

THE DEMAND FOR AND SUPPLY OF LIABILITY INSURANCE

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Abstract

The demand for and supply of liability insurance arise from the legal liability of individuals and corporations for injuries caused to third parties. Tort liability rules and liability insurance markets have attracted substantial attention in recent years. This paper introduces the literature on the demand for and supply of liability insurance. The focus is on issues that distinguish liability from first-party insurance. Particular emphasis is given to the relationships between liability law, liability insurance, and risk reduction.

Key words: liability law, liability insurance, deterrence, compensation, experience rating, undiversifiable risk, underwriting cycle, default risk, regulation

The demand for and supply of liability insurance arise from the legal liability of individuals and corporations for personal injuries and financial losses caused to third parties, as distinct from first-party insurance that covers losses suffered directly by the policyholder. Automobile liability and workers' compensation have the largest volume (table 1). However, the lines that have grown most rapidly and attracted the most attention in recent years are medical malpractice and comprehensive general liability (GL), which includes product liability, municipal liability, and other general liability coverages.

This paper introduces the literature on the demand for and supply of liability insurance.¹ The focus is on issues that distinguish liability from first-party insurance, except to the extent that much of the work on supply deals with the overall property-liability insurance market. Particular attention is given to the relationships between liability law, liability insurance, and risk reduction.

1. The Demand for Liability Insurance

1.1. General Issues

1.1.1. The Role of Liability Rules in Controlling Risk. Since the pioneering work by Coase (1960), Calabresi (1970), and Posner (1972, 1973), the burgeoning field of law and economics has applied standard tools of positive and normative economics to analyze the structure of common law, including the law of tort liability. A major focus of this analysis has been to show that appropriately designed liability rules can be used to achieve a Pareto optimal allocation of resources to risk reduction in contexts where market forces alone would fail because of imperfect information or transactions costs. This extensive literature on optimal liability rules is only briefly summarized here.² We focus on the derivative questions: Under what conditions does liability give rise to a demand for liability insurance? How does the optimal liability insurance contract differ from the optimal first-party insurance contract? Can the structure of competitively determined liability insurance contracts be socially non-optimal in the sense that insurance interferes with the deterrent function of liability?

Accidents involving third parties can arise in many circumstances, including the use of automobiles and other consumer products, professional services such as medical care, and workplace and environmental hazards. The production of safety (risk reduction) can be modeled either in a standard production framework (Brown, 1973) or as a joint product or spillover associated with other beneficial activities (Shavell, 1980; Polinsky, 1980). Formally, the activity of one party, the "injurer," can result in risk of injury to another party, the "victim." The probability or size of loss may depend on both the level of the activity and the amount of care per unit of activity exercised by the injurer (unilateral accidents), and possibly also on activity level and care per unit taken by the victim (bilateral accidents).

In the general case of bilateral accidents where both injurers and

victims choose levels of care and activity levels, the social optimum is defined as the solution to the problem of maximizing the sum of injurers' and victims' utilities from engaging in their activities, net of their costs of care, and expected accident losses (using the notation in Shavell, 1987, pp. 43-44):

$$\text{Max}[u(s) - sx] + [v(t) - ty - stl(x, y)]$$

where

- s = injurer's activity level,
- $u(s)$ = injurer's gross dollar benefits from the activity,
- t = victim's activity level
- $v(t)$ = victim's gross dollar benefits from the activity,
- x = injurer's level of care, measured in unit costs,
- y = victim's level of care, measured in unit costs,
- $l(x, y)$ = expected accident loss per unit of activity, and
- $stl(x, y)$ = expected accident losses.

The optimal values x^* , y^* , s^* , and t^* are defined by the first-order conditions

$$\begin{aligned} tl_x(x, y) &= -1 \\ sl_y(x, y) &= -1 \\ u'(s) &= x + tl(x, y) \\ v'(t) &= y + sl(x, y) \end{aligned}$$

These conditions imply that the marginal cost of taking care must equal the marginal benefit in terms of reduction in expected accident costs, and that the marginal utility of increasing the level of activity must equal the sum of the marginal cost of taking optimal care and the increase in expected accident costs.

The standard results of the Coase theorem apply. Optimal investment in all dimensions of risk reduction will be achieved, regardless of the liability rule, if both parties are informed about the risks and if the costs of negotiation are low. An important corollary is that if risks are obvious and if the parties are in an ongoing contractual relation, as employer/employee or producer/consumer, then market prices will reflect the potential victim's demand for safety and induce optimal levels of safety. Market contracts will also generate an optimal allocation of risk between the parties and optimal levels of compensation in the event of injury.³

In the case of accidents involving strangers, transactions costs may prevent the achievement of a first best solution by voluntary contract. And

even in buyer-seller situations where contracting costs are low, Spence (1977) shows that if consumers misperceive risk, producers have non-optimal incentives for care and consumers will be nonoptimally insured.

Liability rules are one among several possible policy tools for achieving efficient levels of loss prevention and risk allocation where voluntary contracting in private markets fails.⁴ The two benchmark liability rules are negligence and strict liability. Under a negligence rule, the injurer is liable for failure to take due care that is the cause of injury to the victim. Under a simple strict liability rule, the injurer is liable for activities that cause an injury to the victim, regardless of the injurer's level of care. In the United States, negligence is the prevailing rule for personal and professional liability (including medical malpractice) and for automobile injuries except in states that have explicitly adopted first-party no-fault statutes that limit tort liability for minor injuries. Strict liability is exemplified by workers' compensation statutes whereby employers are strictly liable for work-related injuries, regardless of who is negligent. For product-related injuries, manufacturers can be sued under theories of negligence and strict liability, but liability is strict only for injuries caused by *defective* products.⁵ Important variants of these benchmark rules are the application of a contributory negligence defense (which shifts liability to a victim who fails to take due care, regardless of the defendant's care), and comparative negligence, whereby damages are apportioned between the parties in proportion to their degree of negligence.

Brown (1973) first formally modeled the effects of these alternative liability rules on levels of care. He assumed noncooperative (Nash) behavior in a context of bilateral accidents with level of care the only determinant of risk, risk neutrality of both parties, costless administration, and perfect information, in the sense that courts know the level of care actually taken and the parties know safety production functions and the due standard of care. Under these assumptions, three liability rules are potentially efficient: negligence, with or without a contributory negligence defense, and strict liability with a contributory negligence defense. Strict (no) liability is potentially efficient only in the context of unilateral accidents where victim (defendant) care is irrelevant. Haddock and Curran (1985), Cooter and Ulen (1987), and Rubinfeld (1987) show that it is possible to define an efficient comparative negligence rule.⁶

Shavell (1980) generalized Brown's model to allow both levels of activity and levels of care as determinants of risk. The conclusions now depend critically on the potential victim's information about accident risk. If average risk is misperceived, no liability rule is fully efficient. If victims know at least the average risk, a negligence rule is potentially efficient

provided that the formulation of the due care standard includes both the level of care and the level of risky activities (see also Polinsky, 1980). More generally, the due care standard must include all relevant dimensions of care-taking to achieve optimal investment in all dimensions of safety.

1.1.2. The Demand for Liability Insurance. The early models of effects of liability on levels of care ignored the role of liability in allocating risk by assuming that losses are purely financial and either risk neutrality or the availability of actuarially fair insurance to both parties. Shavell (1982) first formally examined the demand for liability insurance, introducing risk aversion of victims and injurers and the availability of first-party and liability insurance into a model of unilateral accidents with pecuniary losses only.⁷ A first best solution now requires a) a level of care that minimizes expected accident losses plus the cost of care, and b) an optimal allocation of risk for both parties.⁸ The demand for liability insurance and its effect on social welfare depend critically on the information available to courts and to insurers.

Perfect information. Under a negligence rule with the standard of care optimally defined and perfectly implemented, there is no demand for liability insurance since it is cheaper for defendants to be nonnegligent than to be negligent and insure against the resulting liability. Since defendants are not liable, they bear no risk.⁹

Under strict liability, if injurers are risk averse and liability insurance is not available, a first best outcome is not attainable. Optimal risk spreading requires setting damage awards at less than full compensation, which leaves both victims and injurers bearing risk. Injurers may take excessive care or engage suboptimally in risky activities. When liability insurance is available and insurers can observe defendant care (perfect experience rating), injurers can be fully protected against risk while preserving optimal incentives for care, and optimal damage awards provide full compensation to victims. Thus liability insurance unambiguously improves social welfare and permits a first-best solution for level of care and allocation of risk.

Imperfect information. Demand for liability insurance under a negligence rule derives from imperfect information of claimants, courts, and insurers. If victims or courts systematically commit Type 1 errors, failing to file and award liability in all instances of negligence, then with actuarial

insurance it is cheaper for defendants to be negligent and to insure against the resulting liability than to always be nonnegligent. Conversely, if claimants or courts commit Type 2 errors, making erroneous filings or findings of negligence, then defendants are exposed to a risk akin to strict liability and will demand liability insurance (Shavell, 1982, 1987; Danzon, 1985a). Even if the level of care is correctly defined on average, random errors can generate a demand for liability insurance.¹⁰ If the insured's level of care is observable to the insurer, the optimal contract would exclude coverage if the defendant acted negligently. But obviously if insurers had the information necessary to implement such a policy, the courts could use the information and eliminate the errors that generated the demand for insurance in the first place.¹¹

Under strict liability, if insurers cannot observe defendants' care, defendants will choose less than full coverage and the outcome for both level of care and allocation of risk is not first best. Thus in the single period context moral hazard induced by asymmetric information results in a tradeoff between loss prevention and risk spreading in the context of liability insurance, as for first-party insurance (Zeckhauser, 1970; Shavell, 1979). But Shavell (1982) concludes that even with imperfect experience rating, government intervention in liability insurance markets is not warranted.¹²

1.1.3. The Judgment Proof Problem and Compulsory Liability. If injurers lack sufficient assets to fully satisfy a judgment, deterrence and incentives to purchase liability insurance are diminished, because part of the premium would cover losses they would not expect to bear (e.g., Calabresi, 1970; Keeton and Kwerel, 1984; Shavell, 1986). The effects of limited liability depend on the level of injurers' assets relative to expected losses.

Under a negligence rule, if the injurer's wealth is less than a critical level that is less than the potential loss, incentives for care are suboptimal. Under strict liability, if insurance is perfectly experience rated, full coverage is purchased and the level of care is efficient if injurers' wealth exceeds some critical level; at lower levels of wealth, injurers do not buy insurance and the level of care is suboptimal. If insurers cannot observe care, above some (higher) critical level of wealth, injurers buy partial coverage but the level of care is nonoptimal. Making liability insurance compulsory can restore efficient incentives for care under both negligence and strict liability, provided that enforcement is complete and that insurers can observe defendants' care and rate premiums appropriately.¹³ But if injurers' care is unobservable, compulsory coverage that

fully protects injurers' assets is counterproductive, whereas prohibiting coverage could improve the level of care (see Shavell, 1986).

In the United States, liability insurance (or ex ante proof of financial responsibility) is compulsory for workers' compensation in all states and in most states for automobile liability. Two arguments can be made for compulsory coverage even in the absence of individual experience rating. First, with experience rating at the level of the group but not the individual, compulsory coverage still internalizes accident costs to the responsible activity or class of individuals. The cost of insurance operates like a tax on the activity and achieves general but not specific deterrence (optimal level of the activity, conditional on nonoptimal care per unit of activity). Second, compulsory insurance assures the compensation function of tort liability. Concern with compensation and the resulting distributive effects between classes of injurers and victims may influence the political demand for compulsory insurance.¹⁴

1.1.4. Optimal Damage Awards. Tort awards simultaneously provide deterrence to injurers and compensation to victims. Viewing tort liability as a system of (conditional) compulsory insurance (Oi, 1973; Danzon, 1984b), it is unique among systems of social and private insurance in that the amount of compensation is determined after the injury, traditionally by jury and without contractual or statutory limits, and is intended to provide full compensation of monetary and nonmonetary loss. This reflects the dual function of tort awards, as compensation to victims and penalties to defendants.

A single award is optimal for both deterrence and compensation only in a restricted set of circumstances. If the victim suffers only a monetary loss (utility is not state-dependent) and if the injurer is either risk neutral or can fully insure at actuarial rates, an award equal to the loss simultaneously provides optimal insurance to the victim and optimal deterrence to the injurer.

When the victim suffers a nonfinancial loss (utility is state dependent), optimal compensation still requires equalization of marginal utility of wealth across states of the world, but the size of award necessary to achieve this result depends on whether the injury raises or lowers the marginal utility of wealth (Cook and Graham, 1977). Since this optimal compensatory award is no longer identical to the optimal deterrence penalty on the injurer, a first best result requires supplementing compensatory awards with a system of fines, paid initially to the state and refunded as subsidies to the risky activity (Spence, 1977). Danzon (1984b) shows that the optimal compensatory award to the victim is inversely

related to the load on the defendant's liability insurance.¹⁵ Rea (1981) demonstrates that lump sum awards are more efficient than periodic payments contingent on losses actually incurred. Contingent periodic payment overinsures the victim and encourages ex post moral hazard.¹⁶

1.2. Optimal Form of Liability Insurance Contracts

The optimal form of insurance contracts has been extensively studied in the context of first-party insurance. Since the policyholder insures against a loss to himself, there is a presumption that the contractual form that emerges in competitive insurance markets maximizes policyholder utility and is also socially optimal even under conditions of moral hazard.¹⁷ But for liability insurance against loss caused by the policyholder to a third party, control of moral hazard is more complex and there is a much weaker presumption that the policy that is privately optimal to the policyholder/defendant is also socially optimal. The liability insurance loss depends not only on the policyholder's effort at injury prevention but also on his cooperation in legal defense and the liability insurer's legal defense effort; the incentives of the victim to pursue a claim and to mitigate the amount of loss in the event of injury; the propensities of judge and jury, given the constraints of statutory and common law; and the structure of statutory and common law constraints. In addition to the influence of moral hazard, the optimal form of liability insurance contract can be affected by undiversifiable risk. The presence of liability insurance also might affect the endogenous choice of legal rules.

1.2.1. Optimal Copayment When Claim Outcome Is Exogenous. If the probability and size of injury depend only on the defendant's level of care and there is a proportional loading, theorems of optimal first-party insurance imply that optimal copayment would include a deductible, a coinsurance rate, or both in the single period case. In the multiperiod case, the optimal policy is experience rated. In the liability context, socially optimal coverage if the insurer could observe the insured's care would provide full coverage of losses if care is efficient ($x \geq x^*$) and zero coverage if care is suboptimal ($x < x^*$). But if there are Type 1 errors (failure to file or find liability for all injuries caused by $x < x^*$), then defendants may prefer a policy that provides coverage even if $x < x^*$ (Danzon, 1985a).

When care is not observable, policyholders may prefer a policy that

requires insurers to invest in information, rather than levy copayments automatically for all claims or all paid claims. Paid claims do not convey perfect information about whether negligence occurred even if courts are unbiased because over 90% of paid claims are settled out of court. The decision to settle and amount of settlement may be influenced by many factors other than the defendant's level of care and plaintiff's true damages, including the parties' misperceptions of the expected verdict, costs of litigation, risk aversion, concerns over precedent, and other factors (see Cooter and Rubinfeld, 1989, for a survey). The private and socially optimal policy would attempt to protect the insured from these exogenous risks and relate copayment only to losses caused by suboptimal care. Thus in the case of Type 2 errors, competitive liability insurance markets will tend to devise contract terms that do not interfere with efficient deterrence.

1.2.2. Optimal Copayment When Claim Outcomes Depend on Legal Defense. When the courts lack perfect information about the defendant's care, the victim's damages, or the injury production function, both parties have incentives to invest in legal effort to influence the outcome.¹⁸ This generates a demand for legal defense insurance. Combining legal defense and damages insurance in a single policy avoids duplicative monitoring of the actions of defense attorneys and policyholders.

But when both the insurer and the policyholder can affect the magnitude of loss, no simple loss sharing contract can simultaneously provide both with optimal marginal incentives. In general, if it is costly for policyholders to monitor the insurer's legal defense effort, the privately optimal copayment is lower than first-party coverage with comparable policyholder moral hazard and even lower if defense effort reduces plaintiff's incentives to file claims (Danzon, 1985a).¹⁹ When claim outcomes depend on legal defense effort, defendants may choose policies with too little copayment: from a social standpoint, too many resources may be devoted to fighting claims and too few to preventing injuries. Private and social optima diverge unless potential victims are in a contractual relationship with defendants and accurately perceive the nature of the defendant's insurance coverage and its likely effects on claim outcomes — but in that case the liability rule is irrelevant.

1.2.3. Empirical Evidence on Copayments. Deductibles are common for product liability and professional liability policies for attorneys, accountants, and corporate directors and officers, but not for medical malpractice. Medical malpractice insurance is typically rated on the

basis of limits of coverage, medical specialty, and geographic location. Individual rating on the basis of exposure (performance of high-risk procedures), volume of business, and individual claim record is relatively limited.²⁰ Several studies have shown that the actual distribution of claims and awards is inconsistent with a purely random distribution, after controlling for specialty (Rolph, 1981; Nye and Hofflander, 1988; Ellis, Gallup, and McGuire, 1990; Sloan, et al., 1989).

If more experience rating is statistically feasible than in fact occurs for medical malpractice insurance, this suggests a lack of demand. The apparent lack of copayment may be deceptive if physicians face significant copayment in the form of uninsurable time and disutility of being sued, or higher premium costs if they are denied coverage by more selective, lower-cost insurers (Danzon, 1985a). To the extent copayment and experience rating exist, it is usually based on additional information to distinguish Type 2 errors from valid claims, rather than automatic copayment for all paid claims, consistent with the hypothesis that the risk of judicial error contributes to the lack of demand for experience-rated policies.²¹ Ellis, Gallup, and McGuire (1990) show that automatic experience rating based on Bayesian conditional means would impose significant risk on physicians and create inequities in premiums across physicians with identical true risks. Thus the lack of experience rating of medical malpractice may reflect a rational demand for protection against the risk of judicial error and being erroneously rated.

1.2.4. Effects of Undiversifiable Risk on Optimal Contractual Form.

Positive correlation of liability losses among policyholders can affect the optimal form of liability insurance contract.²² Positive correlation derives from the dependence of number of claims and size of awards on unanticipated changes in law and social norms. By the operation of legal precedent, a ruling by one court can influence the outcome of related cases, but given the multiplicity of courts and jurisdictions, it may be many years before new majority standards become firmly established.

The undiversifiable risk associated with common factors increases with the duration of insurer liability, which is typically longer for liability insurance than for first-party insurance. Delay between the writing of the policy and the ultimate disposition of all claims is caused partly by delay in the legal process of settling claims. More significant time lapse derives from discovery-based statutes of limitations that do not begin to run until the injury and its cause have been (or with reasonable diligence should have been) discovered, which could be twenty years for some cancers or birth defects. The longer the duration of liability, the greater the risk that

unanticipated information about hazards or new legal standards will shift the distribution of expected loss for all outstanding policies. Socio-legal risk has become more significant with the expansion of liability for defects in product design and warnings, where a single ruling can render all units of a product line defective and hence lay the grounds for hundreds or thousands of claims (e.g., asbestosis claims). Even if courts admit a state-of-the-art defense in principle, some degree of retroactivity is implicit in basic common law rules of procedure and damages, and some courts have explicitly disallowed a state-of-the-art defense.²³

Doherty and Dionne (1989) show that contracts that allow policyholders to bear undiversifiable risk through premium adjustments, dividends, or other features (e.g., claims-made coverage) may have a comparative advantage over occurrence contracts with fixed premiums.²⁴ The intuitive reason is that insureds can share diversifiable idiosyncratic risk without paying a risk premium. Of course, if undiversifiable insurance risk can be costlessly diversified through capital markets, the risk-bearing advantage of such contracts disappears.

A limitation of contracts that provide for retroactive premium adjustments through dividends or assessments on policyholders is that they are costly to enforce when there is asymmetric information between insurer and policyholder in observing the true loss or when the realized loss depends in part on the insurer's incentive for legal defense (Danzon, 1985a). A mutual organizational form that eliminates possible conflicts between owners and policyholders may thus have an advantage in assuring optimal investment in legal defense and in offering contracts with retroactive adjustment or multiperiod policies.

The effect of undiversifiable risk on the optimal structure of damage awards and duration of liability (statutes of limitations) is discussed in Danzon (1984b) and Rubinfeld (1984) but has not been analyzed rigorously in formal models. More generally, the effect of the current structure of liability rules on the risk faced by liability insurers has played a major role in the debate over tort reform and liability insurance crises.

1.2.5. Endogeneity of Legal Standards. A smaller literature adopts a positive approach to explain why certain liability rules have been adopted in particular circumstances (for example, Landes and Posner, 1981, 1987). This literature is not immediately relevant to a survey of liability insurance, except to the extent that the existence of liability insurance influences the evolution of legal rules.

It is often argued anecdotally that jury decisions, in particular the size of awards, are influenced by knowledge of the defendant's liability

insurance coverage, although in principle this is not admissible evidence. Consistent with this hypothesis, Chin and Peterson (1985) find that jury verdicts are significantly higher for the same type of injury if the defendant is a corporation or physician, rather than an individual. Danzon (1980) estimated an elasticity of award size with respect to limits of the defendants' insurance coverage of 0.14. More generally, it is often argued that one factor underlying the shift towards strict product liability in recent years has been the perception of courts that corporate defendants can obtain and pass on the costs of liability insurance more readily than individuals can obtain first-party insurance.

1.3. Liability Rules and Accident Rates: Empirical Evidence

Despite the policy interest in the effect of liability rules on resource allocation to risk reduction and the possible dulling effect of liability insurance, empirical evidence is so far limited and inconclusive. One fundamental problem is the unobservability of relevant rules of common law and of injury rates as opposed to claim rates. Moreover, as discussed above, the rate of injuries, claim frequency and severity, legal expenditures, and even legal rules are simultaneously determined. Data necessary to identify the structural equations of this system are generally not available.

Several studies have estimated the effects of liability on resource allocation in medical care, but without a measure of injury rates have been unable to distinguish cost-justified improvements in prevention that liability is intended to induce from wasteful defensive medicine (Greenwald and Mueller, 1978; Reynolds, Rizzo, and Gonzalez, 1985; Danzon, 1990b).²⁵ Several studies have estimated the impact of a limited set of legal rules on the frequency and severity of claims (for medical malpractice, see Danzon, 1984a, 1986; Danzon and Lillard, 1983; Sloan, Mergenhagen, and Bovbjerg, 1989; for product liability, see Viscusi, 1989). None of these studies have attempted to measure whether liability insurance with imperfect experience rating undermines the incentive effects of liability rules.

Measurement of the relevant law and insurance parameters is generally easier if liability is governed by statute rather than common law, as in workers' compensation and no-fault automobile regimes. Data on accident rates as opposed to claim rates are also available, although subject to reporting error. The evidence for work-related injuries is reviewed here.²⁶

The effect of liability rules on workplace injuries is ambiguous a priori. Since the setting is one of repeated or multiperiod contracting with enduring production technologies, transactions costs may be sufficiently low and information sufficiently symmetric for the rule of liability to be irrelevant (Coase, 1960), except possibly for risks of long-latent diseases such as cancer caused by toxic exposures. Differences across states in timing of adoption of workers' compensation statutes (which replaced traditional common-law employer liability for negligence with strict employer liability) and in statutory benefit provisions have provided the empirical variation necessary to test whether the liability rule matters. However there remains a difficulty of distinguishing injury rates from claim rates.

Several empirical studies have analyzed the effects of workers' compensation statutes or benefit levels on claim rates (e.g., Fenn, 1981; Chelius, 1982; Worrall and Appel, 1982; Butler and Worrall, 1983; Ruser, 1986; Dionne and St-Michel, 1991). Butler and Worrall (1983) use a time-series and cross-section of 35 states for 1972 to 1978 and estimate a simultaneous system in which claim rates, hours of work, and wages are treated as endogenous. They estimate an own benefit elasticity of 0.37 for temporary total injuries, and generally positive elasticities for major and minor permanent partial injuries.²⁷

Ruser (1986) shows formally that the safety response to higher benefit levels depends on the degree of experience rating. Since large firms are either self-rated or self-insured, whereas experience rating is imperfect for medium and small firms, large firms are expected to be more responsive, in addition to having economies of scale in providing safety. Using claim rates and injury rates for 25 industries in 41 states for 1972-1979, Ruser finds some evidence that higher benefit levels have a greater (more negative) effect on injury rates in large firms, consistent with the theoretical prediction from experience rating.

1.4. Relative Efficiency of First- and Third-Party Coverage

It is popular to compare liability insurance to first-party insurance and to note that, from the standpoint of delivering compensation to the victim, transactions costs are much greater for liability insurance. Roughly 40 cents of the product liability or medical malpractice insurance dollar reaches the victim as compensation; of the remainder, roughly 40 cents is litigation expense, divided evenly between plaintiff and defense, and the remainder is insurance overhead (Munch, 1977; Kakalik and Pace, 1986).

By contrast, the load on large group first-party health insurance may be less than 10 cents of the insurance dollar, although higher for small groups and individual policies.

A simple comparison of loading charges is an inappropriate measure of overall efficiency since part of the purpose of the litigation expense component of liability insurance is enforcement of liability rules that in principle serve a deterrent as well as a compensation function. Liability insurance provides the joint products of compensation of the victim, insurance of the defendant, and deterrence, in contexts that intrinsically involve asymmetric information and multiple agency problems. Thus from a social perspective, liability and first-party insurance perform different functions and are used in contexts that make them noncomparable. About all that can be said is that the administrative costs of tort liability are not justified if the impact of legal rules on deterrence is less than some critical level (see Shavell, 1987, ch. 11), and, as previously noted, that optimal compensatory awards are inversely related to liability insurance load factors (Danzon, 1984b).

Epstein (1985) and Priest (1987) examine product liability as an insurance market and argue that it is much less efficient than first-party insurance for purposes of controlling moral hazard and adverse selection. But in the context of two-party accidents such as consumer product injuries, first-party insurance is relatively inefficient at controlling moral hazard on the part of producers, just as liability insurance does little to control moral hazard on the part of consumers. There is parallel here between liability insurance and liability rules: just as one-sided liability rules such as *caveat emptor* and strict liability without a contributory negligence defense are inefficient for controlling bilateral accidents, the associated insurance arrangements similarly fail to provide efficient incentives for care to the party that is immune from liability. It is not obvious a priori that for bilateral accidents, first-party insurance is more efficient than liability insurance.

2. The Supply of Liability Insurance

The effects of liability rules and insurance on resources allocated to risk reduction and the total cost of risk depend on the structure, performance, and regulation of liability insurance markets. Major issues include the degree of competition in the market, determinants of fair premiums and the nature and causes of fluctuations in price and in the availability of coverage, and the effects of insurance regulation. Much of the

work in these areas has dealt with the overall property-liability insurance market.

2.1. Market Structure

2.1.1. Marketing Methods and Organizational Form. The U.S. liability insurance market is characterized by two principal methods of product distribution (independent agency and direct writers) and two principal organizational forms (stocks and mutuals).²⁸ Insurers that use independent agents (and brokers) to distribute their products account for the bulk of premiums for commercial liability insurance and workers' compensation (see table 1). Direct writers generally have significantly lower operating expenses as a proportion of premiums than agency insurers. Whether higher operating expenses for agency companies are associated with greater service to policyholders has been subject to considerable debate, especially for private passenger auto and homeowners' coverage (see the following).

A large majority of premiums in most commercial liability lines is written by stock companies, but mutuals account for over a third of private passenger auto liability premiums.²⁹ Mayers and Smith (1981, 1988) argue that the tradeoff between the ability of mutual organization to eliminate potential incentive conflicts between owners and policyholders and the possibly greater cost of controlling manager-policyholder conflicts with mutuals than with stock companies is likely to make mutual organization advantageous in markets where managerial discretion is limited. Hansmann (1985) suggests that mutual organization may involve less conflict with policyholders over the choice of default risk and that it may have facilitated improved risk selection during the formative years of insurance markets.³⁰

2.1.2. Concentration and Barriers to Entry. The structure of the market for most property-liability insurance lines generally has been regarded as competitive (e.g., Danzon, 1983; Clarke, et al., 1988; Winter, 1988; also see Joskow, 1973). Market concentration generally is low whether measured at the state or national level, especially for commercial lines.³¹ Most studies conclude that there are no substantial barriers to entry.³²

Institutional arrangements for the pooling and analysis of claim cost data and cooperative development of policy forms facilitate entry (e.g., Danzon, 1983; Eisenach, 1985). Absent these arrangements, large insurers would have an advantage over small insurers in forecasting future

Table 1. Liability Insurance Premiums — 1987

	Net Premiums Written (\$ millions)	Market Shares				Direct Writers
		Largest 4 Groups	Stock Co.	Mutual Co.	Independent Agency	
Private Passenger Auto Liability	\$ 37,449	42%	52%	35%	36%	64%
Workers' Compensation	23,429	28	72	26	73	27
General Liability	20,874	28	88	11	82	18
Commercial Multiperil	17,231	24	84	13	81	19
Commercial Auto Liability	11,755	21	77	21	79	21
Medical Malpractice	4,004	38	59	20	45	55
All Property-Liability	193,246	23	70	24	58	42

Source: *Best's Aggregates and Averages*, A.M. Best Co., 1988 ed.

claims and in bearing fixed costs of ratemaking and complying with rate regulation. Since many small firms exist, it is unlikely that either greater variability in average claim costs for small insurers due to their smaller number of exposures or minimum capital and licensing requirements for insurers constitute significant entry barriers.

No substantive entry barriers would appear to be associated with use of independent agents and brokers. Fixed costs associated with risk selection can be reduced by firms that anticipate little volume in a given market by using managing general agents.³³ Joskow (1973) argued that differences in operating costs between direct writers and independent agency insurers could not be explained by differences in service (also see Cummins and VanDerhei, 1979). To explain why direct writers had not grown more rapidly, he suggests that prior approval rate regulation had discouraged price cuts by direct writers, that difficulty in raising capital and obtaining consumer recognition slowed their expansion, and that it would be costly for independent agency insurers to become direct writers (also see Smallwood, 1975). More recently, Pauly, Kleindorfer, and Kunreuther (1986) argue that significant barriers to raising capital for growth are unlikely, and they suggest that direct writers and independent agency insurers produce different levels and types of services.

Numerous studies have estimated property-liability insurer cost functions using cross-firm data on operating expenses and some proxy for output. While the results often suggest increasing returns to scale (e.g., Cummins and VanDerhei, 1979; Doherty, 1981), the use of accounting data to infer returns to scale is problematic. Among other limitations, data on operating expenses aggregate capital (e.g., product and market development) expenditures and current costs. Firm output also cannot be measured accurately (e.g., Doherty, 1981; also see Braeutigam and Pauly, 1986). Appel, Worrall, and Butler (1985) analyze changes in the size distribution of insurers over time. Their results are inconsistent with increasing returns for small insurers and thus more in line with evidence on entry and concentration.³⁴

2.2. Prices, Profits, and Market Volatility

2.2.1. Determinants of Fair Premiums. What level of premiums is needed to produce a fair return to suppliers of capital? Biger and Kahane (1978), Fairley (1979), and Hill (1979) derive fair underwriting margins implied by the Capital Asset Pricing Model (CAPM) (also see Cummins and Harrington, 1985). Myers and Cohn (1986) develop a simple discounted cash flow model of insurance prices. Kraus and Ross (1982)

consider a continuous time model and apply arbitrage pricing theory. Option pricing models are applied to premium determination by Doherty and Garven (1986) and Cummins (1988).

The essence of this research is that fair premiums equal the (risk-adjusted) discounted value of all expected costs associated with writing coverage including the expected cost of claim payments, underwriting expenses, and income taxes. Higher levels of capital lead to higher premiums and lower default risk.³⁵ An important implication is that variability in claim costs that cannot be eliminated by insurer diversification increases fair premiums for a given level of default risk and thus reduces gains from trade. A number of studies emphasize that uncertainty associated with liability law and jury awards can be very costly for this reason (e.g., Danzon, 1984b, 1985b; Clarke, et al., 1988; Abraham, 1988; also see Doherty and Dionne, 1989).

2.2.2. Profitability. Property-liability insurer profitability has been examined using a variety of profitability measures, time periods, and benchmarks for fair profits. Some studies (e.g., Insurance Services Office, 1987) compare accounting returns on net worth (surplus) for property-liability insurers to those of other industries after adjusting for differences in the variability of returns. Other studies compare underwriting profit margins to levels implied by theoretical models (e.g., Fairley, 1979; D'Arcy and Garven, 1990). As discussed further below, insurer financial results during and following the so-called liability insurance crisis of the mid-1980s also have been examined (e.g., Harrington, 1988; also see Lacey, 1988).

Studies of average accounting returns on surplus over time generally suggest that property-liability insurer returns are low to moderate compared to other industries with comparable variability in returns, but the interpretation of these studies is problematic (see Venezian, 1984). In addition to a weak theoretical basis for assuming a positive tradeoff between returns and variability, accounting returns at best are only rough approximations of economic returns.³⁶ Attempts to assess profitability by line (or by line and by state) also are plagued by the lack of a rigorous basis for allocating insurer operating expenses, investment income, and most important, surplus. These and other problems also affect comparisons of reported underwriting margins with levels implied by financial models of insurance prices. Hence, while the results of this literature generally suggest only normal profits, they have not prevented allegations of excessive profits in the policy debate over the cost and availability of liability insurance.

2.2.3. Market Volatility and the Underwriting Cycle. Many lines of insurance appear to be characterized by soft markets, in which prices are stable or falling and coverage is readily available, followed by hard markets, in which prices rise rapidly and the number of insurers offering coverage for some risks declines substantially. Popular wisdom holds that soft and hard markets occur in six-year cycles. Reported underwriting and total operating profit margins for insurers follow a second-order autoregressive process that is consistent with a cycle (see Venezian, 1985; Cummins and Outreville, 1987; Doherty and Kang, 1988; also see Smith, 1989).

According to the traditional view of cycles by industry analysts, which assumes an inelastic supply of capital, competition drives prices down until capital is depleted, insurers ultimately constrain supply to prevent default, and attendant increases in prices and retained earnings replenish capital until price-cutting ensues again.³⁷ Academic researchers have frequently questioned this scenario and whether prices are in fact cyclical. For example, Cummins and Outreville (1987) consider whether cycles in reported underwriting results could simply reflect insurer financial reporting procedures in conjunction with information, policy renewal, and regulatory lags.³⁸

The most controversial episode of volatility in insurance markets was the liability insurance crisis of the mid-1980s, which was characterized by dramatic increases in premiums for many commercial liability risks and reductions in the availability of coverage. Industry financial results surrounding this period suggest that rapid premium growth in general liability insurance during 1985–1986 was associated with upward revisions in insurer loss reserves for prior years' business and rapid growth in reported losses for new business (Harrington, 1988; Harrington and Litan, 1988). Much of the total growth in premiums during 1980–1986 probably can be explained by growth in expected losses and changes in interest rates (i.e., by determinants of fair premiums). However, premiums grew slower than discounted reported losses during the early 1980s and much faster than discounted reported losses during 1985–1986, a result that is consistent with cyclical effects.

The underlying causes of cycles are not well understood. Conventional descriptions suggest a persistent tendency towards destructive price cutting and inelasticity in the supply of capital to the industry. Two possible causes of excessive price cutting in soft markets are overly optimistic forecasts of future claim costs by some insurers and the possibility of aggressive behavior by firms with little to lose in the event of default (McGee, 1986; Harrington, 1988; also see Harrington and Danzon, 1990).³⁹

Winter (1988, 1989) develops a model in which undiversifiable risk and constraints on external capital flows (such as those that might arise from asymmetric information between insurer managers and investors or from income tax treatment of shareholder dividends) and solvency (which could be imposed by regulators or reflect policyholder preferences) could lead to periods of soft markets followed by sharp increases in prices.⁴⁰ Cummins and Danzon (1990) analyze conditions in which costly external capital and exogenous shocks that reduce surplus (such as increases in the liability for unpaid claims) can lead to premium increases in excess of changes in expected costs of providing coverage.⁴¹

Other studies argue that increased uncertainty about the level of future claim costs is likely to have contributed to rapid premium growth and availability problems in commercial liability insurance during the mid-1980s (e.g., Clarke, et al., 1988; also see Danzon, 1984b).⁴² Priest (1987) suggests that an expansion in tort law aggravated adverse selection to the point where some coverage became unavailable at any price. Abraham (1988) argues that expansive court decisions concerning contract language contributed to availability problems in the market for environmental impairment liability coverage in the mid-1980s. As noted earlier, undiversifiable risk associated with the legal system also can make claims-made contracts with premium adjustments attractive relative to fixed premium, occurrence coverage.

2.3. Regulation

Most economic analyses of insurance regulation have focused on solvency regulation and regulation of premium rates and the availability of coverage.⁴³

2.3.1. Default Risk and Solvency Regulation. The traditional rationale for solvency regulation is that consumers are unable to monitor the risk of insurer default. In the United States, solvency regulation has three major facets: 1) direct controls on certain activities and financial reporting, 2) monitoring of insurer behavior, and 3) a system for paying claims of insolvent insurers (see Harrington and Danzon, 1986, for details). Direct controls include minimum capital requirements and limitations on investment activities. The principal monitoring system is administered by the National Association of Insurance Commissioners. Guaranty funds exist to pay claims of insolvent property-liability insurers in all states.⁴⁴

The default rate for property-liability insurers increased substantially in 1984 and has continued at historically high levels since that time. During 1984–1989, the number of failures requiring guaranty fund assessments averaged about 20 per year and assessments totaled \$3 billion (NCIGF, 1990).

Economic analysis of insurer default risk has focused on factors that influence insurer capital decisions.⁴⁵ Munch and Smallwood (1982) and Finsinger and Pauly (1984) model the capital decision assuming that insurers maximize value to shareholders, that demand is inelastic with respect to default risk, and that investing financial capital to support insurance operations is costly. The principal implication is that optimal capital is positively related to the amount of loss that shareholders would suffer if claim costs were to exceed the firm's financial assets. Munch and Smallwood (1982) consider possible loss of goodwill in the event of default; Finsinger and Pauly (1984) assume that an entry cost would be forfeited that otherwise would allow the firm to continue operating. If shareholders have nothing to lose, they will not commit any capital. If they are exposed to loss and it is assumed that firms cannot add capital after claims are realized, firms will commit some capital *ex ante*.⁴⁶

Default risk for insurers that specialize in liability coverage could be expected to exceed risk for insurers that specialize in first-party coverage if liability policyholders would be judgment proof in the absence of coverage and the demand for first-party coverage depends on default risk (see Harrington and Danzon, 1986). Specifically, compulsory liability requirements could lead judgment proof consumers to seek coverage from firms with high default risk and correspondingly low premiums. As a result, there could be a need for solvency regulation of liability insurance even if policyholders were fully informed about default risk.

In an empirical analysis of the effects of solvency regulation, Munch and Smallwood (1980) provide evidence that minimum capital requirements reduced insolvencies by reducing the number of small domestic insurers in the market. Other empirical studies generally have focused on predicting insurer defaults using financial data without relating the variables chosen to the theory of default risk (e.g., Harrington and Nelson, 1986; McDonald, 1988). Not much is known empirically about the magnitude of the effects of regulatory monitoring and guaranty funds on default risk, or about the extent to which unpredictable growth in claim costs for commercial liability or other lines of insurance contributed to the increased default rate in recent years, as opposed to excessive price cutting due to overly optimistic forecasts or aggressive or fraudulent behavior.

2.3.2. Rate Regulation. Regulation of property-liability insurance rates can affect an insurer's average rate level or overall percentage change in its rates during a given period. It also can affect rate differentials between groups of consumers by imposing limits on voluntary or involuntary market rates or by restricting risk classification.⁴⁷

Voluntary market rates for most property-liability lines presently are subject to prior approval regulation in about half of the states. Most states had prior approval regulation during the 1950s and 1960s, and rate regulation probably encouraged insurers to use rates developed by rating bureaus (Joskow, 1973; Harrington, 1984). A trend towards deregulation began in the late 1960s and continued until the early 1980s. A number of states reregulated commercial liability insurance rates following the liability insurance crisis of 1985–1986. California adopted prior approval regulation for property-liability insurance with the enactment of Proposition 103 in 1988. Several additional states either have reenacted or are considering reenactment of prior approval regulation.⁴⁸

Most studies of rate regulation estimate the impact of voluntary market rate regulation in auto insurance on average rate levels for the overall (voluntary and involuntary) market. Major hypotheses are that regulation raises rates due to capture by industry, that regulation has short-run effects due to regulatory lag, and that regulation persistently reduces rates due to consumer pressure. The results of studies using data from the late 1970s and early 1980s (e.g., Pauly, Kleindorfer, and Kunreuther, 1986; Harrington, 1987; Grabowski, Viscusi, and Evans, 1989) suggest that on average prior approval regulation reduced the ratio of premiums to losses, a result that is consistent with consumer pressure for low rates.⁴⁹

Involuntary markets in auto insurance are significantly larger in states with prior approval regulation of voluntary market rates (e.g., Ippolito, 1979; Grabowski, Viscusi, and Evans, 1989). States that have significantly limited involuntary market rates, adopted restrictions on rate classification (e.g., unisex rating), or both generally have large involuntary markets, but the relative effects of these influences and of voluntary market rate regulation would be difficult to sort out. Voluntary and involuntary market regulation of auto liability insurance rates could possibly reduce the number of uninsured drivers by lowering rates to drivers who otherwise would fail to buy coverage (Kunreuther, Kleindorfer, and Pauly, 1983; Keeton and Kwerel, 1984). If so, the efficiency loss from rate regulation that otherwise would be expected from any cross-subsidies would be mitigated.

Several studies have attempted to estimate the impact of prior approval

regulation in commercial lines of business without firm conclusions (e.g., Stewart, 1987; Cummins and Harrington, 1987; Rizzo, 1988; also see Hunt, Krueger, and Burton, 1988). It is very difficult to control for factors that will influence premiums (or the ratio of premiums to losses) for commercial lines in the absence of rate regulation. A priori, rate regulation is likely to have little or no impact in most years for some commercial lines (such as general liability) due to widespread use of individual risk rating (Stewart, 1987).

There has been little formal analysis to date of the wide variation in involuntary market size in workers' compensation, of cross-state variation in the size of joint underwriting associations in medical malpractice insurance and other commercial liability lines, and, in general, of economic and political factors that lead to government intervention in the rate-setting process. A large amount of anecdotal evidence suggests that substantial regulatory intervention in insurance pricing tends to occur in states where the unregulated cost of coverage would be relatively high, that rate regulation tends to favor high-risk groups, and that exits eventually have occurred in response to restrictive regulation. The implication is that high costs lead to effective political pressure for limits on rates. Any tendency for regulation to hold down liability insurance rates for high risks would be likely to dull the incentive affects of tort liability and increase the cost of risk, but it would probably be very difficult to estimate the effects of such policies on levels of activity and care.

2.3.3. The McCarran-Ferguson Act. The McCarran-Ferguson Act (enacted by the U.S. Congress in 1945) establishes the primacy of state insurance regulation and provides the insurance industry with an exemption from federal antitrust law that allows cooperative activities to the extent that they are regulated by the states or unless boycott, coercion, and intimidation are involved.⁵⁰ Two forms of cooperative activity have been subject to substantial controversy in recent years: the development of advisory rates or prospective loss costs by advisory organizations such as the Insurance Services Office (ISO), and the cooperative development of policy forms.⁵¹

Several groups claim that the ISO advisory rate system aggravated rate increases during the liability insurance crisis. For example, Angoff (1988) argues that advisory rates or loss costs stimulate price-cutting during soft markets and permit collusion to raise rates above costs during hard markets. These effects are difficult to reconcile with the industry's competitive structure and with the modern operation of advisory organizations (e.g., Clarke, et al., 1988; Winter, 1988; Harrington and Litan, 1988).

Danzon (1983) concludes that current activities of advisory organizations in auto insurance are inconsistent with cartel behavior and likely to be procompetitive (also see Eisenach, 1985). In commercial liability insurance, independent rate filings, percentage deviations from ISO advisory rates or loss costs, and individual risk rating provide substantial flexibility in pricing. Winter (1988), Harrington (1988), and others also argue that cooperative ratemaking activities allowed under the McCarran-Ferguson Act are likely to enhance efficiency.

3. Conclusions

A major focus of economic analysis of tort liability has been on the design of liability rules to minimize the cost of risk in society. When moral hazard, transactions costs, limited liability, and nonmonetary losses are introduced, the relation between liability law, liability insurance, and risk reduction becomes extremely complex. Unobservability of policyholder care and imperfect experience rating in liability insurance markets undermine the deterrent effects of tort liability and, as in the case of first-party coverage, can produce a tradeoff between risk sharing and loss prevention. Limited liability and the resultant judgment proof problem also reduce incentives for care. Compulsory coverage might produce an efficient reduction in risky activity, but it cannot restore efficient incentives for care when care is unobservable. Nonmonetary losses make it impossible to achieve both efficient deterrence and optimal compensation with a single award for victims.

Undiversifiable risk associated with changes in liability rules is likely to increase premium rates necessary to achieve a given probability of insurer default, alter the optimal form of liability insurance contracts for some risks, aggravate volatility in the price and availability of liability insurance, and increase default risk for some insurers. Increases in expected liability claim costs also are likely to increase pressure on regulators to limit rate increases, especially for high-risk insureds, and thus to further dull the incentive effects of liability law.

Notes

1. Our treatment is not exhaustive; space limitations prevented us from discussing or citing many good papers on these subjects.

2. For reviews of this literature, see Polinsky (1983), Posner (1986), Shavell (1987), Landes and Posner (1987), Cooter and Ulen (1988), and references cited therein.

3. For formal models and empirical estimates of the wage premium for risk-bearing in risky employments and use of such estimates to infer a willingness-to-pay for safety or "value of life," see, for example, Thaler and Rosen (1976), Viscusi (1983), and Viscusi and Moore (1987).

4. Other possible corrective policies, such as regulatory standard setting, taxes and subsidies, and fines and injunctions, are not addressed in this survey since any resulting losses are generally not covered by liability insurance. Liability rules differ from regulatory standard setting in that they do not proscribe a specific course of action *ex ante*. Rather, liability rules define general conditions for allocating the cost of accidents and determining the amount of damages payable.

5. This notion of product defect reintroduces an issue of reasonable care, defined by some weighing of risks and benefits of additional care, analogous to a due care standard under a negligence rule. Thus strict liability for products is not the absolute liability used in simple theoretical models.

6. Cooter and Ulen (1987) argue that a comparative negligence rule is superior to a negligence rule when injurers and victims bear risk and there is evidentiary uncertainty. Rubinfeld (1987) reinforces this conclusion when injurers and victims are heterogeneous.

7. Corporate demand for liability insurance may be explained by risk aversion of customers, suppliers, managers, or employees (Mayers and Smith, 1982).

8. Formally, the problem is to maximize expected utility of the victim, subject to constraints of a) a reservation utility level for the defendant, b) an overall resource constraint, c) victims and injurers choose first-party and liability insurance to maximize their respective utilities, and d) insurers break even. If insurance is not available, then the choice between liability rules depends on which party is better able to bear risk. In particular, strict liability is preferable to negligence if injurers are risk neutral or better able to bear risk.

9. A first best outcome is achieved only if victims can eliminate risk by buying actuarially fair first-party insurance.

10. Calfee and Craswell (1984) analyze effects of uncertain legal standards on compliance under a negligence regime in the absence of liability insurance.

11. In the context of automobile accidents with externalities, Boyer and Dionne (1987) show that multiperiod no-fault insurance contracts (with an infinite horizon and no discounting) using experience rating based on past driving record can induce optimal levels of care.

12. This assumes that government has no information advantage, that damage awards are optimally set, and that defendants are not judgment proof.

13. Other possible remedies are vicarious liability and imposing asset requirements for participating in the activity. Shavell (1986) shows that imposing asset requirements equal to the maximum possible loss may overdeter, because it is socially efficient for parties to participate in an activity if their assets equal the expected loss, which is less than the maximum possible loss.

14. Obviously if compulsory coverage leads to a political demand for rate regulation that guarantees availability of coverage for high risks at subsidized rates, incentives for care are undermined. For further discussion, see Harrington (1989).

15. These conclusions follow from the standard assumption that the optimal damage award is chosen to maximize the utility of the victim, subject to a reservation level of utility for the defendant. Thus by assumption, the incidence of costs of liability is on victims. This is reasonable assuming a perfectly elastic long-run supply of the products or services that are subject to strict liability. But with imperfectly elastic supply in the short run, the incidence of unanticipated changes in liability costs is partly on defendants (Danzon, 1990a).

16. Noncontingent periodic payment of awards, where the amount is determined at time of trial or settlement (also called structured settlements) are potentially more efficient than lump sum awards if the defendant is permitted to provide for the payment of these future damages by the purchase of an annuity or other financial instrument. This transfers from the jury to financial markets the issue of determining expected rates of interest (Danzon, 1984b).

17. The convergence of private and social optima may not hold with adverse selection.

18. For product liability and medical malpractice, plaintiff and defense legal expenditures each average about one half of the net compensation received by plaintiffs (Danzon 1985b; Kakalik and Pace, 1986). For the effects of costly litigation on the efficiency of liability rules see, for example, Polinsky and Rubinfeld (1988) and Cooter and Rubinfeld (1989).

19. For example, a deductible undermines the insurer's incentives to fight claims that can be settled for less than the deductible. For medical malpractice claims closed during 1975-78, 64% of claims closed for under \$3,000 but with mean legal expense in excess of mean damages paid (NAIC, 1980, p. 34). Incurring legal expense in excess of damages may be a privately optimal strategy if it deters other potential claims.

20. Some companies also apply surcharges or exclusions for certain high-risk procedures, such as shock therapy; a crude adjustment for part-time practice; and surcharges of limits on coverage for multiple paid claims.

21. Professional liability policies explicitly exclude coverage of intentional acts. The existence of a demand for and supply of coverage for punitive damages in states where this is permitted suggests a significant risk of Type 2 errors, despite the higher standard of proof (gross negligence or willful misconduct) for punitive awards.

22. The effect of undiversifiable risk on prices, "crises", and cycles in the supply of insurance is discussed in section 2.2.

23. In *Beshada v. Johns-Manville Products Corp.*, 90, New Jersey Supreme Court, 191,447 A2nd 539 (1982) the New Jersey Supreme Court held asbestos manufacturers liable even if the risks were unknowable at the time of manufacture. But in 1984 the same court held that manufacturers are not liable for defects they did not or could not know about when their products were sold (see *Feldman v. Lederle*, cited in *Business Insurance*, August 6, 1984). Retroactivity in tort is discussed by Schwartz (1983) and Danzon (1984b).

24. Danzon (1984b, 1985a,b) makes similar arguments in explaining the switch from claims-made to occurrence coverage and the growth of physician-owned mutuals following the medical malpractice crisis of the 1970s. Also see Marshall (1974).

25. *Defensive medicine* should be defined as practice patterns that would not have been chosen by a fully informed patient, given his or her first-party insurance coverage, and that would not have been taken in the absence of liability. This definition excludes resource misallocations that may be induced by moral hazard on first-party health insurance or asymmetric information in the physician/patient relationship.

26. Studies of automobile injuries (e.g., Landes, 1982; Zador and Lund, 1986; and Cummins and Weiss, 1988) are briefly discussed by Cummins and Weiss elsewhere in this volume (also see Bruce, 1984).

27. Some of the estimated elasticities are implausibly large for major permanent partial injuries.

28. Direct writers use exclusive agents or employees to market their products. Independent agents and brokers have access to more than one insurer.

29. Most large mutuals are direct writers. Reciprocal insurance exchanges and Lloyds associations also account for a small percentage of premiums. For detailed discussion of

alternative organizational forms, see Mayers and Smith (1988).

30. As noted in Section 1, mutual-type insurance schemes also may be advantageous with undiversifiable risk.

31. For medical malpractice, the most highly concentrated of the major property-liability lines, the four-firm concentration ratio exceeds 60% in most states. Danzon (1985b) discusses how higher concentration in medical malpractice is influenced by the prevalence of group coverage sponsored by state medical associations. Joskow (1973) argues that national concentration measures are more appropriate than state measures since most large insurers operate in all states and could readily expand writings in any state.

32. Regulatory prohibitions on the sale and underwriting of insurance by banks, which appear to be eroding, may prevent entry by entities that would employ alternative modes of distribution for some lines of business.

33. Managing general agents have considerable authority to make underwriting and pricing decisions for insurers that they represent. Regulators have recently examined the possible role of managing general agents in insurance company insolvencies. Managing general agents often make risk selection decisions for a fixed percentage of premium revenue. The incentives under these arrangements could be associated with increased default risk for insurers in some instances.

34. Joskow (1973) and others (e.g., Kunreuther, Kleindorfer, and Pauly, 1983) argue that it is difficult for consumers to compare prices, primarily because information from friends and neighbors is unlikely to be useful in view of the dependence of price on differences in risk across consumers. Dahlby and West (1986) (also see Berger, Kleindorfer, and Kunreuther, 1989) provide evidence that suggests that premium variation in auto insurance is influenced by costly search. Costly search for information on premium rates is likely to be less consequential for the commercial market, especially if independent agents are used. In fact, the major problem confronting most consumers may be quality assessment. Costly consumer search has been used to justify solvency regulation for insurers (see below). Costly search associated with the timing and magnitude of claim payments in the absence of insurer default also has received attention (e.g., Smallwood, 1975). The implications of moral hazard and imperfect information for experience rating in liability insurance were briefly discussed in Section 1. Some implications of imperfect information on future claim costs for insurance pricing, price cycles, and pooling of data are discussed below. Work on adverse selection in insurance markets is reviewed elsewhere in this volume.

35. Fair premiums depend on the amount of invested capital in these models because selling insurance (as opposed to operating an investment fund) exposes owners to income tax on investment earnings on capital.

36. For property-liability insurers, accounting returns do not reflect unrealized capital gains on bonds, realized capital gains reflect changes in bond values that occurred in periods prior to the year in which the gain or loss is recognized, and incurred losses are not discounted under either statutory or generally accepted accounting principles. Accounting returns also may be affected by nonrandom reserve errors (Weiss, 1985; also see Harrington, 1988).

37. Berger (1988) provides a simple model of this scenario.

38. Doherty and Kang (1988) argue that cycles in insurer operating results reflect slow adjustment of premiums to changes in the present value of expected future costs. Their analysis seems to imply that cyclical changes in factors such as interest rates cause cycles in operating results, but the relative roles of such changes and slow adjustment are not clear.

39. Venezian (1985) argues that industrywide use of suboptimal forecasting methods could produce cycles.

40. Winter's model predicts a negative relation between price and capital. He reports (1989) some evidence consistent with this prediction using (aggregate) industry data prior to the crisis of 1985-1986, at which time the relationship became positive.

41. Evidence of cycles and experience in the commercial liability insurance market during the 1980s has led to a number of other recent working papers (several of which only contain preliminary analysis and results). See, for example, Gron (1989), Tennyson (1989), and Doherty and Garven (1990).

42. This result would be expected if increased uncertainty raises the amount of capital needed to achieve a given default probability.

43. See Kunreuther, Kleindorfer, and Pauly (1983) for an overview of insurance regulation that also discusses compulsory insurance requirements. Possible conflicts between regulatory goals of reducing rates and promoting solvency have been discussed in many studies.

44. Almost all guaranty funds are financed by post-insolvency assessments on surviving insurers. The scope of coverage is limited. For example, the maximum property-liability claim payable commonly is \$300,000 or less except for workers' compensation claims, which generally are fully covered.

45. A large actuarial literature also analyzes default risk. Portfolio models of property-liability insurance company behavior (e.g., Kahane and Nye, 1975) either treat default risk as exogenously determined or subject to insurer choice, but economic factors that could influence this choice are not emphasized.

46. Doherty (1989) and Tapiero, Kahane, and Jacques (1986) consider insurer capital decisions when demand for coverage depends on default risk. Following Mayers and Smith (1981, 1988), Garven (1987) analyzes default risk within an agency cost framework in which shareholders, managers, sales personnel, and policyholders have different incentives regarding default risk.

47. For background information on insurance rate regulation, see Harrington (1984). Involuntary markets, which are important mainly in auto, workers' compensation, and medical malpractice insurance, include mechanisms such as assigned risk plans and joint underwriting associations. They require joint provision of coverage by insurers at a regulated rate.

48. California and a few other states also enacted rate rollbacks during the last few years.

49. Some evidence of variation in the impact of prior approval regulation across states is provided in several studies, but causes of such variation generally are not analyzed. Pauly, Kleindorfer, and Kunreuther (1986) provide evidence that direct writer market share was significantly lower in states with prior approval regulation and that restrictive rate regulation was associated with lower operating expenses (and presumably lower quality; also see Ippolito, 1979, and Braeutigam and Pauly, 1986).

50. Many states have similar exemptions from state antitrust statutes.

51. Recent policy developments include the filing and subsequent dismissal (based on the McCarran exemption, the state action doctrine, and other grounds) of a federal antitrust suit by a group of state attorneys general, congressional proposals to repeal the industry's antitrust exemption, and a decision by the ISO to cease distributing advisory rates including expense and profit loadings and instead to disseminate developed and trended loss costs. The antitrust suit alleged that the ISO, the Reinsurance Association of America, and a number of insurers and brokers engaged in collusion and boycott when making changes in the standard form of general liability coverage during 1984-1985. The major charges dealt with the inclusion of an optional claims-made form, the inclusion of the retroactive date in

the claims-made form, the exclusion of all coverage for pollution liability, and a proposal (not adopted) to include insurer defense costs within policy limits.

References

- Abraham, Kenneth S. (1988). "Environmental Liability and the Limits of Insurance," *Columbia Law Review* 88, 942-988.
- Angoff, A. (1988). "Insurance Against Competition: How the McCarran-Ferguson Act Raises Prices and Profits in the Property-Casualty Insurance Industry," *Yale J. on Regulation* 5, 397-415.
- Appel, David, Jack D. Worrall, and Richard J. Butler. (1985). "Survivorship and the Size Distribution of the Property-Liability Insurance Industry," *J. of Risk and Insurance* 52, 424-440.
- Berger, Lawrence A. (1988). "A Model of Underwriting Cycles in the Property-Liability Insurance Industry," *J. of Risk and Insurance* 55, 298-306.
- Berger, Lawrence A., Paul R. Kleindorfer, and Howard Kunreuther. (1989). "A Dynamic Model of Price Information in Auto Insurance Markets," *J. of Risk and Insurance* 56, 17-33.
- Biger, Nahum, and Yehuda Kahane. (1978). "Risk Considerations in Insurance Ratemaking," *J. of Risk and Insurance* 45, 121-132.
- Boyer, Marcel, and Georges Dionne. (1987). "The Economics of Road Safety," *Transportation Research* 21B, 413-431.
- Braeutigam, Ronald R., and Mark V. Pauly. (1986). "Cost Function Estimation and Quality Bias: The Regulated Automobile Insurance Industry," *Rand J. of Economics* 17, 606-617.
- Brown, John. (1973). "Toward an Economic Theory of Liability." *J. of Legal Studies* 2, 323-350.
- Bruce, Christopher. (1984). "The Deterrent Effects of Automobile Insurance and Tort Law: A Survey of the Empirical Literature," *Law and Policy* 6, 67-100.
- Butler, Richard J., and Jack D. Worrall. (1983). "Workers' Compensation: Benefit and Injury Claim Rates in the Seventies," *Review of Economics and Statistics* 65, 580-589.
- Calabresi, Guido. (1970). *The Costs of Accidents*. New Haven, Conn.: Yale University Press.
- Calfee, John, and Richard Craswell. (1984). "Some Effects of Uncertainty on Compliance with Legal Standards," *Virginia Law Review* 70, 965-1003.
- Chelius, J. R. (1982). "The Influence of Workers' Compensation on Safety Incentives," *Industrial and Labor Relations Review* 35, 235-242.
- Chin, Audrey, and Mark A. Peterson. (1985). "Deep Pockets, Empty Pockets: Who Wins in Cook County Jury Trials." R-3249-ICJ. Santa Monica, Calif.: The RAND Corporation.
- Clarke, Richard N., Frederick Warren-Boulton, David K. Smith, and Marilyn J. Simon (1988). "Sources of the Crisis in Liability Insurance: An Empirical Analysis," *Yale J. on Regulation* 5, 367-395.

- Coase, Ronald. (1960). "The Problem of Social Cost," *Journal of Law and Economics* 3, 1-44.
- Cook, Philip, and Donald Graham. (1977). "The Demand for Insurance and Protection: The Case of Irreplaceable Commodities," *Quarterly J. of Economics* 91, 143-156.
- Cooter, Robert, and Thomas Ulen. (1987). "The Economic Case for Comparative Negligence," *New York University Law Review* 61, 1067-1110.
- Cooter, Robert. (1988). *Law and Economics*. Glenview, Ill.: Scott Foresman and Co.
- Cooter, Robert, and Daniel L. Rubinfeld. (1989). "Economic Analysis of Legal Disputes and Their Resolution," *J. of Economic Literature* 27, 1067-1097.
- Cummins, J. David. (1988). "Risk-Based Premiums for Insurance Guaranty Funds," *J. of Finance* 43, 823-839.
- Cummins, J. David, and Patricia M. Danzon. (1990). "Price Shocks and Capital Flows in Property-Liability Insurance," Mimeo. University of Pennsylvania.
- Cummins, J. David, and Scott E. Harrington. (1985). "Property-Liability Insurance Rate Regulation: Estimation of Underwriting Betas Using Quarterly Profit Data," *J. of Risk and Insurance* 52, 16-43.
- Cummins, J. David, and Scott E. Harrington. (1987). "The Impact of Rate Regulation on Property-Liability Insurance Loss Ratios: A Cross-Sectional Analysis with Individual Firm Data," *Geneva Papers on Risk and Insurance* 12, 50-62.
- Cummins, J. David, and Francois Outreville. (1987). "An International Analysis of Underwriting Cycles in Property-Liability Insurance," *J. of Risk and Insurance* 54, 246-262.
- Cummins, J. David, and Jack VanDerhei. (1979). "A Note on the Relative Efficiency of Property-Liability Insurance Distribution Systems," *Bell J. of Economics* 10, 709-719.
- Cummins, J. David, and Mary Weiss. (1988) "An Economic Analysis of No-Fault Auto Insurance," Mimeo. University of Pennsylvania.
- Dahlby, Bev, and Douglas S. West. (1986). "Price Dispersion in An Automobile Insurance Market," *J. of Political Economy* 94, 418-438.
- Danzon, Patricia. (1980). "The Disposition of Medical Malpractice Claims," R-2622-HCFA. Santa Monica, Calif.: The RAND Corporation.
- Danzon, Patricia. (1983). "Rating Bureaus in U.S. Property-Liability Insurance Markets: Anti or Pro-Competitive?" *Geneva Papers on Risk and Insurance* 8, 371-402.
- Danzon, Patricia. (1984a). "The Frequency and Severity of Medical Malpractice Claims," *J. of Law and Economics* 27, 115-147.
- Danzon, Patricia. (1984b). "Tort Reform and the Role of Government in Private Insurance Markets," *J. of Legal Studies* 13, 517-549.
- Danzon, Patricia. (1985a). "Liability and Liability Insurance for Medical Malpractice," *J. of Health Economics* 4, 309-331.
- Danzon, Patricia. (1985b). *Medical Malpractice: Theory, Evidence and Public Policy*. Cambridge, Mass.: Harvard University Press.

- Danzon, Patricia. (1986). "New Evidence on the Frequency and Severity of Medical Malpractice Claims," *Law and Contemporary Problems* 49, 57-84.
- Danzon, Patricia. (1990a). "Alternative Liability Regimes for Medical Injuries." *Geneva Papers on Risk and Insurance* 54, 3-21.
- Danzon, Patricia. (1990b). "Liability for Medical Malpractice: Incidence and Incentive Effects." Paper presented at the Rand Conference on Health Economics, March 1990.
- Danzon, Patricia, and Lee Lillard. (1983). "Settlement out of Court: The Disposition of Medical Malpractice Claims," *J. of Legal Studies* 12, 345-378.
- D'Arcy, Stephen, and James R. Garven. (1990). "Property-Liability Insurance Pricing Models: An Empirical Evaluation," *J. of Risk and Insurance* 57, 391-430.
- Dionne, Georges, and Pierre St-Michel. (1991). "Workers' Compensation and Moral Hazard," *Review of Economics and Statistics*, 73, 236-244.
- Doherty, Neil. (1981). "The Measurement of Output and Economies of Scale in Property-Liability Insurance," *J. of Risk and Insurance* 48, 390-402.
- Doherty, Neil. (1989). "On the Capital Structure of Insurance Firms," *Financial Models of Insurer Solvency*. Norwell, MA: Kluwer Academic Publishers.
- Doherty, Neil, and Georges Dionne. (1989). "Risk Pooling, Contract Structure and Organizational Form of Insurance Firms." Mimeo. University of Pennsylvania and University of Montreal.
- Doherty, Neil, and James R. Garven. (1986). "Price Regulation in Property-Liability Insurance: A Contingent Claims Analysis," *J. of Finance* 41, 1031-1050.
- Doherty, Neil, and James R. Garven (1990). "Capacity and the Cyclical of Insurance Markets." Mimeo. University of Pennsylvania and University of Texas.
- Doherty, Neil, and Han Bin Kang. (1988). "Price Instability for a Financial Intermediary: Interest Rates and Insurance Price Cycles," *J. of Banking and Finance* 12, 199-214.
- Eisenach, Jeffrey A. (1985). "The Role of Collective Pricing in Auto Insurance," Staff Report, Bureau of Economics, U.S. Federal Trade Commission.
- Ellis, Randall P., Cynthia L. Gallup, and Thomas G. McGuire. (1990). "Should Medical Professional Liability Insurance be Experience Rated?" *J. of Risk and Insurance* 57, 66-78.
- Epstein, Richard A. (1986). "Product Liability as an Insurance Market," *J. of Legal Studies* 14, 645-669.
- Fairley, William. (1979). "Investment Income and Profit Margins in Property-Liability Insurance: Theory and Empirical Results," *Bell J. of Economics* 10, 192-210.
- Fenn, Paul. (1981). "Sickness Duration, Residual Disability and Income Replacement: An Empirical Analysis," *The Economic Journal* 91, 158-173.
- Finsinger, Jorg, and Mark V. Pauly. (1984). "Reserve Levels and Reserve Requirements for Profit-Maximizing Insurance Firms," *Risk and Capital*. Berlin: Springer-Verlag.

- Garven, James R. (1987). "On the Application of Finance Theory to the Insurance Firm," *J. of Financial Services Research* 1, 57-76.
- Grabowski, Henry, W. Kip Viscusi, and William N. Evans. (1989). "Price and Availability Tradeoffs of Automobile Insurance Regulation," *J. of Risk and Insurance* 56, 275-299.
- Greenwald, Bruce C., and Marnie W. Mueller. (1978). "Medical Malpractice and Medical Costs," *The Economics of Medical Malpractice*. Washington, D.C.: American Enterprise Institute.
- Gron, Anne. (1989). "Capacity Constraints and Cycles in Property-Casualty Insurance Markets." Mimeo. Massachusetts Institute of Technology.
- Haddock, David, and Christopher Curran. (1985). "An Economic Theory of Comparative Negligence," *J. of Legal Studies* 14, 49-72.
- Hansmann, Henry. (1985). "The Organization of Insurance Companies: Mutual versus Stock," *J. of Law, Economics, and Organization* 1, 125-153.
- Harrington, Scott E. (1984). "The Impact of Rate Regulation on Prices and Underwriting Results in the Property-Liability Insurance Industry: A Survey," *J. of Risk and Insurance* 51, 577-617.
- Harrington, Scott E. (1987). "A Note on the Impact of Auto Insurance Rate Regulation," *Review of Economics and Statistics* 69, 737-741.
- Harrington, Scott E. (1988). "Prices and Profits in the Liability Insurance Market," *Liability: Perspectives and Policy*. Washington, D.C.: The Brookings Institution.
- Harrington, Scott E. (1989). "The Efficiency and Equity of Compulsory Automobile Insurance Laws." Mimeo. University of South Carolina.
- Harrington, Scott E., and Patricia M. Danzon. (1986). "An Evaluation of Solvency Surveillance in the Property-Liability Insurance Industry." Schaumburg, Ill.: Alliance of American Insurers.
- Harrington, Scott E., and Patricia M. Danzon. (1990). "Price-Cutting in Liability Insurance Markets." Mimeo. University of Pennsylvania and University of South Carolina.
- Harrington, Scott E., and Robert E. Litan. (1988). "Causes of the Liability Insurance Crisis," *Science* 239, 737-741.
- Harrington, Scott E., and Jack M. Nelson. (1986). "A Regression-Based Methodology for Solvency Surveillance in the Property-Liability Insurance Industry," *J. of Risk and Insurance* 53, 583-605.
- Hill, Raymond D. (1979). "Profit Regulation in Property-Liability Insurance," *Bell J. of Economics* 10, 172-191.
- Hunt, H. Allen, Alan B. Krueger, and John F. Burton, Jr. (1988). "The Impact of Open Competition in Michigan on the Employer's Cost of Worker's Compensation," *Worker's Compensation Insurance Pricing*. Boston: Kluwer.
- Insurance Services Office. (1987). *Insurer Profitability: A Long-Term Perspective*. New York, N.Y.: Insurance Services Office.
- Ippolito, Richard. (1979). "The Effects of Price Regulation in the Automobile Insurance Industry," *J. of Law and Economics* 22, 55-89.
- Joskow, Paul. (1973). "Cartels, Competition, and Regulation in the Property-

- Liability Insurance Industry," *Bell J. of Economics and Management Science* 4, 375-427.
- Kahane, Yehuda, and David J. Nye. "A Portfolio Approach to the Property Liability Insurance Industry," *J. of Risk and Insurance* 42, 579-598.
- Kakalik, James S., and Nicholas M. Pace. (1986). "Costs and Compensation Paid in Tort Litigation," R-3391-ICJ. Santa Monica, Cal.: The RAND Corporation.
- Keeton, William R., and Evan Kwerel. (1984). "Externalities in Automobile Insurance and the Uninsured Driver Problem," *J. of Law and Economics* 27, 149-180.
- Kraus, Alan, and Stephen A. Ross. (1982). "The Determinants of Fair Profits for the Property-Liability Insurance Firm," *J. of Finance* 37, 1015-1030.
- Kunreuther, Howard, Paul R. Kleindorfer, and Mark V. Pauly. (1983). "Insurance Regulation and Consumer Behavior in the United States," *J. of Institutional and Theoretical Economics* 139, 452-472.
- Lacey, Nelson J. (1988). "Recent Evidence on the Liability Crisis," *J. of Risk and Insurance* 55, 499-508.
- Landes, Elizabeth M. (1982). "Insurance, Liability, and Accidents: A Theoretical and Empirical Investigation of the Effects of No-Fault Accidents," *J. of Law and Economics* 25, 49-65.
- Landes, William M., and Richard Posner. (1981). "The Positive Economic Theory of Tort Law," *Georgia Law Review* 15, 851-924.
- Landes, William M. (1987). *The Economic Structure of Tort Law*. Cambridge, Mass.: Harvard University Press.
- McDonald, James B. (1988). "Predicting Insurance Insolvency Using Generalized Qualitative Response Models." Mimeo. Brigham Young University.
- McGee, Robert T. (1986). "The Cycle in Property/Casualty Insurance," *Federal Reserve Bank of New York Quarterly Review* 22-30.
- Marshall, John M. (1974). "Insurance Theory: Reserves versus Mutuality," *Economic Inquiry* 12, 476-492.
- Mayers, David, and Clifford W. Smith, Jr. (1981). "Contractual Provisions, Organizational Structure, and Conflict Control in Insurance Markets," *J. of Business* 54, 407-434.
- Mayers, David, and Clifford W. Smith, Jr. (1982). "On the Corporate Demand for Insurance," *J. of Business* 55, 281-296.
- Mayers, David, and Clifford W. Smith, Jr. (1988). "Ownership Structure Across Lines of Property-Casualty Insurance," *J. of Law and Economics* 31, 351-378.
- Munch, Patricia. (1977). "The Costs and Benefits of the Tort System if Viewed as a Compensation System," P-5921. Santa Monica, Cal.: The RAND Corporation.
- Munch, Patricia, and Dennis Smallwood. (1980). "Solvency Regulation in the Property-Liability Insurance Industry: Empirical Evidence," *Bell J. of Economics* 11, 261-282.
- Munch, Patricia, and Dennis Smallwood. (1982). "Theory of Solvency Regulation in the Property and Casualty Insurance Industry," *Studies in Public Regulation*. Cambridge, Mass.: MIT Press.

- Myers, Stewart C., and Richard A. Cohn. (1986). "A Discounted Cash Flow Approach to Property-Liability Insurance Rate Regulation," *Fair Rate of Return in Property-Liability Insurance*. Boston, Mass.: Kluwer.
- National Association of Insurance Commissioners (NAIC). (1980). *Malpractice Claims*. Brookfield, Wis.: NAIC.
- National Conference of Insurance Guaranty Funds (NCIGF). (1990). *State Insurance Guaranty Funds and Insurance Company Insolvency Assessment Information 1969-89*. Columbus, Oh.: NCIGF.
- Nye, Blain F., and Alfred E. Hofflander. (1988). "Experience Rating in Medical Professional Liability Insurance," *J. of Risk and Insurance* 60, 150-157.
- Oi, Walter. (1973). "The Economics of Product Safety," *Bell J. of Economics* 4, 3-28.
- Pauly, Mark V., Paul R. Kleindorfer, and Howard Kunreuther. (1986). "Regulation and Quality Competition in the U.S. Insurance Industry," *The Economics of Insurance Regulation*. London: MacMillan Press.
- Polinsky, A. Mitchell. (1980). "Strict Liability vs. Negligence in a Market Setting," *American Economic Review* 70, 363-370.
- Polinsky, A. Mitchell. (1983) *An Introduction to Law and Economics*. Boston, Mass.: Little-Brown.
- Polinsky, A. Mitchell, and Daniel L. Rubinfeld. (1988). "The Welfare Implications of Costly Litigation," *J. of Legal Studies* 17, 151-164.
- Posner, Richard. (1972) "A Theory of Negligence," *J. of Legal Studies* 2, 205-221.
- Posner, Richard. (1973). *Economic Analysis of Law*. Boston, Mass.: Little-Brown.
- Posner, Richard. (1986). *Economic Analysis of Law*, 3rd ed. Boston, Mass.: Little-Brown.
- Priest, George. (1987). "The Current Insurance Crisis and Modern Tort Law," *Yale Law J.* 96, 1521-1590.
- Rea, Samuel. (1981). "Lump Sum versus Periodic Damage Awards," *J. of Legal Studies* 10, 131-154.
- Reynolds, Roger A., John A. Rizzo, and Martin L. Gonzalez. (1987). "The Cost of Medical Professional Liability," *J. of the American Medical Association* 257, 2776-2781.
- Rizzo, John A. (1989). "The Impact of Medical Malpractice Insurance Rate Regulation," *J. of Risk and Insurance* 56, 482-500.
- Rolph, John E. (1981). "Some Statistical Evidence on Merit Rating in Medical Malpractice Insurance," *J. of Risk and Insurance* 48, 247-260.
- Rubinfeld, Daniel L. (1984). "On the Optimal Magnitude and Length of Liability in Torts," *J. of Legal Studies* 15, 551-563.
- Rubinfeld, Daniel L. (1987). "The Efficiency of Comparative Negligence," *J. of Legal Studies* 16, 375-394.
- Ruser, John H. (1986). "Workers' Compensation Insurance, Experience Rating and Occupational Injuries," *Rand J. of Economics* 16, 487-503.

- Schwartz, Gary. (1983). "New Products, Old Products, Evolving Law, Retroactive Law," *New York University Law Review*. 58, 796-840.
- Shavell, Steven. (1979). "On Moral Hazard and Insurance," *Quarterly J. of Economics* 93, 541-562.
- Shavell, Steven. (1980). "Strict Liability versus Negligence," *J. of Legal Studies* 9, 1-25.
- Shavell, Steven. (1982). "On Liability and Insurance," *Bell J. of Economics* 13, 120-132.
- Shavell, Steven. (1986). "The Judgment Proof Problem," *International Review of Law and Economics* 6, 45-58.
- Shavell, Steven. (1987) *Economic Analysis of Accident Law*. Cambridge, Mass.: Harvard University Press.
- Sloan, Frank A., Paula M. Mergenhagen, and Randall R. Bovbjerg. (1989). "Effects of Tort Reforms on the Value of Closed Medical Malpractice Claims: A Microanalysis," *J. of Health Politics, Policy, and Law* 14, 663-689.
- Sloan, Frank A., Paula M. Mergenhagen, W. Bradley Burfield, Randall R. Bovbjerg, and Mahmud Hassan. (1989). "Medical Malpractice Experience of Physicians," *J. of American Medical Association* 262, 3291-3297.
- Smallwood, Dennis. (1975). "Competition, Regulation, and Product Quality in the Automobile Insurance Industry." In Almarin Phillips, ed., *Promoting Competition in Regulated Markets*. Washington, D.C.: The Brookings Institution. 241-299.
- Smith, Michael L. (1989). "Investment Returns and Yields to Holders of Insurance," *J. of Business* 62, 81-98.
- Spence, Michael. (1977). "Consumer Misperceptions, Product Failure and Product Liability," *Review of Economic Studies* 64, 561-572.
- Stewart, Richard E. (1987). *Remembering a Stable Future: Why Flex Rating Cannot Work*. New York: Insurance Services Office and Insurance Information Institute.
- Tapiero, Charles S., Yehuda Kahane, and Laurent Jacques. (1986). "Insurance Premiums and Default Risk in Mutual Insurance," *Scandinavian Actuarial J.* 82-97.
- Tennyson, Sharon. (1989). "Capacity Constraints and Cycles in Property-Casualty Insurance Markets." Mimeo. Northwestern University.
- Thaler, Richard, and Sherwin Rosen. (1976). "The Value of Saving a Life: Evidence from the Labor Market." In N. Terleckyz, ed. *Household Production and Consumption*. NBER Studies in Income and Wealth no. 40. New York: Columbia University Press.
- Venezian, Emilio. (1984). "Are Insurers Under-Earning?" *J. of Risk and Insurance* 51, 150-156.
- Venezian, Emilio. (1985). "Ratemaking Methods and Profit Cycles in Property and Liability Insurance," *J. of Risk and Insurance* 52, 477-500.
- Viscusi, W. Kip. (1983). *Risk by Choice: Regulating Health and Safety in the Workplace*. Cambridge, Mass.: Harvard University Press.

- Viscusi, W. Kip. (1989). "The Interaction between Product Liability and Workers' Compensation as Ex Post Remedies for Workplace Injuries," *J. of Law, Economics, and Organization* 5, 185-209.
- Viscusi, W. Kip, and Michael J. Moore. (1987). "Workers' Compensation: Wage Effects, Benefit Inadequacies and the Value of Health Losses," *Review of Economics and Statistics* 69, 249-261.
- Weiss, Mary. (1985). "A Multivariate Analysis of Loss Reserving Estimates in Property-Liability Insurers," *J. of Risk and Insurance* 52, 199-221.
- Winter, Ralph A. (1988). "The Liability Crisis and the Dynamics of Competitive Insurance Markets," *Yale J. on Regulation* 5, 455-499.
- Winter, Ralph A. (1989). "The Dynamics of Competitive Insurance Markets." Mimeo. University of Toronto.
- Worrall, John D., and David Appel. (1982). "The Wage Replacement Rate and Benefit Utilization in Workers' Compensation Insurance," *J. of Risk and Insurance* 49, 361-371.
- Zador, Paul, and Adrian Lund. (1986). "Re-Analysis of the Effects of No-Fault Auto Insurance on Fatal Crashes," *J. of Risk and Insurance* 50, 631-669.
- Zeckhauser, Richard. (1970). "Medical Insurance: A Case Study of the Tradeoff Between Risk Spreading and Appropriate Incentives," *J. of Economic Theory* 2, 10-26.

MORAL HAZARD AND INSURANCE CONTRACTS

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Abstract

This essay synthesizes and extends the theory of optimal insurance under moral hazard, with a focus on the form of insurance contracts. The simplest model illustrates the most fundamental result: that the market responds to moral hazard with partial insurance coverage. But this model is not general enough to predict the contractual form of this response. The most general model, the Principal-Agent model, yields mostly negative results. In extending the theory, I adopt an intermediate approach, distinguishing between moral hazard on the probability of an accident and moral hazard on the size of the loss. This approach generates predictions as to when deductibles, coinsurance and coverage limits will be observed. The essay reviews as well moral hazard with a partially informed insurer and dynamic models of moral hazard. It concludes with a discussion of open questions in the theory of moral hazard and insurance.

Key words: moral hazard, insurance, principal-agent, contracts

Moral hazard refers to the detrimental effect that insurance has on an individual's incentives to avoid losses. A car theft, an accident, or a house fire may not be completely avoidable, but the probability or size of the loss involved is almost always influenced by an individual's actions.

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