$12 million.

Even with this improved data, this and all other studies of the value of life should be considered with caution. Statistical estimates such as these are necessarily imprecise and should be used merely to suggest a plausible range of risk-dollar tradeoffs, not to pinpoint a particular trade-off value.

84. Howard, *On Making Life and Death Decisions*, in SOCIETAL RISK ASSESSMENT 89 (1980).

85. *Id.*

as markets are perfect, the parties will take the efficient level of precautions to control risk.

The difficulty here, of course, is that markets are far from perfect.⁸⁶ Specifically, information and transactions costs make complete internalization of the costs of risk impossible. The resulting risk-reduction incentives exist at less than efficient levels, giving rise to a greater than optimal number of accidents.

B. *Risk-Reduction Incentives and Tort Liability*

Tort damages awards also create incentives for producers to control risks. Firms can internalize damages payments as part of their production costs.⁸⁷ Even when firms insure against liability risks, they have an incentive to reduce risky behavior because their insurance premiums often reflect the long-term risks generated by their operations.⁸⁸ The expected costs of tort liability create financial incentives that are similar to the market risk premium paid to workers.⁸⁹

The so-called liability "crisis" of the 1980s is simply a reflection of the market response to the increased costs imposed by tort liability.⁹⁰ One would expect some physicians to react to new economic incentives resulting from increased tort damages awards by changing their specialties.⁹¹ Decisions to discontinue products that are the subject of litigation are rational responses to changing economic circumstances.⁹² Such changes are not necessarily evidence of a crisis. The analysis needed to determine whether a crisis exists, or whether an efficient redistribution of risky activities is taking place, must involve an evaluation of the tort system and of how the liability insurance market functions.⁹³

Tort liability provides optimal deterrence as long as firms correctly anticipate damages awards.⁹⁴ Unfortunately, a variety of obstacles prevent

86. See *supra* notes 9-17 and accompanying text.

87. See *Escola v. Coca-Cola Bottling Co.*, 24 Cal. 2d 453, 461-62, 150 P.2d 436, 440-41 (1944) (Traynor, J., concurring).

88. Lacey, *The Competitiveness of the Property-Casualty Insurance Industry: A Look at Market Equity Values and Premium Prices*, 5 YALE J. ON REG. 501, 506-11 (1988).

89. These incentives have been documented in the case of workers' compensation. See W.K. VIS-CUSI & M. MOORE, *COMPENSATION MECHANISMS FOR JOB RISKS* (forthcoming from Princeton University Press).

90. See Clarke, Warren-Boulton, Smith & Simon, *Sources of the Crisis in Liability Insurance: An Economic Analysis*, 5 YALE J. ON REG. 367, 389-95 (1988).

91. See Blair & Makar, *The Structure of Florida's Medical Malpractice Insurance Market: If It Ain't Broke, Don't Fix It*, 5 YALE J. ON REG. 427, 428 (1988).

92. See P. HUBER, *LIABILITY: THE LEGAL REVOLUTION AND ITS CONSEQUENCES* 155-61 (1988).

93. For an overview of the current liability crisis, see the symposium *Perspectives on the Insurance Crisis*, 5 YALE J. ON REG. 367 (1988).

94. See *supra* notes 87-89 and accompanying text.

a firm from developing a complete understanding of the true costs of its risky activity. First, damages awards are not reliable indicators of all damages to actual victims. Courts base awards on the loss to the plaintiff without considering other accident victims who did not file a claim or were unable to obtain compensation.⁹⁵ Thus, firms may have inadequate information concerning the damages of victims who did not bring successful claims. Second, not all firms actually contemplate paying the damages awards assessed. Speculative ventures may have short time horizons, and new and well-established enterprises alike may reorganize under federal bankruptcy law to limit liability when faced with the prospect of particularly large claims.⁹⁶ Third, the size of a damages award does not always reflect the true damages suffered by the injured party. To provide efficient deterrence incentives in a tort system that compensates all accident victims, the damages award must give the producer the same incentives to exercise care as do private valuations.⁹⁷

Table 2 provides some information concerning the distribution of product liability payments by severity of injury.

95. See *supra* notes 18–23 and accompanying text; see *infra* text accompanying note 168 and Table 5.

96. A striking example of the difficulties posed by very large losses is that of asbestos related compensation and, in particular, the recently concluded reorganization of Johns-Manville Corporation. See generally Gwynne, *Humbled But Raring to Go*, TIME, Nov. 21, 1988, at 113. Indeed, the stakes potentially involved exceeded the resources of Manville's insurers. See Viscusi, *Structuring a Disease Policy*, *supra* note 3, at 68.

97. If a producer can reduce a product's risk by a factor of 10,000 and each of the potentially injured parties values this reduction at \$400, then the damages award should be \$4,000,000 to create efficient incentives.

Table 2⁹⁸
Distribution of Payments By Severity of Bodily Injury

Severity of Injury	Percentage of Parties w/Payment	Average Payment	Percentage of Total Payments
Death	3.6	\$232,391	18.8
Permanent Total Disability	3.0	446,656	29.9
Permanent Partial Disability	2.3	275,010	14.2
Temporary Total Disability	23.0	28,955	15.0
No Disability	68.2	14,444	22.2
Total	100.0	44,408	100.0
Unknown	---	74,026	---

All figures are in 1985 dollars.

The Table shows that the average individual receives far more for permanent disability (\$446,656) than for a fatality (\$232,391). Even more startling is the fact that the average award for a fatality is typically an order of magnitude below private valuations.⁹⁹ Thus, tort liability is often not an efficient deterrent because tort awards are less than private valuations of risk.

The tort damages assessment procedure¹⁰⁰ explains this sort of undercompensation. Consider three cases: (1) an individual with no dependents who is killed; (2) a head of a household who is killed; and (3) a single wage earner who is injured. In the first case, unless statutes provide compensation to the estate, there are no damages awarded because no party requires compensation.¹⁰¹ Courts tend to focus only on meeting the income needs of surviving dependents. When there are no such dependents, damages are zero and deterrence is suboptimal.

In the second case, involving the death of a head of a household, courts base the level of damages on the present value of the deceased's earn-

98. INSURANCE SERVICES OFFICE, *PRODUCT LIABILITY CLOSED CLAIMS SURVEY: A TECHNICAL ANALYSIS OF SURVEY RESULTS* 113 (1977).

99. Individuals receive, for a fatality, an average tort award of \$232,391, *see supra* Table 2, but implicitly value life from \$5,000,000 to \$6,000,000, *see supra* Table 1 and note 83 and accompanying text.

100. A commonly used compendium that reviews the tort damages assessment procedures is S. SPEISER, *RECOVERY FOR WRONGFUL DEATH* (2d ed. 1975).

101. *Id.* § 10:1.

ings.¹⁰² They then reduce the award by the amount of income that would have been consumed by the deceased.¹⁰³ Because many commodities are jointly consumed, there is less than a fifty percent reduction for a two-person household.¹⁰⁴ Nevertheless, the reduction in damages is often substantial, and it reflects the general approach that tort liability takes in addressing the income needs of survivors. By ignoring the implicit valuation of the deceased's life,¹⁰⁵ tort liability damages fail to provide appropriate compensation and deterrence.

In the case of a nonfatal injury, tort damages include the present value of both lost earnings and future medical expenses attributable to the accident.¹⁰⁶ There is no consumption deduction in this case.¹⁰⁷ In spite of this, the safety incentives provided by tort liability for nonfatal accidents are inadequate for two reasons. First, tort damages compensate individual victims only for their actual losses. Because some victims are exposed to risk without injury and some other victims never file suit, damages awards do not accurately reflect the harms produced by risky behavior. Second, although the system may compensate for pain and suffering, the financial component of tort damages tends to drive the award.¹⁰⁸

If tort damages were to compensate for lost years of life expectancy, then the tort system could provide efficient deterrence of risks. A system of strict liability that includes a contributory negligence defense and adjusts damages to include lost life expectancy would provide both efficient deterrence to risk producers and appropriate compensation to victims.¹⁰⁹ In general, however, tort damages underestimate the true cost of risky activity, which causes inefficient risk-reduction incentives.

C. *Risk-Reduction Incentives and Social Insurance*

Whereas tort liability provides at least some safety incentives for producers by raising their costs for unsafe products, the current social insurance structure has few or no safety incentive effects. This structure's main difficulty is that it does not link funding mechanisms to safety performance. For example, a firm's tax payments for the Social Security disability

102. *Id.* § 3:8.

103. R. POSNER, *supra* note 1, § 6.12.

104. S. SPEISER, *supra* note 100, § 3:2. The allocation of commodities that are jointly consumed by the household is necessarily somewhat arbitrary.

105. *See supra* notes 82–85 and accompanying text.

106. *See* R. POSNER, *supra* note 1, § 6.12.

107. *Id.*

108. If pain and suffering were fully compensated, damages awards would be much more substantial than they are currently. This is because pain and suffering awards are not intended to reflect lost years of life due to the accident. Thus, while a burn victim may receive some compensation for the pain and suffering endured, any shortened life expectancy will not be compensated.

109. *See* A.M. POLINSKY, *supra* note 1, at 42–49.

program are not correlated with its accident history,¹¹⁰ even though the costs of supporting the disabled and survivors of fatal accidents vary systematically. This means that firms receive no market valuation of their risky activity and have no incentive to reduce risks.

In contrast, workers' compensation programs do attempt to link funding mechanisms to each firm's performance. The Black Lung program, which is a targeted compensation program for the coal mining industry, finances benefits through an output-related tax.¹¹¹ This is a major improvement over the typical social insurance program. However, while this approach captures the effect of a firm's scale of operations on risks produced, it ignores mine safety for any given level of production. The program creates a disincentive for production in an industry that is generally unsafe, but it does not reward firms that invest in safety improvements.

Similarly, the government bases workers' compensation for small firms not on the safety performance of individual employers, but on the average performance of the industry most representative of a firm's operations.¹¹² In contrast, it merit-rates larger firms or they self-insure, both of which tend to promote efficient safety incentives.¹¹³ In all these cases, the level of workers' compensation payments is below that of tort damages for any given injury,¹¹⁴ indicating inefficient risk-reduction incentives. The implicit markets for risk in hazardous jobs also affect those incentives. Workers' compensation is a valued component of workers' pay packages, especially for those in hazardous industries.¹¹⁵ The benefits reduce the wages the firm would otherwise have to pay to workers in hazardous jobs. Indeed, because of the insurance function they serve, risk-averse workers value benefits at more than their actuarial cost as long as the program does not overprovide benefits.¹¹⁶ In addition, the employer's compensation premiums have favorable tax consequences.¹¹⁷ As a result, workers' compensation premiums do not impose annual costs on employers that do not

110. 42 U.S.C. § 401(b) (1982).

111. Black Lung Benefits Revenue Act of 1977, 26 U.S.C. § 4121 (1982 & Supp. IV 1986). Coal producers are currently required to pay \$1.10 per ton of coal extracted from underground mines and \$0.55 per ton from surface mines, provided that the tax does not exceed 4.4% of the price at which each ton is sold. A portion of the funds collected is used to reimburse the Black Lung Disability Trust Fund for advances it pays to victims of pneumoconiosis. The rates decrease to \$0.50 and \$0.25 per ton, respectively, when there are no outstanding reimbursements or interest thereon.

112. See Chelius & Smith, *Experience-Rating and Injury Prevention*, in *SAFETY IN THE WORKFORCE: INCENTIVES AND DISINCENTIVES IN WORKERS' COMPENSATION* 128 (1983).

113. See W.K. Viscusi & M. Moore, *supra* note 89.

114. See *supra* Table 2.

115. See *supra* notes 6-8 and accompanying text (discussing market mechanism providing compensation for engaging risk).

116. See Viscusi & Moore, *supra* note 12, at 249-61.

117. W.K. Viscusi & M. Moore, *Have Increases in Workers' Compensation Benefits Paid for Themselves?*, (Nov. 1986) (manuscript on file with author).

correspond to efficient deterrence levels.¹¹⁸ The net effect of the premiums on safety is therefore negligible.

Workers' compensation programs have serious moral hazard problems that undermine deterrence on the job.¹¹⁹ This problem is most evident with respect to how soon workers return to work after suffering an injury.¹²⁰ If benefits fully replace a worker's earnings, they reduce his incentive to earn the same amount. Although benefit plans can address this problem of adverse incentives through benefit caps and duration limits,¹²¹ these constraints raise the concern that individuals meriting assistance do not recover benefits. Thus, these plans are not as prevalent as one might expect.

In short, even workers' compensation, the social insurance scheme that passes benefits along to claimants with the fewest possible distortions,¹²² does not create efficient risk-reduction incentives. Four factors prevent it from doing so: first, the program does not index compensation premiums to a firm's safety record; second, premiums are tax deductible; third, workers require lower wages than they normally would because of the insurance function provided by workers' compensation; and fourth, the program creates incentives that distort worker choices.

D. *Risk-Reduction Incentives and Regulation*

Regulation has great potential to set efficient levels of safety in society. Depending upon available technologies, the government can manipulate standards governing risky activity over a wide range of risks. In extreme cases, it may ban certain products or activities altogether. The difficult problem with regulations is crafting them so as to create efficient risk-reduction incentives.

Regulations are distinctive because they arise from a variety of sources. Agencies promulgate regulations based on scientific evidence or widespread accident patterns. This process is subject to the same political forces that drive other types of government action. Individual parties

118. Currently, workers' compensation premiums are roughly a break-even proposition for most firms. Thus, the safety incentives of the premiums tend to be offset by the additional wage reductions and tax advantages associated with such compensation.

119. See *supra* note 11 and accompanying text.

120. One controversial analysis of the substantial relationship between the length of workers' absences and workers' compensation is provided by Johnson, *Work Disincentives of Benefit Payments*, in *SAFETY AND THE WORKFORCE: INCENTIVES AND DISINCENTIVES IN WORKERS' COMPENSATION* 138 (1983).

121. For example, in the 1976 time period analyzed in W.K. VISCUSI & M. MOORE, *supra* note 89, Utah limited temporary total disability benefits to 312 weeks, and there were similar limitations in 18 other states. See U.S. CHAMBER OF COMMERCE, *ANALYSIS OF WORKERS' COMPENSATION LAWS* 19 (1976).

122. See *supra* note 12 and accompanying text.

exposed to risk can sometimes initiate action as well, as in the case of OSHA inspections prompted by worker complaints or fatalities.¹²³ Similarly, when a significant number of product-related accidents suggests a defect, NHTSA or the CPSC can initiate product recalls.¹²⁴ Moreover, some statutes empower individuals and organizations to bring citizen suits to force firms to comply with regulatory standards.¹²⁵

The regulatory process involves substantial delays at the outset of a rulemaking. An agency must identify a problem area, prepare a regulatory analysis, receive approval from the Office of Management and Budget (OMB), and provide for extensive comment before issuing an authoritative regulation.¹²⁶ The regulatory process shapes fairly permanent rules that provide clear guidance in creating risk-reduction incentives. The problem with regulations is that they must be carefully designed to create efficient incentives.

The danger of poorly designed regulations was exposed in a recent study of the cost-effectiveness of forty-four proposed or enacted health and safety standards. Table 3 demonstrates the range of variation in the cost of saving a life under some of the regulations.

123. 49 C.F.R. § 554.4 (1987).

124. The CPSC bases its actions on its injury surveillance system data. See W.K. VISCUSI, REGULATING CONSUMER PRODUCT SAFETY, *supra* note 34, at 48-54.

125. See, e.g., Clean Air Act, 42 U.S.C. § 7604(a) (1982); CAL. HEALTH & SAFETY CODE § 25249.7 (West Supp. 1988).

126. Administrative Procedure Act, 5 U.S.C. § 553 (1982). The process is even more complex than indicated by the Act because agencies' regulatory agendas must be approved annually before they can proceed. See Exec. Order No. 12,498, 50 Fed. Reg. 1036 (1985), *reprinted in* 5 U.S.C. § 601 (Supp. IV 1986).

Table 3¹²⁷

The Cost of Regulations Per Life Saved

Proposed (P) or Final (F) Regulation	Year	Agency	Thousands of Dollars (1984) Per Life Saved
Steering Column (F)	1967	NHTSA	\$100
Passive Restraints (F)	1984	NHTSA	300
Children's Sleepwear			
Flammability (F)	1973	CPSC	1,300
Asbestos (F)	1972	OSHA	7,400
Acrylonitrile (F)	1978	OSHA	37,600
Asbestos (P)	1986	OSHA	89,300
Arsenic (F)	1978	OSHA	92,500
Asbestos (P)	1986	EPA	104,200
Benzene/Storage (P)	1984	EPA	202,000
Land Disposal (P)	1986	EPA	3,500,000
Formaldehyde (P)	1985	OSHA	72,000,000

The study generally shows that many regulations save lives at a cost that is greater than the private valuation of life.¹²⁸ This means that if efficient control of risks is the sole objective of a risk-management system, then regulations are far too stringent in many cases. The study also shows that when technological change is not very costly, as with steering column controls, regulation can save lives quite inexpensively. However, when products do not have inexpensive substitutes, as is the case with land disposal facilities, the cost of saving lives can be extremely expensive. Regulation is most efficient when directed at industries that can respond quickly and when information and technological changes are less costly.

Table 4 provides a summary of various studies concerned with the efficacy and effects of a variety of regulations.

127. Morrall, *A Review of the Record*, REGULATION Nov.-Dec. 1986, at 25, 30.

128. The private valuation of life ranges from \$5,000,000 to \$6,000,000. See *supra* note 83, and Table 1 and accompanying text.

Table 4¹²⁹

Summary of Effects of Regulation

Class of Regulations (Investigator)	General Conclusion
<u>Product Safety</u>	
1. CPSC -- General (Viscusi)	Few standards and no significant beneficial effects on safety.
2. CPSC -- Mattresses (Linneman)	No significant beneficial effect on safety.
3. CPSC -- Safety Caps (Viscusi)	No significant beneficial effect on safety due to offsetting behavioral response.
4. NHTSA -- Seatbelts (Peltzman)	No significant beneficial effect on safety due to offsetting behavioral response.
5. NHTSA -- Seatbelts (Crandall & Graham)	Offsetting response to seatbelts exists but does not negate their beneficial effects.
6. FDA -- Pharmaceuticals (Grabowski & Vernon)	Excessively stringent drug screening leads to lag in obtaining health-enhancing drugs.
7. Prescription Drugs (Peltzman)	No significant health benefits of prescription requirement.
8. FDA -- Food Additives (Lave)	Need to set priorities and promulgate more balanced regulations.
<u>Worker Safety</u>	
9. OSHA (Viscusi)	Weak enforcement. No significant effects until 1980s, when small effects are observed.
<u>Environmental Risks</u>	
10. EPA -- Air (Crandall)	Improvements are needed in enforcement; a market-based pollution tax should be implemented.
11. EPA -- Water (Magat & Viscusi)	Frequent enforcement and substantial effect on pollution by pulp and paper mills.
12. NRC -- Nuclear (Wood)	Need to reorganize entire agency and streamline licensing process.
<u>Hazard Warnings</u>	
13. Worker and consumer (Viscusi & Magat)	"Educational" efforts that provide no new information are unsuccessful, but warnings that convey new knowledge can be effective.

129. Sources (referenced by Study number): (1) W.K. VISCUSI, REGULATING CONSUMER PRODUCT SAFETY. (1984); Viscusi, *Consumer Behavior and the Safety Effects of Product Safety Regula-*

The studies included in Table 4 indicate that a regulatory regime must surmount three main difficulties to become an attractive policy alternative: (1) inadequate regulatory design;¹³⁰ (2) ineffective and shoddy enforcement of efficient regulations; and (3) offsetting behavior of workers and consumers that counteracts some of the salutary effects of regulation.

The first major problem with regulations is that they may not enhance safety even if they are effectively enforced. For example, of the few regulations that the CPSC has promulgated,¹³¹ almost none is strongly related to safety.¹³² In the case of prescription medicine requirements, restrictions on access to drugs have not had the expected benefits in terms of safer drug use.¹³³ In the case of workplace safety, OSHA's standards may be less effective than performance-oriented alternatives.¹³⁴

A second and more pervasive problem with regulations is that entities empowered to enforce them may not do so. Proper enforcement is a function of information, monitoring costs, and sanctions for violations. In some instances, agencies enforce standards strictly; for example, FDA must approve new pharmaceuticals before they can be sold.¹³⁵ These regulations are associated with full compliance, as are requirements that cars have seatbelts¹³⁶ and that medicine bottles have safety caps.¹³⁷ Similarly,

tion, 28 J.L. & ECON. 527 (1985) [hereinafter Viscusi, *Consumer Behavior*]; (2) Linneman, *The Effects of Consumer Safety Standards: The 1973 Mattress Flammability Standard*, 13 J.L. & ECON. 461 (1980); (3) Viscusi, *The Lulling Effect: The Impact of Child-Resistant Packaging on Aspirin and Analgesic Ingestions*, 74 AM. ECON. REV. PAPERS & PROC. 324 (1984); (4) Peltzman, *The Effects of Automobile Safety Regulations*, 83 J. POL. ECON. 677 (1975); (5) Crandall & Graham, *Automobile Safety Regulation and Offsetting Behavior: Some New Empirical Estimates*, 74 AM. ECON. REV. PAPERS & PROC. 328 (1984); (6) H. GRABOWSKI & J. VERNON, *THE REGULATION OF PHARMACEUTICALS: BALANCING THE BENEFITS AND THE RISKS* (1983); (7) Peltzman, *The Health Effects of Mandatory Prescriptions*, 30 J.L. & ECON. 207 (1987); (8) L. LAVE, *THE STRATEGY OF SOCIAL REGULATION* (1981); (9) Viscusi, *The Impact of Occupational Safety and Health Regulation, 1973-1983*, 17 RAND J. ECON. 567 (1986) [hereinafter Viscusi, *The Impact of Occupational Safety and Health Regulation*]; (10) R. CRANDALL, *CONTROLLING INDUSTRIAL POLLUTION: THE ECONOMICS AND POLITICS OF CLEAN AIR* (1983); (11) Magat & Viscusi, *The Effectiveness of EPA's Regulatory Enforcement: The Case of Industrial Effluent Standards*, — J.L. & ECON. — (1989) (forthcoming); (12) W. WOOD, *NUCLEAR SAFETY: RISKS AND REGULATION* (1984); (13) *LEARNING ABOUT RISK: CONSUMER AND WORK RESPONSES TO HAZARD INFORMATION* (W.K. Viscusi & W. Magat eds. 1987).

130. Particularly severe legal constraints on cost-benefit tradeoffs are imposed on EPA air pollution regulations. See R. CRANDALL, *supra* note 2, at 32-57.

131. See W.K. VISCUSI, *REGULATING CONSUMER PRODUCT SAFETY*, *supra* note 34, at 58.

132. Indeed, these regulations have had no significant effect on overall product safety or on safety of specific products, such as mattresses and carpets. *Id.* at 71-86.

133. See Peltzman, *supra* note 129 (1987).

134. A prominent example is OSHA's machine guard standards. See *supra* note 34. See also OSHA SAFETY REGULATION: REPORT OF THE PRESIDENTIAL TASK FORCE 15 (P. MacAvoy ed. 1977); Shapiro & McGarity, *supra* note 73, at 36-38.

135. See *supra* note 65.

136. 15 U.S.C. § 1392 (1982); 49 C.F.R. §§ 571.209-210 (1988).

EPA water pollution regulations have reasonably high rates of compliance¹³⁸ because they require firms to submit monthly reports regarding their discharges and EPA to inspect firms roughly once a year.¹³⁹ Thus, if information and monitoring costs are relatively low, compliance rates tend to be quite high.

Weak enforcement sanctions compound the problems created by monitoring difficulties, hampering regulatory performance even further. OSHA regulations only modestly reduce worker injuries because they require only rare inspections and because their sanctions for noncompliance are usually inconsequential.¹⁴⁰ Other classes of regulations that lack strong enforcement provisions include those governing the dumping of toxic wastes, where the injuring party often cannot be identified. In these and other instances in which enforcement is not effective, regulations are inefficient.

A third difficulty with regulations is that they cause offsetting behavioral responses by consumers that counteract beneficial regulatory effects. For example, in the case of seatbelt regulations,¹⁴¹ the use of belts reduces the risk-reduction incentives that drivers might otherwise face. Wearing a seatbelt may decrease the likelihood of safe driving, leading some analysts to conclude that drivers wearing seatbelts cause additional injuries to pedestrians and motorcyclists.¹⁴² Safety cap regulations also induce a potentially counterproductive behavioral response:¹⁴³ some individuals now leave bottles open because it is so difficult to grapple with the caps.¹⁴⁴ Moreover, caps have lulled some parents into a false sense of security, causing them unintentionally to increase their children's access to the

137. 15 U.S.C. § 1472 (1982); 16 C.F.R. § 1700.15 (1988).

138. For an analysis of compliance rates for these standards, see W. Magat & W.K. Viscusi, *The Effectiveness of EPA's Regulatory Enforcement: The Case of Industrial Effluent Standards* (June 1988) (working paper manuscript on file with author).

139. *Id.*

140. The average facility covered by OSHA regulations will be inspected once every 34 years at the current rate of enforcement activity. Currently the total annual penalties levied by OSHA are under \$10,000,000. Viscusi, *Reforming OSHA Regulation of Workplace Risks*, in *REGULATORY REFORM: WHAT ACTUALLY HAPPENED* 234, 254-58 (1986). For a recent assessment of the effect of OSHA enforcement and a discussion of the data presented in Table 3, see Viscusi, *The Impact of Occupational Safety and Health Regulation*, *supra* note 129.

OSHA recently levied its heaviest penalty ever against a single employer when it fined a meatpacker \$4,330,000 "for hundreds of 'egregious' and 'willful' violations at [one of its] plant[s]." Hershey, *Meatpacker Fined a Record Amount on Plant Injuries*, N.Y. Times, Oct. 29, 1988, at 1, col. 2.

141. *See supra* note 136.

142. *See* Peltzman, *supra* note 129. *But see* Crandall & Graham, *supra* note 129.

143. *See* Viscusi, *Consumer Behavior*, *supra* note 130.

144. *Id.* at 544.

products.¹⁴⁵ As a result, the number of analgesic poisonings has increased, offsetting the expected beneficial effects of safety caps.¹⁴⁶

None of these problems, except perhaps occasional offsetting behavioral responses, is intractable. Society can establish whatever health and safety standards it believes are appropriate, with the only concerns being the cost of providing the increased safety and the value of the increased safety to society. For risk regulation to realize its potential, however, regulatory design and enforcement must improve. Society can resolve these problems more easily than the problems associated with both tort liability¹⁴⁷ and social insurance.¹⁴⁸ In addition, once an agency promulgates regulations, social costs need not be incurred again. In this sense, regulation is a larger investment in a more permanent solution than the ones offered by insurance or tort liability.

IV. The Adequacy of Compensation

Successful risk management does not imply that health and safety risks will cease to exist. Illnesses and injuries will always occur in a world that values hazardous products and activities. The goal of creating risk-reduction incentives is to reduce risky activity, not to prohibit it. In light of the inevitable illnesses and injuries confronting society, it is an important social objective to provide appropriate levels of compensation. A common benchmark of appropriate compensation is the amount of insurance an individual would purchase at actuarially fair prices.¹⁴⁹ This Part considers two structural traits of risk-management institutions: the identity of the initiating party and the time it takes to receive compensation.¹⁵⁰

A. *The Initiating Party and Time Lags*

Some party must activate an institution before it can compensate individuals who engage a risk or suffer an injury. In a market system, those who undertake a risk are the initiating parties. For example, all workers

145. *Id.* at 538–44.

146. *Id.* at 544–48.

147. See *supra* text accompanying notes 87–109.

148. See *supra* text accompanying notes 110–22.

149. Individuals transfer income from their pre-accident to post-accident endowments until the marginal utility derived from insurance just equals the marginal utility of money when healthy. If all losses are purely financial, the optimal result entails “full” compensation. For a mathematical proof of this proposition, see K. ARROW, *supra* note 52, at 212–16. When nonfinancial losses fundamentally affect one’s welfare, this relationship need not hold since the underlying preferences will have been altered. See W.K. VISCUSI, *EMPLOYMENT HAZARDS*, *supra* note 17, at 264–70; Spence, *Consumer Misperceptions, Product Failure, and Product Liability*, 44 *REV. ECON. STUD.* 561, 567–69 (1977).

150. Government regulation is not a compensatory mechanism except to the extent that it acts prophylactically to reduce the number of injuries. Although this benefit can be construed as compensation, it is difficult to measure and beyond the scope of this Article.

in dangerous jobs and all consumers of hazardous products require compensation if they are to bear the additional risk of employment or consumption.¹⁵¹

In contrast, under tort liability or social insurance, only individuals injured by the risky product or activity may seek compensation.¹⁵² To the extent that compensation creates efficient risk-reduction incentives, restricting eligibility for compensation makes economic sense. Risk producers perceive no economic difference between liability for one award of \$1,000,000 and a thousand awards of \$1000, although the large single damages award generates more interest among affected persons and spurs the filing of claims. Under social insurance schemes funded on the basis of a firm's history, the same analysis applies.

Institutional timing is another important structural trait in this analysis of compensation. Market compensation generally operates *ex ante*.¹⁵³ When risks are traded in the market, parties receive full compensation prior to the injury. In contrast, injured persons receive compensation from a successful tort liability claim *ex post*, and the claim process may take years to complete.¹⁵⁴ Social insurance also operates *ex post*, but generally the lag time is shorter unless the agency disputes the claim.¹⁵⁵

B. *Private Insurance as a Benchmark for Compensation*

One option an individual may have to ensure compensation for injuries is to purchase comprehensive private insurance. Life insurance and medical insurance policies that cover all risks are more efficient than policies covering individual risks. For example, the decision to purchase flight insurance is irrational because flight insurance is considerably more ex-

151. The magnitude of the wage or price differential is, however, more narrowly determined. In setting the premium the focus is on the marginal worker or consumer; that is, the person least willing to purchase the product or perform the work in question. The compensating differential will leave this marginal person indifferent to facing the risk, and all infra-marginal workers will be paid more than they require to engage the same risk. The result is full or excessive *ex ante* compensation. See *supra* notes 6-8.

152. See *supra* notes 18-21 and accompanying text. This feature causes practical difficulties because the injured party may be dead with no survivors. Of course, in some cases the survivors of the deceased may be able to file a claim.

153. See *supra* notes 6-8 and accompanying text.

154. The average product liability claim, for example, has a lifetime of 1.6 years or 4 years to reach a verdict. This estimate comes from a sample of over 10,000 closed product liability claims. Viscusi, *The Determinants of the Disposition of Product Liability Claims and Compensation for Bodily Injury*, 15 J. LEGAL STUD. 321, 326-27 (1986).

155. Where prompt compensation is highly valued, the timing of the market may seem preferable. A more comprehensive examination of timing effects, however, reduces one's enthusiasm for *ex ante* treatment of risks. In particular, lag time is irrelevant with respect to the creation of risk-reduction incentives, provided that the damages award and associated interest amounts are set appropriately and the firm remains in business. (The solvency issue is particularly relevant in mass tort actions.) What matters to a firm is the level of discounted expected costs of accidents, not the timing of those costs.

pensive than conventional life insurance.¹⁵⁶ Single policy coverage for individual risks imposes greater administrative costs and limits the insurer's ability to pool different kinds of risks. As a consequence, coverage is more expensive.¹⁵⁷

Private insurance is inefficient for three reasons. First, insurance companies typically sell policies at rates that are not actuarially fair.¹⁵⁸ When insurance is more expensive than the expected costs of accidents, risk neutral individuals do not insure fully.¹⁵⁹ Second, adverse selection of risk causes only poor risks to insure in some cases.¹⁶⁰ Third, moral hazard adversely affects the risk-taking actions of the insured, increasing the number of injuries.¹⁶¹ Although the result is a variety of private insurance offerings, the coverage of the available policies falls short of those that would prevail in an ideal market.

C. *Compensation Under The Various Institutions*

Sources of compensation other than privately purchased insurance include the market, social insurance, and tort damages.¹⁶² Markets provide compensation to all individuals who engage risk;¹⁶³ they compensate for the *ex ante* probability that an injury will occur. In markets, an individual who is actually injured does not receive additional compensation in comparison to the worker who engages the risk but is not injured.

In contrast, tort damages awards serve an insurance function. For a product that continues to involve some risk and the chance of a damages award, the product's price incorporates the expected award or the firm's liability insurance premium. In effect, consumers purchase product-specific insurance¹⁶⁴ within the constraints of the tort system.¹⁶⁵ Such purchases of insurance provide less efficient risk coverage than do broader insurance policies covering multiple risks.

Although tort liability often provides substantial compensation, the common belief that product liability awards lead to windfall gains is erro-

156. For a complete analysis, see Eisner & Strotz, *Flight Insurance and the Theory of Choice*, 69 J. POL. ECON. 355 (1961).

157. *Id.*

158. See *supra* note 12 and accompanying text.

159. Although expected payments are below premium levels because of the administrative costs and insurance company profits, the resulting insurance loading is offset to some degree by the preferable tax treatment of life insurance provided as an employee fringe benefit. See 26 U.S.C. § 79 (1982 & Supp. IV 1986).

160. See *supra* note 10 and accompanying text.

161. See *supra* note 11 and accompanying text.

162. See *supra* note 150.

163. See *supra* notes 6-8 and accompanying text.

164. See *supra* note 156 and accompanying text.

165. See *supra* notes 18-23 and accompanying text.

neous. A person who suffers pecuniary loss should be made whole.¹⁶⁶ For example, an injured wage earner should be compensated for lost earnings and medical expenses. The actual value of court awards and settlements is, however, often less than the actual losses suffered by the victim.

Table 5 summarizes a number of studies relating to loss replacement rates for product liability claims.

Table 5¹⁶⁷
Loss Replacement Rates
All Product Liability Claims

Panel A

Bodily Injury Loss of Range (\$1000s)	Mean Bodily Injury Loss	Mean Bodily Injury Pymnt	Mean Replacement Ratio	Fraction of Claims in Group
0-10	614	4,467	7.27	.91
10-25	15,413	49,477	3.21	.04
25-50	35,071	70,493	2.01	.02
50-100	74,019	185,048	2.501	.01
100-200	137,242	91,952	.67	.01
200-500	278,838	189,610	.68	.01
500-1,000	665,223	286,046	.43	.00
Over 1,000	2,131,438	532,859	.25	.00
Overall	12,707	13,281	1.05	1.00

166. See RESTATEMENT, *supra* note 18, § 903.

167. Viscusi, *The Determinants of the Disposition of Product Liability Claims and Compensation for Bodily Injury*, 15 J. LEGAL STUD. 321, 339 & Table 5 (1986).

Claims Where Plaintiff Receives Court Award

Panel B

Bodily Injury Loss Range (\$1000s)	Mean Bodily Injury Loss	Mean Bodily Injury Pymnt	Mean Replacement Ratio	Fraction of Claims in Group
0-10	1,432	27,767	19.39	.67
10-25	17,213	78,493	4.56	.16
25-50	39,678	108,320	2.73	.06
50-100	63,447	107,226	1.69	.04
100-200	124,872	194,801	1.56	.03
200-500	259,189	575,400	2.22	.03
500-1,000	602,273	265,000	.44	.01
Over 1,000	2,250,000	112,500	.05	.01
Overall	38,877	67,799	1.74	1.00

The data indicate that insurers tend to overcompensate small losses because insurers are willing to provide appropriate compensation for pain and suffering and to settle claims, thereby avoiding administration and litigation costs. However, insurers tend to undercompensate large losses.¹⁶⁸ Court awards in panel B of Table 5 follow the same general pattern as do claims overall, shown in panel A. It is clear from these data that tort liability does not always provide appropriate compensation.

In addition, the damages awarded generally exceed the amount most victims actually receive. Contingent fee arrangements typically reduce a damages award by roughly one-third. In complex cases, such as asbestos-related claims, recovery of damages may be either delayed for many years or never paid to claimants at all.¹⁶⁹ Furthermore, some legitimate claims might not succeed, and particularly risk-averse claimants often settle for less than their expected court award.¹⁷⁰ Claims in categories for which the award is highly variable are especially likely to settle for less than the expected damages award.¹⁷¹

168. It should be emphasized that these results reflect stated losses, not actual losses.

169. Viscusi, *Structuring a Disease Policy*, *supra* note 3, at 64.

170. See Viscusi, *Product Liability Litigation with Risk Aversion*, 17 J. LEGAL STUD. 101, 118 (1988).

171. For a discussion of these formulas, see *id.* at 107-08. They show that despite the loss of the contingency fee, the effective after-tax replacement rate is greater than 0.67, see W.K. VISCUSI & M. MOORE, *supra* note 89, because damages awards are accorded favorable tax status. 26 U.S.C. § 104(a)(2) (1982).

Social insurance is similar to tort liability in that it performs an insurance function. However, the general purpose of social insurance programs is to provide broad-based coverage for survivors of deceased persons, the disabled, and victims of occupational accidents.¹⁷² Because the programs typically attempt to compensate those who most need compensation, payments often tend to be lower than private insurance payments because the programs cover a broad range of individuals and injuries.¹⁷³

Workers' compensation is more generous, with two-thirds earnings replacement for most injuries.¹⁷⁴ In addition, this form of compensation enjoys a favorable tax status.¹⁷⁵ On average, the result may be that there is close to full after-tax earnings replacement from workers' compensation for most injuries.¹⁷⁶ Increases in benefits over the past decade have led to levels of compensation that are close to the efficient level for the average worker in a hazardous job.¹⁷⁷ In short, workers' compensation comes close to levelling pre- and post-accident marginal utility of income. Thus, social insurance programs that mimic the more generous workers' compensation model can alleviate the problems of partial compensation from which private insurance and tort damages awards tend to suffer. Social insurance in combination with efficiently enforced risk regulations is the surest way to provide both appropriate compensation and efficient deterrence.

V. Overcoming the Problems of Institutional Overlap

There is no formal method for assigning institutional roles and reallocating institutional responsibilities. As a result, current risk-reduction incentives and levels of compensation indicate an improper institutional mix. This Part describes the shortcomings that result from the imperfect interplay among the market, the tort system, social insurance, and regulation.

172. The special treatment of job injuries rather than product injuries stems primarily from the need to decrease the costs of litigating those accidents. For a more complete discussion of the history of, and the multiple rationales for, workers' compensation, see PROSSER & KEETON, *supra* note 20, § 80.

173. See *supra* notes 24-25 and accompanying text.

174. See U.S. CHAMBER OF COMMERCE, *supra* note 121, at 19.

175. See 26 U.S.C. § 104(a)(1) (1982).

176. In a reasonably representative national sample of workers, the effective replacement rate, taking into account the favorable tax status of benefits, was 83.5%. See W.K. VISCUSI & M. MOORE, *supra* note 89.

177. See Viscusi & Moore, *supra* note 12.

A. *Risk-Reduction Incentives and Institutional Overlap*

If markets functioned perfectly, the incentives they generated would lead to efficient levels of risk.¹⁷⁸ Augmenting market processes with social insurance arrangements would not substantially alter the efficient outcome, because risk-related taxes do not finance general social insurance mechanisms.¹⁷⁹ If markets and social insurance do generate an efficient outcome, then efficient government regulation simply confirms it. Moreover, if the other institutions are inefficient, then appropriately designed regulations can fully remedy any shortcomings that exist.¹⁸⁰

1. *The Problem of Inefficient Risk-Reduction Incentives*

The first real difficulties arise when tort liability is superimposed on the system. If no markets for risk exist, and if regulations or merit-rated social insurance do not address risks, then tort liability can serve a constructive role. However, the tort system by itself ultimately creates inefficient incentives because of the manner in which it determines damages.¹⁸¹ Perhaps the best situation is one in which the institutions lead to partial, but less than efficient, control of risk, so that the additional incentives generated by tort liability augment the other incentives by just the appropriate amount.

A second, recurring problem in this scheme is a skewing of the market caused by overly stringent regulation.¹⁸² Currently, OSHA strictly regulates asbestos exposures with an average cost per life saved of \$89,300,000.¹⁸³ EPA has proposed even more stringent regulations for environmental exposures to asbestos. These standards create an expected cost per life saved of \$104,200,000.¹⁸⁴ The inefficiencies of such regulations are obvious in light of the response to widespread publicity concerning asbestos. The substantial costs of product liability insurance coverage

178. See *supra* notes 6–8 and accompanying text.

179. Although workers' compensation benefits are merit-rated, particularly for large firms, the estimated wage cuts that workers incur in return for these benefits roughly offset the premium amount; the overall safety incentives remain efficient if workers' compensation is provided in an otherwise efficient market. A problem arises only for small firms that are not taxed based on their safety performance. In this case, the wage offset from providing workers' compensation without effective experience rating in effect leads to a subsidy of unsafe conditions. See *supra* notes 110–22 and accompanying text.

180. Regulations also effectuate standards that society chooses to set more stringently than efficiency alone would suggest.

181. See *supra* notes 100–09 and accompanying text.

182. See *supra* notes 131–35, Table 2 and accompanying text.

183. This number was generated from an OSHA analysis prepared for OMB. Morrall, *supra* note 127, at 30; see *supra* Table 3.

184. *Id.*

for firms using asbestos¹⁸⁵ bolster the already strong market incentives that caused the manufacture of asbestos-related products to plummet.¹⁸⁶ In the case of asbestos, high regulatory thresholds have created greater-than-optimal expected liabilities and inefficient risk-reduction incentives.

2. *Overcoming the Problem of Inefficient Risk-Reduction Incentives*

The problems of institutional overlap and inefficient risk-reduction incentives are not insurmountable. One possible solution is to attack them by expanding the common law defense of "assumption of risk"¹⁸⁷ on the grounds that the injured party receives compensation *ex ante* through a wage or price differential.¹⁸⁸ This defense is currently applied only in situations of express¹⁸⁹ or implied¹⁹⁰ consent by the injured party. From a market perspective, however, all risk negotiations based on accurate perceptions involve implied consent. This implied consent applies to risks that arise in any activity or from any product. In contrast, tort liability focuses on implied consent regarding a specific hazard, such as knowingly driving a car with defective brakes.

To reduce the potential overlap with market-induced risk-reduction incentives, courts could broaden the assumption of risk defense to include the entire spectrum of assumed risks. To do so would require a detailed assessment of both the risk information available to the parties and its implications for risk perceptions and market operation. Courts would need to focus their attention on the adequacy of market remedies, at least when a market exists for the risk in question.

Allowing firms to plead compliance with government regulations as a defense could also reduce the overlap of tort liability with government regulations.¹⁹¹ Currently, the role of regulatory compliance in judicial proceedings is largely one-sided: noncompliance with regulations suggests

185. See Viscusi, *Structuring a Disease Policy*, *supra* note 3, at 59-60. These firms must now generally self-insure because the insurance industry underwrites very little coverage. Insurance Services Office, General Liability Records, 1980-84 (computer files on product liability policies written in the United States) (on file with author).

186. One useful index of industry output is the employment level, which has plummeted in the asbestos industry. In 1976 employment stood at 20,700, see BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, OCCUPATIONAL INJURIES AND ILLNESSES IN THE UNITED STATES BY INDUSTRY 26 (1976), but by 1983 it had dropped to 11,900, see BUREAU OF LABOR STATISTICS, U.S. DEP'T OF LABOR, OCCUPATIONAL INJURIES AND ILLNESSES IN THE UNITED STATES BY INDUSTRY 4 (1983).

187. RESTATEMENT, *supra* note 18, § 496A.

188. But see *supra* text accompanying note 9.

189. RESTATEMENT, *supra* note 18, § 496B. See also PROSSER & KEETON, *supra* note 20, § 68.

190. RESTATEMENT, *supra* note 18, § 496C.

191. For a discussion of compliance with government regulations as a defense, see Viscusi, *Product Liability and Regulation*, *supra* note 4, at 300-01.

that a product either is defective or was negligently produced, but compliance with the standard does not free the defendant of liability.

Table 6 shows the relationship between the incidence of a regulatory violation in a particular case and a verdict in the plaintiff's favor.

Table 6¹⁹²

Panel A

Regulatory Violations and Product Related Claims

Fraction of	No Violation	Any Violation	CPSC Violation	OSHA Violation	Other Violation
Claims	.81	.19	.06	.02	.11
Successful claims	.76	.81	.80	.83	.82
Claims dropped	.20	.13	.13	.13	.13
Claims settled out of court	.77	.83	.81	.85	.84
Court cases won by claimant	.41	.33	.29	.19	.36
Bodily injury loss	\$6,253	\$14,772	\$6,582	\$7,948	\$20,051
Bodily injury payment	\$5,640	\$16,091	\$11,311	\$12,570	\$19,100

192. Insurance Services, Product Liability Offices Closed Claims Survey (1977) (data generated by author from computer tapes containing data from survey) (on file with author).

Panel B

Regulatory Violations and Product Liability Claims for On-The-Job Injuries

Fraction of	No Violation	Any Violation	CPSC Violation	OSHA Violation	Other Violation
Claims	.72	.28	.04	.08	.16
Successful claims	.60	.72	.66	.71	.74
Claims dropped	.28	.15	.23	.15	.13
Claims settled out of court	.65	.75	.74	.77	.75
Court cases won by claimant	.25	.40	0.00	.40	.43
Bodily injury loss	\$50,084	\$56,855	\$77,386	\$26,461	\$67,994
Bodily injury payment	\$21,002	\$38,062	\$20,559	\$32,262	\$45,190

Table 6 panel A provides data for product liability claims; panel B contains data concerning on-the-job accidents involving products. Twenty-eight percent of the job-related claims involved work situations that did not meet applicable standards; the comparable figure for product liability claims is nineteen percent. Differences in the other violation groupings also appear significant; this group includes violations of other federal, state, or municipal standards. The presence of a regulatory violation improves a plaintiff's prospects for recovery for both types of injuries. Regulatory violations also lower the fraction of claims dropped, increase the likelihood of an out-of-court settlement, and lead to greater overall payments of claims. The only surprising result is that product injuries with regulatory violations are less likely to lead to claimant success in court. This may reflect self-selection of claims, with the best claims settling before going to court.

Risks are often the target of specific regulations. OSHA's ladder standard, for example, establishes very detailed requirements for a safe ladder.¹⁹³ At least when regulations are highly pertinent to the hazard in question, compliance alone should suffice to remove liability.¹⁹⁴

Although regulatory compliance can make a significant contribution, it is not the fundamental issue. It serves as an imperfect proxy for whether risk levels are efficient. Before adopting regulatory compliance as a defense, society should be certain that regulations are set at efficient levels. Fortunately, regulation as an institution is flexible enough to allow the necessary adjustments.

B. *Compensation and Institutional Overlap*

Although risk-reduction incentives can be efficient in the absence of tort liability, tort damages can play a valuable role in compensating those injured parties. Because of the limited funding available for social insurance programs, reformers may find it desirable to augment market and insurance compensation by transferring funds from the injurer to the victim. This promotes greater equity and compensation in those cases where the injurer can be identified.

The potential for the institutions to overlap and provide multiple recoveries presents a serious efficiency problem. If private insurance, social insurance, and tort damages all were to compensate the injured party, the victim would collect three times for the same injury, resulting in inappropriate compensation and inefficient risk-reduction incentives.

Policymakers should take measures to ensure that the injured party cannot reap windfall gains. Offset provisions and subrogation rules can limit the importance of such overlaps by preventing "double-dipping." Similarly, a subrogation action by a workers' compensation carrier against

193. 29 C.F.R. §§ 1910.25-.27 (1987).

194. One must exercise care in drawing such conclusions in the case of regulations that are not updated regularly. Once a product is on the market, review is much less extensive. Because testing protocols change over time and even well-designed tests may not detect all potential risks that are present, the product's ability to pass an initial screening might not be a reliable index of the appropriateness of a defense of compliance after additional hazards are discovered.

Regulatory compliance can sometimes be inappropriate as a complete defense because government regulations might not cover the hazard in question. This lack of coverage is particularly great for product risks because the CPSC has very few regulatory standards. The Agency relies primarily on recalls of defective products, and there must be a prominent national pattern for such a recall to be warranted. See *supra* note 124 and accompanying text.

a negligent producer enables the carrier to receive compensation for benefits paid to the injured party. This outcome is more attractive than a system in which the injured party obtains compensation from both the workers' compensation system and the third-party producer under tort liability. By contrast, if the employer can file a successful subrogation action against the producer of the equipment that caused the injury, the award increases the purchase price of the defective equipment. This price increase ensures that the resulting lower wage eliminates the possibility of overcompensating the injured employee.¹⁹⁵

The claimant should have no preference as to which mechanism compensates him. Reducing the compensation received from private and social insurance is the only way both to eliminate the potential for windfall gains and to preserve the incentive function of tort liability. Although it may seem unfair to reduce the amount paid by private insurance, in the long run premiums will decrease to reflect the reduction in expected compensation costs.

Although appropriate offset arrangements can handle multiple *ex post* compensation, more difficult problems plague *ex ante* compensation. Privately traded risks in perfect markets lead to complete *ex ante* compensation; thus, any rationale for a damages award must stem from society's concern over the difference between *ex post* actual damages and *ex ante* probabilities. More generally, there should be some adjustment of compensation levels to reflect the fact that individuals who receive both *ex ante* and *ex post* compensation receive preferable treatment compared with those who receive only *ex post* compensation.¹⁹⁶

Conclusion

Table 7 summarizes this Article's analyses and general assessments of institutional performance. Column 1 provides a summary of the main themes. Not all of these categories represent mutually exclusive concerns, so one should be cautious of the method used to combine the ratings. Moreover, the importance of each category varies in different contexts.

195. See generally Viscusi, *The Interaction Between Product Liability and Workers' Compensation as Ex Post Remedies for Workplace Injuries*, 6 J.L. ECON. & ORG. — (1989) (forthcoming).

196. In the long run, anticipation of *ex post* compensation will raise the product price, but the initial beneficiaries of both court awards and *ex ante* compensation will reap a windfall gain.

Column 1 does provide, however, a convenient summary of the main themes of this Article and a reasonably detailed checklist of factors that are important in assessing institutional performance. A review of Table 7 shows that tort liability should play a decreasing role in achieving the goals of creating risk-reduction incentives and compensating the injured.

As in the past, the tort system can promote risk-reduction incentives and provide adequate compensation for accident victims in simple cases involving only financial losses. Although other institutions may still have competitive advantages, tort liability could be the foundation of an effective effort to manage some risky activity in these kinds of cases.

The efficacy of the tort system diminishes considerably in the context of mass product liability suits. Many of the deficiencies of tort liability stem from its individualized nature. Small-scale tort actions lack the economies of scale necessary to provide the risk-reduction incentives and compensation that mass product liability claims require. Although class actions remove some inefficiencies, the tort system tends to function poorly in these situations.

The recent explosion of toxic tort cases has created even more fundamental difficulties because of the courts' inability to determine linkages between producers' actions and victims' health status. In addition to the intrinsic uncertainties involved, the courts lack the scientific expertise to develop the necessary doctrines and causation rules relevant to multiple and probabilistic causation. In these cases, government regulation is the best institution to create efficient risk-reduction incentives and social insurance is the best institution to provide appropriate compensation.

The superiority of regulation and social insurance in these types of cases does not mean that tort liability cannot play a constructive role in managing risks. Rather, it implies that the role of the tort system should be subsidiary to the other institutions. Tort liability can create significant risk-reduction incentives and compensate some of those who are injured.

Table 7
Institutions to Control Risk and Their Performance

Risk- Management Institution	Market Forces	Tort Liability	Social Insurance	Government Regulation
Scope of Risk Coverage	All perceived risks traded in markets	Injuries and illnesses for which it is possible to establish harm, link to injurer, and show liability	General social insurance and coverage of specific classes of risk	Risks covered by broad-based regulations or recall power
Information Requirements	Risk perceptions, market value, and risk- reduction	Causality, damages, and level of care	Base wage and nature of injury	Risks and costs of risk- reduction
Incentives to generate risk information and integrate it into institutional response	Weak or modest incentives to generate, stronger to integrate	Weak to generate, stronger to integrate	Weak	Relatively strong incentives
Response to change	High	High, if case specific	High, but not as relevant	Moderate, but greater for technology- induced change
Adequacy of risk-reduction incentives	Adequate, if perceived	Inadequate	Inadequate	Great potential if not too stringent or poorly enforced
Institutional operation	All exposed to risks traded in market	Victims of risks or their survivors	Victims of risk or their survivors	Regulatory agency
Timing, vis-a- vis accident	<i>Ex ante</i> , also <i>Ex post</i>	<i>Ex post</i>	<i>Ex post</i>	<i>Ex ante</i> and <i>Ex post</i>
Adequacy of compensation	Ideal if perfect insurance	Inadequate	Reasonably adequate floor	No compensation
Institutional overlap	Institutional reference point	Potential overlap in compensation and incentives	Potential overlap, more for compensation than incentives	Fine-tuning mechanism

Tort Liability Reform

In addition, the tort system provides a useful forum for identifying potential targets for regulation and for addressing idiosyncratic risks not covered by broadly based regulations. However, tort reform proposals should recognize the subsidiary role that tort liability must play in the future and focus on achieving the traditional goals of the tort system through increased use of government regulation and social insurance.

