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Product Liability Litigation With Risk Averson

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PRODUCT LIABILITY LITIGATION WITH RISK AVERSION

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I. INTRODUCTION

THE recent law and economics literature has directed much energy toward identifying the various factors that determine whether parties will litigate or settle accident claims.[1] The substantive interest in this area rests in large measure on the obvious element of conflict in all these cases: the plaintiff is trying to obtain reimbursement for his losses from the defendant, which the defendant wishes to avoid paying. The strategic structure of their interaction is quite complex because the outcomes of bringing claims are heavily influenced by the costs, usually substantial, of both bargaining and litigating. The game between plaintiff and defendant is nonzero sum; indeed, it is negative sum. Playing it successfully requires the parties to consider both the competitive and the cooperative elements in their behavior.

The types of action that the parties can take in this environment are quite diverse, as is illustrated by the product liability cases that are the subject of this paper. Once a claim is filed, the claimant must decide whether to pursue the claim to a court verdict, to drop the claim, or to settle out of court. Going to court is a more costly battlefield, so the incentive to settle out of court is very strong. If an out-of-court settlement

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[1] Among the major theoretical contributions to this area are papers by William M. Landes, An Economic Analysis of the Courts, 14 J. Law & Econ. 61 (1971); Richard A. Posner, An Economic Approach to Legal Procedure and Judicial Administration, 2 J. Legal Stud. 399 (1973); John P. Gould, The Economics of Legal Conflicts, 2 J. Legal Stud. 279 (1973); and Patricia Munch Danzon & Lee A. Lillard, Settlement Out of Court: The Disposition of Medical Malpractice Claims, 12 J. Legal Stud. 345 (1983).

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is an option, the claimant must decide how much he is willing to accept, and the producer of the product involved must make an analogous decision.

In addition to being a sequential play game, the litigation process takes on added interest since the mix of cases observed at each stage will be determined by a nonrandom selection process.[2] As a consequence, when we observe patterns of behavior, such as the plaintiff's propensity to win a suit, we must take into account that the mix of cases that we observe has been influenced by decisions at an earlier stage either to settle or drop a claim. Differences in the parties' risk aversion will affect this mix by introducing an asymmetry into the payoffs of the two parties.

Although there have been a number of conceptual analyses of the litigation process, these studies have all made the simplifying assumption that claimants and defendants are risk neutral. Because of the substantial variation in possible payoffs from a claim, in practice the presence of a payoff lottery rather than a certain reward for one's claim should be of substantial consequence, particularly for claimants who are unable to diversify their holdings.

The degree to which there is strong evidence of claimant risk aversion also may affect how we view the current product liability crisis. The rising frequency of product liability claims and increases in settlement levels have made the legal system a prominent force in creating financial incentives for safer products. If, however, there is evidence of a dominant role of risk aversion, so that claimants are willing to settle for much less than their expected court award when the variance in the court outcomes is large, then one might question the extent to which the legal system addresses claimants' needs. Strong evidence of risk aversion may also change how we view the increased size of product liability awards, since, even with recent increases, claimants will remain at a disadvantage if there are differences in claimant and defendant risk aversion with respect to the litigation lottery.

The extent to which evidence of risk aversion raises such doubts about the efficacy of tort liability remedies for product-related injuries hinges in large part on whether court-awarded verdicts are socially optimal. If these verdicts are excessive, then a dampening of settlement levels below these amounts would not necessarily lead to inadequate levels of compensation.

[2] The seminal case selection paper is that of George L. Priest & Benjamin Klein, The Selection of Disputes for Litigation, 13 J. Legal Stud. 1 (1984). For elaborations on this approach and variations of it, see Donald Wittman, Is the Selection of Cases for Trial Biased? 14 J. Legal Stud. 185 (1985); and George L. Priest, Reexamining the Selection Hypothesis: Learning from Wittman's Mistakes, 14 J. Legal Stud. 215 (1985). I present an empirical exploration of these issues for the product liability case in W. Kip Viscusi, The Determinants of the Disposition of Product Liability Claims and Compensation for Bodily Injury, 15 J. Legal Stud. 321 (1986).

Indeed, in this instance, risk aversion may serve to correct the excesses of the tort liability system.

Risk aversion also has implications for the way in which we model litigation behavior. In this paper, I will outline how the decisions to drop and to settle a claim are affected by risk aversion, as well as how risk aversion affects the settlement amounts.

The empirical tests of the role of risk aversion will entail the use of a sample of over 10,000 closed product liability claims. The principal result is that both the expected awards and the variance in these awards have the influence one would predict; the risk aversion of claimants is greater than that of defendants. However, risk aversion does not appear to be overly weighty. Rather, in terms of the magnitudes of the effects, it is the expected rewards variable that is dominant, which suggests that risk aversion does not play an overwhelming role in modifying claimants' behavior.

II. A Model of the Litigation Process with Risk Aversion

The series of decisions involved in the litigation process can be analyzed by assuming optimizing behavior by the company that produced the product as well as by the claimant, who, in this case, has suffered a product-related loss. The most convenient procedure for analyzing the series of decisions involved is to proceed using the standard dynamic programming technique of backward induction. In particular, I will consider the final stages of the litigation process first and then investigate how the outcomes at these stages are influenced by earlier decisions.

It should be emphasized that the model I am developing is by necessity less complicated than some others that have appeared in the literature. My purpose is to devise a framework that can be estimated empirically rather than to produce an elaborate model that is of interest only because of its theoretical structure. Thus, my intent is to structure the model in as parsimonious a fashion as possible, while at the same time retaining enough of the key elements of the theoretical structure to capture the most salient aspects of the litigation process. Apart from the role of risk aversion in the analysis and the introduction of factors pertinent to empirical estimation, the general spirit of the model developed below follows an approach to the litigation decision that is broadly consistent with a substantial body of research in the law and economics field.

The Court Verdict

If the parties do not settle the claim, or if the plaintiff does not drop the claim, the parties' rewards will be governed by the size of the court verdict and the associated litigation costs. Consider first the rewards to

the plaintiff. For simplicity, assume that the plaintiff perceives a probability p of winning the case and receiving an award V, and he has a probability $1 - p$ of losing the case. To generalize from this a distribution of multiple possible payoff levels is straightforward, but complicates the analysis unnecessarily. The defendant also incurs litigation costs C.

The court verdict is solely relevant in the influence it exerts on the parties' expectations in previous stages of the claims process. The role of claimant risk aversion does not enter the analysis of court outcomes since, once a decision has been made to proceed to a verdict, the outcome will not be affected by the degree of risk aversion.[3] Since I have considered the determinants of the probability of the claimant's winning a lawsuit and the magnitude of the court award for my sample of product liability cases in my earlier product liability analysis,[4] I will focus in this paper on the influence of risk aversion on the earlier stages of the claims process.

If the plaintiff is risk neutral, the rewards associated with proceeding to a court verdict will be governed by the expected payoff $pV - C$. The presence of this lottery, and the possible high variability in the payoff, will make a risk-averse plaintiff value going to court at an amount below its expected value. More specifically, the certainty equivalent CE_{1c} of going to court will be below the expected value by some insurance premium R_1 or

$$CE_{1c} = pV - C - R_1. \tag{1}$$

For purposes of the empirical estimation, I will assume that R_1 is related both to the variance of the payoffs σ^2 and to the Pratt-Arrow[5] measure of absolute risk aversion A for this lottery by the relation

$$R_1 \approx (1/2)\sigma^2 A. \tag{2}$$

If claimants' preferences are characterized by constant absolute risk aversion, then the formulation above is valid regardless of the distribution of payoffs to the litigation process.

In practice, the measure of absolute risk aversion might be decreasing rather than constant, so that willingness to engage in legal lotteries might increase with wealth. The absence of a claimant wealth variable in the data set I will utilize necessitates the use of the formulation in equations

[3] The mix of cases that proceed to a court verdict will, of course, be affected by risk aversion. I will analyze this influence through the effect of risk aversion on the incentive to settle or drop claims.

[4] See Viscusi, *supra* note 2.

[5] See John Pratt, Risk Aversion in the Small and the Large, 30 Econometrica 122 (1964); and Kenneth Arrow, Essays in the Theory of Risk Bearing (1971).

(1) and (2). If there is not substantial heterogeneity in the wealth of the claimants, this approach will provide a good approximation of what would be found with a wealth-dependent measure. Moreover, the constant risk-aversion assumption implies that the utility function is a negative exponential of the form $a - be^{-dX}$, where X is the claimant's asset position.[6] This utility function is commonly used both in conceptual analyses and in empirical applications, so that the framework adopted is well within the usual practices in the empirical risk-economics literature. A final factor leading to the adoption of this specification is that, if the payoffs are distributed lognormally, and if preferences satisfy constant relative risk aversion—thus permitting wealth-related variations in risk aversion—then one is also led to a formulation that is fairly similar.[7]

The defendant in a product liability case is typically a large firm or its insurer and, as a result, may be risk neutral when evaluating a lottery involving even a potentially large claim of $1,000,000 or more.[8] Even in the case of a risk-averse firm, one would expect its insurance premium R_2 to be less than the claimant's value of R_1. The value of R_2 will be governed by a proportionality relation identical to that in equation (2) for R_1, but we should expect that empirically R_1 will exceed R_2.

Let q be the firm's perceived probability that the claimant will win the case, where q may equal p but need not. If D represents the firm's litigation costs, then the firm's certainty equivalent CE_{2c} of going to court is

$$CE_{2c} = -qV - D - R_2. \tag{3}$$

The Drop Decision

At various stages in the litigation process, the claimant must decide whether to pursue his claim. Before going to court, the claimant must decide whether it is worthwhile to incur the legal expenses involved.[9] The claimant will drop the case if the certainty equivalent CE_{1c} associated with going to court is negative, or

[6] For discussion of the utility function, see Ralph Keeney & Howard Raiffa, Decisions with Multiple Objectives: Preferences and Value Tradeoffs (1976), at 159–72.

[7] The main difference is that it is the natural log of the certainty equivalent that will be related to the mean and variance terms. For a discussion of this result in a different context, see Michael J. Moore, Three Essays in Labor Economics (unpublished Ph.D. dissertation Univ. Michigan, 1984), and, for empirical support of the constant relative risk aversion assumption, see Marshall Blume & Irwin Friend, The Asset Structure of Individual Portfolios and Some Implications for Utility Functions, 30 J. Finance 585 (1975).

[8] My implicit assumption is that the firm views this award in isolation, not as a precedent that will affect future awards.

[9] The approach here simplifies the drop decision somewhat since the plaintiff also could choose to drop the case after taking it to court, particularly if the trial is long.

$$CE_{1c} < 0.$$

This drop decision will be the focus of the empirical analysis.

Estimation of the drop probability is not straightforward, however, since the components of CE_{1c} are not directly observable. Instead, we will use a proxy AVEPAYOFF for the term pV, a proxy VARPAYOFF for the claimant's insurance premium term R_1, and a vector of variables $\mathbf{Z}$ to capture litigation costs and omitted aspects of the claimant's prospects. Rather than observing CE_{1c}, we observe related variables, so that

$$CE_{1c} = CE^*_{1c} + u_1 = \beta_1 AVEPAYOFF + \beta_2 VARPAYOFF + \mathbf{Z}'\boldsymbol{\beta}_3 + u_1,$$

where u_1 is a random error term.

The drop probability will be given by

$$pr(DROP) = pr(-u_1 > CE^*_{1c}) = [1 + \exp(-CE^*_{1c})]^{-1}, \qquad (4)$$

provided that the drop probability can be characterized by assuming a logistic probability function.

The Settlement Decision

The claimant and defendant may settle the claim out of court if there is a potential gain for both parties in doing so rather than in going to court. In setting the reservation settlement level for this bargaining process, the claimant will require a payment of at least CE_{1c}, since he can earn this certainty equivalent by going to court. If CE_{1c} is negative, he can drop the case. As a result, the claimant's reservation settlement S_1 is given by

$$S_1 = \max(0, CE_{1c}).$$

For concreteness, I will focus on the situation where CE_{1c} is positive. A claimant can potentially settle with the firm for a positive amount even though his certainty equivalent of proceeding to court may be negative since settlements need not be at the reservation settlement level. In that instance, the pertinent S_1 value for the analysis below is zero, and the results are modified accordingly.

The company's maximum offer S_2 to the defendant equals what it expects to lose by going to court, in terms of the expected settlement, its risk premium, and the associated court costs, or

$$S_2 = -CE_{2c} = qV + D + R_2.$$

If S_2 exceeds S_1, there will be the potential for an out-of-court settlement that will enhance the welfare of both parties. There is no assurance, however, that such a settlement will be reached in practice. This analysis

is based on the assumption that the parties will behave rationally in terms of their own perceived rewards.

A necessary condition for the claim to be settled out of court is that

$$0 < S_2 - S_1 = (q - p)V + R_1 + R_2 + C + D.$$

If the probabilistic beliefs regarding the claimant's chance of success are identical, the expected court award serves simply as a transfer between two parties and V nets out of the analysis. The presence of the claimant's risk-premium term R_1, and the defendant's risk-premium term R_2, both create an incentive for an out-of-court settlement, as do the two litigation cost terms. Indeed, there will only be a desire to go to court if the claimant's perceived probability of success p exceeds the defendant's assessment q by a sufficient amount.

The values of S_1 and S_2 are not directly observable, but we can establish proxies for them as was done for CE_{1c} above. In particular, let

$$S_1 = S_1^* + u_2 = \beta_4 \text{AVEPAYOFF} + \beta_5 \text{VARPAYOFF} + \mathbf{Z}_1'\boldsymbol{\beta}_6 + u_2,$$

and

$$S_2 = S_2^* + u_3 = \beta_7 \text{AVEPAYOFF} + \beta_8 \text{VARPAYOFF} + \mathbf{Z}_2'\boldsymbol{\beta}_9 + u_3,$$

where AVEPAYOFF and VARPAYOFF are proxies for the expected court award and its variance, and $\mathbf{Z}_1$ and $\mathbf{Z}_2$ are vectors of variables that measure both the associated court costs and omitted aspects of the court verdict not captured by AVEPAYOFF and VARPAYOFF.

The probability that the parties will settle the claim out of court is given by

$$\text{pr(SETTLE)} = \text{pr}[u_2 - u_3 \leq S_2^* - S_1^*],$$

or in terms of the logit equation to be estimated,

$$\begin{aligned} \text{pr(SETTLE)} = \{1 + \exp[-(\beta_7 - \beta_4)]\text{AVEPAYOFF} \\ - (\beta_8 - \beta_5)\text{VARPAYOFF} - \mathbf{Z}_2'\boldsymbol{\beta}_9 + \mathbf{Z}_1'\boldsymbol{\beta}_6\}^{-1}. \end{aligned} \tag{5}$$

Settlement Level

If the parties settle out of court and behave rationally, settlement level will be in the range (S_1, S_2), assuming that S_2 is not below S_1 and that $S_1 \geq 0$. Where they settle within this range will depend on the bargaining power of the two parties. One can view the eventual settlement as being a weighted average of S_1 and S_2, where there is some weight w on S_1 and $1 - w$ on S_2 that reflects the parties' respective bargaining power. One

can then write the observed settlement level PAY for the bodily injury cases to be examined in this study as

$$\text{PAY} = wS_1 + (1 - w)S_2,$$

or

$$\begin{aligned}\text{PAY} = {} & [wp + (1 - w)q]V - wR_1 \\ & + (1 - w)R_2 - wC + (1 - w)D.\end{aligned} \tag{6}$$

If parties have equal bargaining power ($w = .5$), and if the plaintiff's risk premium is greater (that is, $R_1 > R_2$, as one would expect), then the net effect of risk aversion will be to decrease observed settlement levels.

As before, we will utilize a set of variables that measures these components of PAY with some error, or

$$\text{PAY} = \beta_{10}\text{AVEPAYOFF} + \beta_{11}\text{VARPAYOFF} + \mathbf{Z}_3'\boldsymbol{\beta}_{12} + u. \tag{7}$$

Early Drop Decisions

The claimant may choose to drop his claim at a very early stage. If bargaining for an out-of-court settlement is costless, as has been modeled above, the claimant will have no reason to drop his claim before it reaches the stage of having to go to court. The extent of out-of-court negotiation will vary with the particular circumstances, and the claimant may choose not to pursue the claim further.

Suppose that the out-of-court bargaining is not costless but will impose a cost G on the claimant. In addition, let s be the claimant's perceived probability that an out-of-court settlement will be reached and $1 - s$ be the probability that the case goes to court. Then the plaintiff will not engage in bargaining in order to reach an out-of-court settlement if

$$0 > s\text{PAY} + (1 - s)\max(0, \text{CE}_{1c}) - G - R_0,$$

where R_0 is some risk premium associated with this lottery. The role of the substantive variables in such a decision will be similar to that in equation (4) above. For example, higher values of AVEPAYOFF should raise PAY and CE_{1c}, lowering the DROP probability. VARPAYOFF will have the opposite effect.

If settlement bargaining is viewed as being too costly, the parties proceed directly to the go-to-court/drop-case decision that takes the form specified by equation (4) above, regardless of whether there is a decision to engage in pretrial bargaining. As a result, there is no loss in generality (in terms of the analysis of the drop decision) by focusing on a decision made just before going to court. What is omitted from the analysis is an

estimation of the decision to engage in bargaining to obtain an out-of-court settlement.

The Empirical Model

The empirical estimation will focus on three equations: the drop probability (eq. (4)), the settlement probability (eq. (5)), and the size of the out-of-court settlement (eq. (7)). These are the three outcomes that will be most directly affected by claimant risk aversion. Other issues could have been addressed but have not. For example, one could explore how risk aversion affected the mix of cases that went to trial and what the court awards would have been had these cases been litigated.[10] Thus, the empirical analysis below does not reflect an exhaustive analysis of all of the ramifications of risk aversion, but it does touch on the most prominent manifestations of its influence.

III. The Sample and the Variables

The empirical analysis utilizes a very rich set of data on product liability claims. The Insurance Services Office (ISO) Product Liability Closed Claims Survey[11] used for the analysis includes information on the disposition of the claim, the size of the settlement, and other key variables in the analysis. As in my earlier paper,[12] my analysis will focus on the claims in the sample involving bodily injury. Since the sample characteristics are identical to those in my earlier paper, they will not be reported here.[13]

The sample for the survey was quite extensive, as it included data on 10,784 bodily injury claims from twenty-three insurance companies. Claims were from all fifty states. They were closed between the latter half of 1976 and mid-1977. This time period is after the advent of fundamental changes in modern product liability doctrines and, in particular, the emergence of strict liability and the evolution in the concept of a design defect.[14] Nevertheless, the mass tort cases had not yet closed, so that the

[10] Apart from the role of risk aversion, the structure of these issues could be addressed with the framework developed by Danzon & Lillard, *supra* note 1. However, for the reasons discussed in Viscusi, *supra* note 2, I have chosen not to do so. Most important is that exploration of this set of issues entails a number of restrictive assumptions.

[11] The data tapes used contain information that is summarized in a survey volume by the Insurance Services Office, Product Liability Closed Claims Survey (1977).

[12] See Viscusi, *supra* note 2.

[13] In particular, see the full sample statistics in table 1 of Viscusi, *supra* note 2.

[14] For a history of these developments, see Richard A. Epstein, Modern Products Liability Law: A Legal Revolution (1980); and George L. Priest, The Invention of Enterprise Liability: A Critical History of the Intellectual Foundations of Modern Tort Law, 14 J. Legal Stud. 461 (1985).

legal landscape of a decade ago was not identical to that of today.[15] Since my focus is on claimants' responses to financial risks rather than on liability doctrines per se, this continued evolution in product liability law is not central to the analysis here.

The first decision analyzed is whether the claim was dropped, which is captured by a 0 − 1 dummy variable (dv) DROP that takes on a value of one if the claim is dropped. About one-fifth of all claims are dropped. The most prevalent outcome is to settle the claim out of court, which is captured by the SETTLE dv. About three-fourths of all claims are resolved in this fashion. The remaining claims are those that go to a court verdict—an outcome that arises in only 4 percent of all cases.

The bodily injury compensation received by the claimant, which is possibly zero, is given by PAY. On average, the claimants receive compensation just below $10,000. This actual rewards variable will be coupled with two variables constructed using the health effect of the accident on the individual.

These two explanatory variables are AVEPAYOFF, which is a proxy for the expected court verdict, and VARPAYOFF, which is a proxy for its variance. Since the claimant's insurance premium is a linear function of the variance of the lottery outcomes (from eq. (2)), VARPAYOFF will serve as a proxy for the insurance premium associated with the claim payoff lottery.

The AVEPAYOFF and VARPAYOFF variables were constructed in the following fashion. The expected court verdict pV was not the focus of the analysis since the number of claims settled in court was small, and there is a sample selection bias affecting such claims. Instead, I utilized both court awards and out-of-court settlements. Out-of-court settlements will differ from the court awards only by the role of the risk premiums if legal costs and perceptions of the relative bargaining power of the parties are identical (from eq. (6), where $w = .5$, and $C = D$).[16] Moreover, if the

[15] The claims performance in terms of the amount of compensation does not appear to have changed greatly through 1979. For a comparison of the ISO data with 1979 statistics compiled in the Alliance of American Insurers, Highlights of Large-Loss Product Liability Claims (1980), see W. Kip Viscusi, Alternative Approaches to Valuing the Health Impacts of Accidents: Liability Law and Prospective Evaluations, 46 J. L. & Contemp. Probs., 49, (No. 4, 1983). The emergence of mass tort claims and their effect is addressed by Richard Epstein, The Legal and Insurance Dynamics of Mass Tort Litigation, 13 J. Legal Stud. 475 (1984); and W. Kip Viscusi, Structuring an Effective Occupational Disease Policy: Victim Compensation and Risk Regulation, 2 Yale J. Reg. 53 (1984).

[16] Thus, the statistics reflect the expected payoff over all claims. If one wished to address the more difficult issues, such as what a settled claim might have received had it gone to court, one can use the more complex structural model described in Danzon & Lillard, *supra* note 1.

risk premiums are also identical, settlements will equal expected court awards.

These dollar values were then matched to nineteen accident categories (for example, poisonings, lacerations), each of which was segmented into two groups—fatal and nonfatal accidents. For each health-mortality status category, I constructed the average payoff to the claimant (AVEPAYOFF) and its variance (VARPAYOFF), which served as the key financial reward variables in the empirical analysis. To facilitate the reporting of the results, VARPAYOFF is the variance of the health category's payoffs multiplied by 10^{-8}.[17]

It should be emphasized that use of AVEPAYOFF and particularly of VARPAYOFF as proxies for the individual's perceived expected awards and awards variance involves substantial measurement error. The empirical measure being used reflects the nationwide variation rather than simply the local variation. Since these are likely to be important regional differences in law, in the odds of successful litigation for a given injury, and in the awards levels, the VARPAYOFF measure will overstate the true variance in any particular state. A second source of bias, which operates in the opposite direction, is that, to the extent that settlements are influenced by risk aversion, the VARPAYOFF measure will already imbed the net influence of the claimant's and the defendant's risk aversion, biasing the measure downward if claimant risk aversion is of greater consequence.

No previous analysis has investigated the effect of the VARPAYOFF variable or other related measures of the dispersion in outcomes. The mean rewards have received more scrutiny in the medical malpractice literature. There, notably, Danzon and Lillard[18] found that increases in the level of the potential verdict increased claimants' reservation acceptance values, raised defendants' maximum offer amounts, and raised the overall settlement size. The results developed here on the basis of product liability cases indicate that there is also the expected effect on specific components of the litigation process and that the variance of the awards is also consequential.

The explanatory variables also include measures related to the likely economic loss associated with the health outcome, the costs associated with litigating a claim, and the legal prospects of the case, all of which affect both the probability of a claimant's success and his likely litigation costs. The variables of this type were the claimant's age (AGE), whether

[17] The mean value of AVEPAYOFF is $9,995.01, and its standard deviation is 18,375.3, whereas, for VARPAYOFF, the mean value is 49.0, and its variance is 103.9.

[18] See Danzon & Lillard (1983).

the claimant was male (MALE dv), and whether the claimant was married (MARR dv).

Only 13 percent of all claims are job related. Since workers' compensation is the exclusive remedy in the case of workers injured because of actions by the employer, these product liability claims are typically third-party lawsuits. For example, a worker suffering from asbestosis contracted while working in an automobile brake factory can sue the asbestos manufacturer. Many work-related product liability claims are filed by the employers acting under the subrogation rights rather than by the worker.

In the case of a claim on behalf of the victim of a fatal accident (DEATH dv), the health effect is both severe and unambiguous, thus strengthening the validity of the case. A death may have the opposite influence as well if there are no heirs to press the case or if there are no individuals who would suffer financial losses that need compensation. In contrast, if the injury involves scarring (SCAR dv) there is a clear-cut injury that goes beyond the financial loss, and the injured party is able to pursue the claim. Scarring also presents visible evidence to support possible compensation for pain and suffering.

One monetary variable that was included may serve as a proxy for nonmonetary, legal concerns. If the claimant has received collateral private insurance payments for his injury already (COLLATERAL dv), such payments might be a signal of a legitimate claim. They also indicate that the claimant has filed multiple claims for the same injury, possibly joining as defendants firms with only a tangential relation to the injury.

Several legal variables were also examined. By far, the most important was the legal basis for the claim—whether it was based on strict liability (STRICT dv), absolute liability (ABSOLUTE dv), negligence (NEGLECT dv), or breach of warranty, which was always omitted from the equations to prevent singularities. Absolute liability is a little-used liability criterion that permits no defenses to defeat liability. The recent emergence of strict liability principles is generally believed to boost the claimant's chance of success and to lower the costs associated with proving its case.[19] Chief among the other legal variables also included is whether the product was in violation of OSHA or CPSC standards. Evidence of such violations enhances the claimant's prospects of ultimate success since the law gives an advantage to claimants in situations of statutory violations.[20] The REG dv used to capture these regulatory effects assumed a value of one if the product violated either set of regulations and was zero otherwise. A related dummy variable (DESIGN) took on a value of one only if

[19] W. Page Keeton *et al.*, Prosser & Keaton on the Law of Torts (5th ed. 1984).

[20] *Id.* at 220–33.

the product suffered from design defects, which will capture the specific role of this legal criterion that has undergone considerable change in recent years.

IV. The Decisions to Drop or Settle a Claim

Because of the discrete zero-to-one nature of the DROP variable, the DROP probability equation was estimated using a maximum likelihood estimation technique. The logit results are reported for two specifications in Table 1. The first equation includes only an intercept and the two financial rewards variables—AVEPAYOFF and VARPAYOFF. The second equation adds a detailed set of personal characteristic and legal variables. The rationale for adding these variables is that AVEPAYOFF and VARPAYOFF are based only on the distribution of outcomes for par-

TABLE 1

Maximum Likelihood Estimates of the DROP Probability Equation*

	Coefficients (Asymptotic SEs)	
	1	2
Independent variables:		
AVEPAYOFF	−5.28E−6	−1.32E−5
	(2.70E−6)	(.36E−5)
VARPAYOFF	6.56E−5	1.03E−3
	(45.02E−5)	(.51E−3)
MARR	...	−.246
	...	(.053)
REG	...	−.574
	...	(.078)
JOB	...	.394
	...	(.078)
COLLATERAL	...	(.522)
	...	(.063)
SCAR	...	−.457
	...	(.071)
DEATH	...	.293
	...	(.165)
ABSOLUTE	...	−.067
	...	(.232)
STRICT	...	.058
	...	(.069)
NEGLECT	...	.305
	...	(.065)
−2 Log likelihood	10516.6	10270.0

* Other variables included were an intercept in eq. (1) and AGE, MALE, and STATE in eq. (2).

ticular injury categories. Thus, they do not fully reflect all the factors influencing the plaintiffs' and defendants' decisions. Inclusion of these other influences may, however, also pick up some of the influence of the financial rewards variables, so that examination of the more parsimonious equation (1) in Table 1 is also instructive.

The most consistently powerful influence on the DROP probability is the AVEPAYOFF variable, as health effects associated with larger expected rewards are less likely to be dropped by the claimants. The effect is statistically significant and in the expected direction. The VARPAYOFF variable should boost the incentive to drop the case if the claimant is risk averse. This variable has the expected positive influence but only passes the usual tests of statistical significance in equation (2) in Table 1 once the legal and personal characteristics variables are added. The additional variables in equation (2) capture omitted determinants of both the expected rewards and the litigation costs.

Nevertheless, even in equation (2), it is the expected rewards that are the more important concern. The mean effect of the AVEPAYOFF on the DROP probability is over two times as great as the effect of VARPAYOFF evaluated at its mean. The role of risk aversion in affecting the DROP probability is statistically significant but not dominant in its influence. Its effect is less than half of that of the mean rewards.

The other variables included in equation (2) perform in the expected fashion. Married claimants are less likely to drop a claim because a variety of related influences may be at work. Married claimants are more likely to have a spouse to assist in pursuing a claim (particularly after a fatality), and the presence of a spouse and family boosts the expected court award to the extent that these awards are based on the objective of adequate compensation of one's survivors. The age and sex of the claimant were inconsequential, with effects much smaller than the associated standard errors.

Several legal variables were particularly instrumental. Variables that should both increase the probability of a successful claim and reduce the litigation costs should lower the DROP probability. The two statistically significant variables with the expected negative influence were whether the product violated government safety regulations (REG) and whether the injury involved any scarring (SCAR). Scarring provides visible evidence of an injury as well as the basis for possible compensation for pain and suffering.

Significant variables with expected effects in the opposite direction included JOB, COLLATERAL, DEATH, and NEGLECT. Job-related cases are more likely to be dropped because of the greater difficulty in proving the applicability of product liability remedies rather than work-

TABLE 2

MAXIMUM LIKELIHOOD ESTIMATES OF THE SETTLE PROBABILITY EQUATION*

	COEFFICIENTS (Asymptotic SEs)	
	1	2
Independent variables:		
AVEPAYOFF	−2.33E−5	−1.30E−5
	(.33E−5)	(.37E−5)
VARPAYOFF	2.13E−3	1.20E−3
	(.64E−3)	(.67E−3)
MARR	...	−.171
	...	(.111)
REG	...	−.0018
	...	(.1286)
JOB	...	−.291
	...	(.138)
COLLATERAL	...	−.427
	...	(.118)
SCAR	...	−.636
	...	(.112)
DEATH	...	−.860
	...	(.184)
ABSOLUTE	...	.661
	...	(.498)
STRICT	...	.242
	...	(.131)
NEGLECT	...	.310)
	...	(.130)
ASSUME	...	−.488
	...	(.127)
−2 Log likelihood	3378.4	3234.4

* Both eqq. included an intercept, and eq. (2) also included AGE, MALE, and STATE.

ers' compensation. Collateral payments similarly boost the DROP probability insofar as they are an index of multiple lawsuits, where the existence of other compensation indicates the more tenuous nature of this particular claim. In addition, subrogation rules may lead to a reduction in compensation from one source if the multiple claims are successful. Finally, negligence-based claims (NEGLECT) are more likely to be dropped, which is consistent with the general perception that this approach is less advantageous than strict liability theories.

For claims that are not dropped, the next discrete choice is whether to settle the claim before trial. The estimates of the SETTLE probability equation (5) of Section II, which are presented in Table 2, also yield effects consistent with an optimizing litigation model. The estimation re-

sults indicate that increases in AVEPAYOFF have a consistent negative effect, which one would expect if the claimant's perceived chance of success in a lawsuit exceeds that of the firm, so that increasing the stakes boosts the relative amount of optimism for the claimant. Thus, not only does the expected award affect litigation behavior but the asymmetry in the expectations is evident as well.

Unlike in the DROP result, where the variance in rewards was not influential in the first equation, VARPAYOFF has a positive effect on SETTLE that is statistically significant in both cases. Risk-averse claimants are expected to be more willing to settle claims associated with a large payoff variance out of court. Moreover, unlike the DROP results, risk aversion on the part of defendants is also of consequence; it is the combined influence of risk aversion on the part of plaintiffs and defendants—each of which has positive effects on the settlement probability—that will be of consequence.

The mean effect of the AVEPAYOFF variable is double that of VARPAYOFF, which represents some narrowing of their relative influence compared with the DROP results in Table 1.[21] This comparatively stronger role of VARPAYOFF is what one would expect given the theoretical structure of equations (4) and (5) in Section II. In each case, VARPAYOFF's coefficient is linked to how this variable affects the claimant's certainty equivalent CE_{1c} of going to court. In the case of the DROP results, AVEPAYOFF's role was also linked to how it affected CE_{1c}, whereas for the SETTLE results it is the differential effect of VARPAYOFF on CE_{1c} and CE_{2c} that matters. In the case of identical perceived claimant success probabilities ($p = q$), the AVEPAYOFF variable would drop out altogether. In addition, both parties' risk aversion boosts the settlement probability, whereas only the claimant's risk aversion affects the probability that the case is dropped. The narrower difference between the effect of AVEPAYOFF and VARPAYOFF on SETTLE as compared with DROP consequently is an additional result consistent with the theoretical predictions.

From equation (5) in Section II, we know that the other variables included in the equation will have an influence dependent on two sets of factors. First, to the extent that the variable raises the costs of litigation for either party, it will increase the settlement probability. Second, the settlement probability will also increase as the firm's expectation of the

[21] The negative sign of the AVEPAYOFF variable in the SETTLE equation also is consistent with the prediction of several litigation models that higher stakes reduce the likelihood of settlement. See Posner, *supra* note 1; Danzon and Lillard, *supra* note 1; and Wittman, *supra* note 2.

court award increases relative to that of the plaintiff. Some of the signs of the independent variables will be difficult to predict a priori since they may affect the different components of the settlement determinants in possibly conflicting fashion.

To the extent that litigation costs are less for married claimants because of the presence of a spouse to assist in pressing the claim, one would expect a negative effect on SETTLE. The negative coefficient that is observed is statistically significant at the 90 percent level (one-tailed test). Married claimants also might expect greater financial compensation because of their greater financial needs, and the net effect of this influence will also be negative, provided that married claimants have a higher perceived probability of success p than the firm's perception of this probability.

Job-related claims are much less likely to be settled out of court because the firm's perception that such claims have a low chance of success apparently plays a dominant role. Likewise, claims for which collateral payments have already been received are less likely to be settled. Collateral payments reduce the costs to the claimant of future litigation, decreasing the settlement probability. Moreover, if these claims are viewed as being more tenuous, and there is a differential effect on the firm in terms of lowering the perceived chance of a large court award for the claimant, then there will also be the observed negative influence.

Two attributes that may greatly increase the plaintiff's expectations of an ultimate court award are the presence of scarring (SCAR) or a fatality (DEATH). In each case, there is a significant negative effect on the likelihood of an out-of-court settlement, which apparently is either an indication of a greater effect on the claimant's expectations than on the firm's or else a likely reduction in the litigation costs associated with health effects of a more visible nature.

All of the three principal variables for the legal basis of the claim—ABSOLUTE, STRICT, and NEGLECT—are positive, although ABSOLUTE's coefficient has a large standard error because of the few cases involved. On balance, these variables have a combined positive effect on SETTLE, so that the omitted dummy variable for claims on breach of warranty grounds has a negative effect.[22] Warranty-based arguments are generally believed to be the weakest, so the lower value of SETTLE reflects the lower chance such claims have of receiving compensation of any kind. For similar reasons, situations in which the firm can make arguments regarding assumption of risk (ASSUME) or related contribu-

[22] For a fuller discussion of warranty-based claims than that given below, see George L. Priest, A Theory of the Consumer Product Warranty, 90 Yale L. J. 1297 (1981).

tory negligence arguments are less likely to be settled out of court by the firm.

V. The Level of Out-of-Court Settlements

As indicated by equations (6) and (7) in Section II, the level of out-of-court settlements will be driven by the same types of economic concerns as were the decisions to settle or drop a particular case. To reduce the possibly distortive effect of outliers on the results, I utilized the natural logarithms of PAY, AVEPAYOFF, and VARPAYOFF as the main financial variables.[23]

Table 3 summarizes the findings for the effect of the principal financial variables, both with and without the inclusion of the set of other attributes.[24] Both equations yield the expected relation. Higher levels of expected rewards AVEPAYOFF should boost the level of out-of-court settlements (PAY), and this effect is almost exactly a one-to-one relation in the equation including only the two financial rewards variables. Increases in the variance of rewards will diminish the expected settlement level since risk-averse claimants will be willing to accept a certain reward that becomes lower as the variance of the likely outcomes increase. This effect is also borne out.

In each case, the magnitude of the effects is reduced for equation (2) as additional, related explanatory variables are added. The earlier pattern of the AVEPAYOFF variable playing a more consequential role than the VARPAYOFF variable is even stronger for the results in Table 3. The mean effect of AVEPAYOFF is roughly nine times as great as the mean effect of VARPAYOFF for equation (1), with an even greater disparity for equation (2).

Although the mean level of awards is more influential than is the variance, the VARPAYOFF variable is statistically significant in each equation. The fact that VARPAYOFF has a negative effect on payments is of substantial economic interest since this result arises when the risk premium of the claimant exceeds that of the defendant, where the role of

[23] This use of the semilogarithmic specification is done in both Danzon & Lillard, *supra* note 1, for medical malpractice claims, and, in Viscusi, *supra* note 2, for product liability claims.

[24] The overall fit of eq. (2) in Table 3 is somewhat below that (R^2 difference of .02) in table 6 of Viscusi, *supra* note 2. The inclusion of AVEPAYOFF, VARPAYOFF, and several other variables (AGE, MALE, SCAR, and DEATH) leads to less predictive power than the use of the actual bodily injury loss and the square of this value. The fact that the actual claim variable performs slightly better than a national predicted average and variance of claims is not surprising, given the direct relation of claimed losses to awards. It should be noted that the fit of the DROP and SETTLE equations reported in this paper is superior to those in Viscusi, *supra* note 2.

TABLE 3

REGRESSION RESULTS FOR ln(Pay) EQUATIONS

	COEFFICIENTS (SEs)	
	1	2
Independent variables:		
ln(AVEPAYOFF)	1.192	.445
	(.061)	(.068)
ln(VARPAYOFF)	−.312	−.066
	(.032)	(.033)
MALE	...	.246
	...	(.054)
MARR	...	.246
	...	(.054)
REG	...	.283
	...	(.069)
JOB	...	.906
	...	(.089)
COLLATERAL	...	.637
	...	(.071)
SCAR	...	.979
	...	(.069)
DEATH	...	1.103
	...	(.165)
ABSOL	...	.447
	...	(.198)
STRICT	...	.535
	...	(.066)
NEGLECT	...	.219
	...	(.064)
$\bar{R}^2$	.10	.19
SSR	48,874	43,875

* Each eq. also included a constant term, and eqq. (2) and (3) included AGE, STATE, DESIGN and ASSUME.

each risk-aversion term is weighted by the party's respective bargaining power (see eq. (6) in Section II). Claimant risk aversion is consequently more influential than defendant risk aversion.

The inclusion of the legal and personal characteristic variables captures in part the determinants of settlement levels and reduces the effects of AVEPAYOFF and VARPAYOFF accordingly. Payment levels increase for those who are married or male, which is a reflection of the higher earnings of this group. Court awards are based primarily on the earnings that have been lost because of death or injury, thus generating the observed relation.

Two surprising results are the positive effects of JOB and COLLATERAL on payment levels. In each case, these variables had a negative

influence on whether the parties were likely to settle out of court. Although such claims are less likely to be settled, if settled, they are likely to be settled for greater amounts, controlling for the expected payoff level and its variance. Such a pattern is consistent with a situation in which there is substantial heterogeneity in the legitimacy of the claims.

Cases involving scarring or a fatality are more likely to be settled for a larger amount. In each case, these variables serve as an index of the accident's severity and reflect, at least in part, the same types of influences captured by AVEPAYOFF and VARPAYOFF. The SCAR and DEATH variables have additional nonfinancial implications as well, since they represent tangible physical evidence that there was an adverse health effect, thus facilitating the injured parties' pursuance of the claim.

Of the principal legal criteria on which one can base a claim, the strongest effects are for STRICT and ABSOLUTE. These effects are consistent with the higher chance of success that such claims based on strict liability principles have. The second strongest legal criterion—negligence-based (NEGLECT) cases—has a smaller positive effect, and the omitted dummy variable for warranty-based cases is negative. As with the explicit financial rewards variables, these variables also perform in the expected manner.

VI. Conclusion

Situations involving litigation are a paradigmatic case of bargaining conflict. The parties' interests are opposed, but there are some shared interests as well. Moreover, in the situation in which at least one of the parties is risk averse, there are additional potential gains of trade since out-of-court bargaining will serve an insurance function for the parties who might otherwise have faced a random court lottery.

The empirical results were consistent with an economic model of optimizing litigation and bargaining behavior, where the issues examined were the claimant's decision to drop a claim, the joint decision to settle a claim out of court, and the level of such out-of-court settlements. An economic approach to litigation is a fruitful analytical device for interpreting the role of not only the financial effect variables but also the legal and personal characteristic variables.

The primary focus of the empirical analysis was on the effect of the expected value of a claim and its variance on behavior. In all cases, the expected payoff played an instrumental role in influencing behavior, as one would expect, given the key role that this variable has had in models of litigation behavior. Moreover, the expected award had from two to nine times the influence as did the variance, depending on the particular

issue involved. Risk aversion plays a statistically significant role but is by no means the major force that drives behavior in product liability cases. Claimant risk aversion has a greater empirical influence than any possible risk aversion on the part of defendants.

Proper recognition of this role of risk aversion in conceptual models poses no great difficulties. Most of the conventional results can be amended with the addition of risk-premium terms to the analysis.

In terms of the policy implications with respect to the functioning of the judicial system for product liability claims, the differential role of claimant risk aversion does not appear to put claimants at a substantial bargaining disadvantage. Perhaps in large part because of the prevalence of contingent fee arrangements—which greatly limit the risk exposure of the claimant—the dominant concern of claimants is their expected payoff rather than uncertainty regarding the level of such an award. The findings, while important, do not require any substantial modifications in the conceptual models used to analyze litigation strategies. In most instances, it should suffice to amend the analysis by introducing a risk premium into the analysis.

The policy implications of these findings are also of real importance. In many discussions, it has been asserted that the risk aversion places injured parties at a substantial bargaining disadvantage for which legal countermeasures might be appropriate. This study indicates that the fear is overstated. The dominant concern of tort claimants is their expected payoff and not their uncertainty regarding the level of the award. The explanations for this outcome are not altogether clear, but it may have a good deal to do with the well-nigh universal contingent fee arrangement, which allows the injured party to transfer some portion of the risk to the lawyer, who in turn can diversify risk by handling a portfolio of claims at any single time. But, whatever the complete explanation, the risk aversion of claimants is not the dominant feature in product liability litigation.