MEASURING THE IMPA CTS OF NON-UNIFORM PRODUCT LIABILITY LAWS
ON THE COST OF U.S. GOODS

PHASE I: METHODOLOGY AND STUDY DESIGN

Final Report

February 28, 1992

Submitted to:
Office of Advocacy
U.S. Small Business Administration
409 Third Street, S.W., 5th Floor
Washington, D.C. 20416

Contract No. SBA 5647-OA-90
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES AND FIGURES</td>
<td>iii</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td>xiv</td>
</tr>
<tr>
<td><strong>INTRODUCTION</strong></td>
<td>1</td>
</tr>
<tr>
<td>I. EVOLUTION OF PRODUCT LIABILITY LAW IN THE UNITED STATES</td>
<td>5</td>
</tr>
<tr>
<td>A. From Privity to Negligence</td>
<td>5</td>
</tr>
<tr>
<td>B. From Negligence to Strict Liability</td>
<td>7</td>
</tr>
<tr>
<td>C. Implied Warranties</td>
<td>9</td>
</tr>
<tr>
<td>D. The Restatement (Second) of Torts: 402A</td>
<td>10</td>
</tr>
<tr>
<td>E. Summary of the Historical Development of the Law</td>
<td>12</td>
</tr>
<tr>
<td>II. AN OVERVIEW OF STATE DIFFERENCES IN PRODUCT LIABILITY LAW</td>
<td>13</td>
</tr>
<tr>
<td>A. Extent of Liability:</td>
<td>13</td>
</tr>
<tr>
<td>Who can be held liable for what damages?</td>
<td></td>
</tr>
<tr>
<td>B. The Standard of Liability:</td>
<td>16</td>
</tr>
<tr>
<td>What triggers liability and recovery?</td>
<td></td>
</tr>
<tr>
<td>C. Allowable Defenses:</td>
<td>20</td>
</tr>
<tr>
<td>What actions bar or limit recovery?</td>
<td></td>
</tr>
<tr>
<td>D. Procedural Issues:</td>
<td>24</td>
</tr>
<tr>
<td>Where and when can suits be brought, and what evidence is allowable?</td>
<td></td>
</tr>
<tr>
<td>E. Implications of Differences among States:</td>
<td>26</td>
</tr>
<tr>
<td>A Framework</td>
<td></td>
</tr>
<tr>
<td>III. PRODUCT LIABILITY AND FIRMS' COSTS</td>
<td>32</td>
</tr>
<tr>
<td>A. The Cost of Precaution</td>
<td>34</td>
</tr>
<tr>
<td>B. Liability Costs</td>
<td>36</td>
</tr>
<tr>
<td>C. Insurance Costs</td>
<td>45</td>
</tr>
<tr>
<td>D. Market Impacts of Product Liability</td>
<td>51</td>
</tr>
<tr>
<td>E. Summary of Product Liability and FIRMS' COSTS</td>
<td>55</td>
</tr>
<tr>
<td>IV. EXISTING EVIDENCE ON THE EFFECTS OF PRODUCT LIABILITY</td>
<td>57</td>
</tr>
<tr>
<td>A. General Studies</td>
<td>57</td>
</tr>
<tr>
<td>B. Studies of Effects on Small Firms</td>
<td>69</td>
</tr>
<tr>
<td>C. Studies of the Effects of State Differences</td>
<td>71</td>
</tr>
<tr>
<td>D. General Conclusions of Existing Studies</td>
<td>73</td>
</tr>
<tr>
<td>E. Specific Conclusions on Variability in State Laws and Small Business Impacts</td>
<td>76</td>
</tr>
</tbody>
</table>
V. ISSUES IN THE DESIGN OF AN EMPIRICAL STUDY OF PRODUCT LIABILITY
   A. Statistical vs. Non-Statistical Analysis 78
   B. Measurement Problems 80
   C. Insufficient Variability in Data 85
   D. Workplace vs. Consumer Product Accidents 87

VI. STUDY DESIGN 88
   A. Uses of Existing Data 91
   B. Collection of Primary Data 102

VII. SOME ILLUSTRATIVE RESULTS 114
   A. Insurance Premiums and Firm Size 114
   B. Cases and Firm Size 122
   C. Implications 127

REFERENCES 129

ENDNOTES 135
# LIST OF TABLES AND FIGURES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1. Summary of Hypothesized Effects of Firm Size and State Differentials on Firms</td>
<td>at 57</td>
</tr>
<tr>
<td>Table 2. Summary of Previous Empirical Studies of Product Liability</td>
<td>at 58</td>
</tr>
<tr>
<td>Table 3. Description and Sources of Data in Previous Studies</td>
<td>at 58</td>
</tr>
<tr>
<td>Table 4. Relation between S.I.C. Codes Dominated by Large or Small Business, and Incidence of Products Suits</td>
<td>at 98</td>
</tr>
<tr>
<td>Table 5. Insurance Premiums by Industry</td>
<td>at 98</td>
</tr>
<tr>
<td>Table 6. Distribution of Employment by Industry</td>
<td>at 99</td>
</tr>
<tr>
<td>Table 7. Employment vs. Insurance Premiums</td>
<td>at 121</td>
</tr>
<tr>
<td>Table 8. Employment vs. Cases</td>
<td>at 126</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1. [Two Possible Distributions of S]</td>
<td>at 29</td>
</tr>
<tr>
<td>Figure 2. [Symmetric and Skewed Distributions]</td>
<td>at 30</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

Over the past half century, the scope of producer liability for product-related accidents has expanded greatly in the United States. The expansion has occurred largely through changes in tort law -- namely, a shift in the standard of liability from privity of contract to negligence, and then to strict liability, in torts. Manufacturers argue that the resulting expansion in the liability burden of business has dramatically increased their costs, raising prices to consumers and eroding the international competitiveness of American business -- thus encouraging imports and discouraging exports.

The present study focuses on two issues related to concerns over the growing burden of product liability: (1) the effects of not having uniform product liability laws across the states; and (2) whether the effects of product liability are more adverse for small firms than for large firms. Sellers contend that the lack of uniformity itself raises the costs of product liability by making their legal burdens more uncertain. Small firms argue that their product liability costs are disproportionately greater than those of large firms, because (1) they cannot exploit scale economies in product safety and litigation; and (2) they find it more difficult, or costly, to insure against product liability claims.
The purpose of this study is to lay the conceptual and methodological basis for empirically testing the magnitude and significance of those two issues.

The Evolution and Current State of Product Liability Law

The evolution of U.S. product liability law has been marked by a steady trend toward expanded producer liability (section I). At the turn of the 20th century, the law required privity of contract for a victim to recover damages from a manufacturer. Privity gradually gave way to a negligence standard under torts, and then (by about 1970) negligence was superseded by strict liability for defective products. This historical trend has meant an increase in the average burden of liability for producers.

Even though most states followed the trend, product liability laws still vary considerably across states (section II). The various laws differ in the following four categories: (i) the extent of liability; (ii) the standard of liability; (iii) allowable defenses; and (iv) procedural issues. Variability in state laws increases the variance of a firm's liability burden -- that is, the extent to which its liability in particular states differs from its overall average liability. Lack of uniformity in the law may also skew the distribution of a firm's liability "to the right," if a few states' laws create the potential for very large awards.
An important element in sorting out the debate over product liability burdens centers on which of these factors -- the mean award, the variance of awards, or the degree of right-skewewedness -- affects firms' behavior most.

**Product Liability and Firms' Costs**

Product liability law imposes three types of costs on firms: (i) product safety (or precaution); (ii) damage awards (or settlement amounts) and other litigation costs; and (iii) liability insurance. Both the variability of product liability laws across states and firm size may have effects on these costs and thus on firms' decisions.

To figure out how to measure these effects, we use economic theory to model the costs of product liability for producers of potentially dangerous products (section III). Our model predicts that variability in the law unambiguously increases firms' costs, but that firm size has ambiguous effects.

The lack of a uniform national product liability law increases uncertainty about a firm's exposure to liability. The results are higher costs litigation per suit, more suits for any given accident rate, and higher costs of market insurance. Legal uncertainty also reduces the ability of firms to send accurate price signals of the costs of product liability to consumers. An important empirical question here is the
extent to which the ostensibly different state laws really do significantly alter decisions by firms engaged in interstate commerce (most manufacturers in the United States), compared with their decisions under some form of uniform national standard.

Turning to firm size, on the one hand, small firms may have lower total costs of product liability than large firms because (i) their smaller outputs lead to fewer accidents per firm; (ii) their smaller assets limit expected awards and steer plaintiffs to defendants with "deeper pockets;" and (iii) they invest less in reputation and thus stand to lose less from a products suit.

On the other hand, small firms may face higher costs because (i) they cannot exploit scale economies in precaution, litigation, and insurance coverage; (ii) they may be less skilled at bargaining with plaintiffs; and (iii) their limited assets increase their need to rely on market insurance. In addition, small firms, to the extent they lack market power relative to that of large firms, are less able to pass higher costs on to consumers in the form of higher prices.

Existing Evidence on the Impact of Product Liability

Three themes emerge from the findings of the small body of empirical work done to date on the impacts of product liability law (section IV).
The first theme concerns the source of the perceived crisis in product liability insurance during the 1980s: Was it caused by the insurance industry or by changes in tort law? Most studies have concluded that, while the increase in premiums in the mid-1980s was due in part to losses sustained by insurers during the 1970s, the primary cause was the tort system.

The second theme concerns the size and distribution of damage awards in product liability cases. A common perception is that recent awards have been excessive. Nevertheless, most studies have found compensatory awards to be closely related to the actual damages suffered by victims. The perception seems to have been shaped by a few cases in which large damages were awarded, and by a handful of industries that have borne especially large litigation burdens.

The third theme deals with the desirability of "reforming" tort law by limiting the liabilities of defendants. The general conclusion of the existing studies is that popular reform proposals would have little effect on product liability litigation.

Little or no evidence exists on the specific questions of interest to this study: the impacts of non-uniform laws and of firm size. What evidence there is suggests that the major effect of both is through insurance costs. First, insurance companies charge higher premiums to all firms because the lack
of a uniform law makes it more difficult to predict accurately a firm's liability risks. Second, because small firms are more dependent on market insurance than large firms, they are disproportionately burdened by the costlier insurance.

**Issues in the Design of an Empirical Study of Product Liability Law**

Given the paucity of empirical evidence on the impact of non-uniform product liability laws on small firms, our goal is to design an empirical study to evaluate these effects. Our primary objectives are three: first, to identify the issues involved in undertaking such a study; second, to propose specific methods for addressing those issues; and third, to provide some illustrative results using available data.

We see four issues as key in designing an empirical analysis of product liability (section V). The first issue is whether the analysis will be statistical or non-statistical. While non-statistical analysis is generally simpler to carry out, it provides less conclusive results because multiple effects generally cannot be disentangled. Statistical analysis is thus generally preferred if the data permit.

The second issue involves problems encountered in measuring the variables of interest. It is not clear, for instance, how one should quantify the stringency of different states' product liability laws, their variability across states, or firms' levels of precaution.
The third issue in designing an empirical study is whether there is sufficient variability in the relevant data to allow observation of causal connections. For example, if measures of the stringency and variability of the law across states can only vary over time, then cross-sectional data would not support analysis of the differential effects of these variables on small versus large firms; a combined cross-sectional and time-series data set would be necessary.

The fourth and final issue is what to do about the fraction of product liability cases that arise from workplace accidents. In those cases, it is frequently difficult to distinguish accidents caused by products from those merely associated with products. In addition, the reporting conventions used in existing data may not be suitable for the proposed study; workplace accidents necessarily interact with workers' compensation law; and there is some evidence that courts treat consumer and workplace accidents differently.

**Study Design**

The specific objective of the study and the characteristics of existing data would determine the strategy one would choose in confronting these four issues. An empirical study of the impact of product liability law on small business could look at (i) effects on small firms only, either across industries or within a single industry; (ii) effects on small
versus large firms in a single industry; or (iii) effects on small versus large firms across industries.

The data for the study could be from existing sources, or they could be primary (most likely survey) data (section VI). Using existing data would cost less, but it will limit the questions that can be answered. The existing data that we were able to identify fall into five categories: (i) accidents; (ii) litigation; (iii) insurance; (iv) firm characteristics; and (v) product liability statutes and court decisions. In all likelihood, to conduct a study that would yield definitive insights into the impact of the states' product liability laws on small firms would require collecting primary data.

Some Illustrative Results

To illustrate the possible uses of existing data, we used two sets of existing data to measure the impact of product liability law on small versus large firms.

In the first example, we tested whether industries with relatively more small firms incur higher product liability insurance costs than industries with more large firms. For this analysis we combined data on product liability insurance premiums by industry with data on the distribution of small versus large firms by industry. To control for industry size -- larger industries should have more accidents -- we divided
the premium data by GNP originating in each industry. The results of simple regression analysis indicated no clear relation between size-adjusted premiums and the importance of small firms for the full range of industries in the total sample, or for "service-oriented" industries. However, when we limited the sample to "production-oriented" industries, including but not limited to manufacturing, we found significant positive relationships.

These results suggest that production-oriented industries "dominated" by small firms bear relatively greater insurance premiums than do large-firm-dominated industries. The results do not tell us, however, whether small firms pay higher premiums because of their size per se, or whether they manufacture less safe products.

In the second example, we tested whether industries with relatively more small firms faced more product liability suits than industries "dominated" by large firms. We combined data on product liability suits filed in Federal district courts, by industry group, weighted (as before) by GNP originating, with data on the distribution of small versus large firms by industry. The results of simple regression analysis indicated no systematic relationship between size-adjusted numbers of cases and the importance of small firms in a given industry, whether for the full sample or for manufacturing industries alone. Removing the industry (SIC 32) that accounts for a
large proportion of asbestos cases, and which therefore experienced an extreme rate of case growth over the sample period, gave coefficients on firm size that were weakly significant (at about the 15-20 percent level). Thus, it would be worthwhile to attempt to disaggregate the case data and re-test for a relationship between products cases and firm-size characteristics.

Again, the tests just described will not support a comparison of the case burdens of small vs. large firms within the same industry, hence producing the same product mix.

These illustrative results, however slender a reed, are consistent with our theoretical predictions and previous studies. They seem to suggest that, if small firms are disproportionately burdened by product liability, it is through the cost of liability insurance. Verification of these results, of course, would require more detailed studies of the sort described above.
ACKNOWLEDGEMENTS

We wish to thank, without necessarily implicating, the following people for their assistance in preparing this report: Frank Goetz, David Jackson, Laura Malinauskas, Jon Vilasuso, W.K. Viscusi, Thomas Winslow, and Laura Wright.
MEASURING THE IMPACT OF NON-UNIFORM PRODUCT LIABILITY LAWS ON THE COSTS OF U.S. GOODS AND SERVICES (with Special Reference to Small Business) 

by 

Thomas J. Miceli, Kathleen Segerson, and Arthur W. Wright 

INTRODUCTION 

While liability for defective products has long been part of the common law, over the past half century the scope of that liability has greatly expanded in the United States. The standard of liability has shifted from the doctrines of privity and implied warranty (under the law of contracts) to reliance on the doctrine of strict liability under torts. This shift of standard has enlarged the set of both potential plaintiffs and potential defendants. It has also made recovery easier because (under strict liability) plaintiffs do not have to prove negligence. In addition, what is "defective" has come to cover design as well as construction. The combination of these changes has greatly increased the potential liability faced by producers. 

In turn, the increased potential liability has altered the circumstances and (one would expect) also the behavior of business firms operating in the United States. The effects of the increase in liability span a wide variety of industries -- services as well as manufacturing, and producer as well as consumer goods and services. The main avenue of those effects is through firms' costs, which have increased in a number of respects: testing and surveil-
lance, product design, litigation and liability insurance costs. Increases in producer costs potentially affect both domestic and foreign markets in general, and the relative competitiveness of American firms in particular.

As may happen in the U.S. federal system, the move toward greater product liability in the United States has varied from state to state. As a consequence, firms are confronted with a variety of statutes and case law; this applies to firms producing for sale anywhere in the United States, not just to those engaging in interstate commerce in the narrow sense of the term. Thus far, Congress has refrained from passing a uniform Federal law that would supplant state laws, although "model" Federal laws have been proposed and new bills are continually introduced (most recently, companion bills by Rep. J. Roy Rowland and Sen. Robert Kasten -- H.R. 3030 and S. 640 respectively).

The lack of uniformity in statutes and case law may further raise firms’ product liability costs above what they would be under a uniform national standard. Information costs may be higher if firms have to learn the applicable law in every state in which their products may be sold or used -- effectively, in every state. Sellers would face greater uncertainty with 50 different sets of statutes and case law than they would under a Federal statute and opinions. Planning may be more difficult if firms must operate under a number of different product-liability constraints rather than under a single constraint set by Federal law. Finally, product liability insurance coverage may cost more, or be harder to
obtain, because lack of a national uniform standard makes it more difficult for insurance companies to predict a firm's liability burden.

Increased costs from greater product-liability exposure and from the lack of a uniform national law may affect different firms differently. Many such costs are "lumpy" in nature and thus will raise the unit costs of small businesses more than those of large businesses. For example, relative to small firms, large firms can spread higher fixed costs of designing and testing a product over larger sales volumes, thus reducing unit costs. A similar argument may apply to litigation and liability insurance costs. Thus, the burden of the shift toward greater producer liability may be falling disproportionately on small businesses.

The present study is concerned with how to identify and measure the most significant impacts of current product liability law on small businesses. Its purpose is to lay the conceptual and methodological basis for empirical work on how product liability law affects small firms. This basis consists of two parts: (1) analysis of both the legal and economic questions involved; and (2) devising measures to translate the analysis into operational form. The end product of this study is a study design for empirical analysis aimed at determining the impacts of product liability law on small businesses.

Section I below examines the historical evolution of product liability law, and section II reviews differences in that law across the states. Section III analyzes the costs to firms of
product liability law, incorporating both firm size and state differences in law. Section IV then examines the existing empirical evidence, and section V discusses four issues regarding the research agenda for an empirical study of product liability. Section VI presents a study design for just such an empirical investigation. Finally, section VII sets out the results of two examples of empirical analysis, using existing data, that illustrate how the study design could be implemented.
I

EVOLUTION OF PRODUCT LIABILITY LAW IN THE UNITED STATES\textsuperscript{1}

In contrast to the image of modern product liability law as protecting ignorant consumers against producers and sellers of potentially dangerous products, early U.S. law was based on the twin beliefs that excessive product liability litigation would burden society with high administrative costs and threaten the economic viability of producers. These beliefs took the form of strong limitations on producer liability. The primary limitations were (a) the doctrine of privity, which required that plaintiffs have a contractual relationship with the defendant, and (b) the availability of defenses such as contributory negligence and assumption of risk.

The history of product liability law in the United States since the mid-nineteenth century has consisted of the general decline and redefinition of these limitations on producer liability, starting with the requirement of privity.\textsuperscript{2}

I.A. From Privity to Negligence

The doctrine of privity limited product liability actions to those against defendants with whom the plaintiff had a direct contractual relationship. The allocation of risk from product-related injuries thus largely relied on contract rather than tort principles.\textsuperscript{3} The privity doctrine insulated most manufacturers from liability, because their products reached ultimate consumers through a chain of intermediate distributors and retailers. The
A key case in establishing the privity requirement was *Winterbottom v. Wright* (1842).  

Three exceptions to the privity rule arose during the last half of the 19th century. These exceptions, which involved the common-law doctrines of negligence and fraud, were summarized in *Huset v. J.I. Case Threshing Machine Co.* (1903): (1) A supplier's negligence in the sale or preparation of a product that is imminently dangerous to the ultimate user (e.g., mislabelling a drug) is actionable by a third party. (2) An owner's negligence that causes injury to someone invited to use a defective product on the owner's premises (e.g., defective scaffolding) is actionable against the owner. (3) Someone who sells or delivers an article known to be imminently dangerous, but without giving warning (e.g., an inferior gun misrepresented as being of higher quality), is liable to anyone, including a remote plaintiff, who suffers damages as a result.

The privity limitation was formally overturned in *MacPherson v. Buick* (1916). The plaintiff was injured when the wheel broke on a car he had recently purchased -- from a dealer rather than directly from the manufacturer. Because none of the exceptions seemed to apply, privity (if invoked) would have barred recovery. The plaintiff won, however, based on the argument that injury to individuals other than the immediate purchaser of the car (the dealer) was foreseeable to the manufacturer, and that the manufacturer's failure to inspect the car before putting it on the market constituted negligence.
I.B. From Negligence to Strict Liability

Following the rejection of privity, tort principles, and in particular, a negligence standard governed products liability cases, at least in theory (Cooter and Ulen, 1988: p. 430). Legal scholars early in this century justified the negligence rule on the basis of a defendant's right to be free from the burden of litigation unless fault (in addition to causation) on his part was involved. Determination of negligence, however, involves an often subjective balancing of costs and benefits by the court, in order to establish "reasonable care." This balancing clearly entails higher administrative costs per case compared with strict liability, where only causation need be proved.7

The few early product liability decisions in which privity was overcome sidestepped this difficulty by implicitly equating negligence with the very production of a dangerous or defective product. Once privity was abolished by MacPherson, however, the courts were faced with the problems of implementing a negligence standard. Their response was to move in the direction of the administratively cheaper rule of strict liability.

Two routes were followed in moving from negligence to strict liability. The first was an increase in the standard of care owed by manufacturers to consumers -- especially evident for manufacturers of food. A related move was the refusal of courts to accept industry custom as the due standard of care.

The second route from negligence to strict liability, again primarily in food cases, was the application of the doctrine of res

7
ipsa loquitur (literally, "the matter speaks for itself"). Under this doctrine, negligence was presumed (with the burden shifted to the defendant to prove otherwise) if the following were true: (1) the event in question did not ordinarily occur in the absence of negligence; (2) its occurrence was exclusively under the control of the defendant; and (3) it was not due to any action by the plaintiff.

Two cases mark the shift to strict liability in product injury cases: Escola v. Coca-Cola Bottling Co. (1944) and Greenman v. Yuba Power Products, Inc. (1963). In Escola, the plaintiff was injured when a bottle of Coca-Cola exploded in her hand. Despite extensive evidence that the defendant had exercised reasonable care, recovery was allowed under res ipsa loquitur. The opinion in Escola laid out three arguments in favor of strict liability over negligence: (1) the manufacturer's superior ability to protect against product-related accidents; (2) the manufacturer's superior ability to insure against accident losses by passing on the costs in the form of higher prices; and (3) the lower administrative cost of strict liability (Cooter and Ulen, 1988: p. 433). In Greenman, the plaintiff was injured by a power tool but failed to prove negligence by the manufacturer. Damages were awarded nonetheless under strict liability, on the argument that, by marketing the tool, the manufacturer was implicitly representing it as safe for the task for which it was built.

Recovery in both Escola and Greenman turned on (1) the presence of a product defect that caused harm, and (2) the manufacturer
marketed the product in the knowledge that it would be used without inspection, thereby implicitly representing it as safe for ordinary use. This second basis for recovery closely resembles that under the theory of implied warranty.

I.C. **Implied Warranties**

Implied warranties offered plaintiffs an alternative to negligence in seeking recovery in products cases. The advantage of an implied warranty action for plaintiffs was that it imposed a strict liability standard on sellers of goods. That is, recovery was allowed if the goods were not as represented (whether implicitly or explicitly), regardless of the seller's care. The disadvantage, however, was the requirement of privity, because warranties are a form of contract. In *Chysky v. Drake Brothers, Inc.* (1923), for example, the plaintiff was injured by a nail contained in a cake she had bought. However, because the defendant (the baker) had not sold the cake directly to the plaintiff, recovery was not allowed: without privity, there was no implied warranty.

*Chysky* defined the boundary between tort and implied warranty theories of recovery in products liability cases for some forty years. Whereas *MacPherson* (1916) had taken privity out of the tort-based negligence standard, *Chysky* established that (even with negligence) one needed privity under the contract-based theory of implied warranty. While courts fashioned a number of exceptions to get around the privity requirement in implied warranty cases, privity was not explicitly eliminated until the early 1960s, in *Hen-
With *Henningsen* and *Greenberg*, the tort and contract theories of recovery for product injuries in effect converged. The plaintiff had to prove essentially the same thing under the two theories. Under implied warranty, a product defect was evidence of a breach of warranty, which was the basis for recovery. Under strict liability, the fact of the defect itself was grounds for recovery. Interestingly, the equivalence of the strict liability and implied warranty theories underlies the continuing reluctance of some state courts to adopt a strict liability standard in torts, as we shall see below (section II.B.).

*Henningsen* set another important precedent in products liability law, by limiting the right of parties to contract around liability rules. This right was generally unchallenged during the nineteenth and much of the twentieth centuries, based on the principle of freedom of contract. *Henningsen*, however, invalidated a clause in a car-sale contract relieving both the dealer and the manufacturer of liability for personal injuries, on the ground that such clauses were unfair. The implication was that implied warranties of fitness overrode any expressed intention of the parties.

I.D. **The Restatement (Second) of Torts: 402A**

Section 402A of the *Restatement (Second) of Torts* (1965) explicitly recognized strict liability in products cases. According to this document, the seller would be liable for the harm
caused by a defective product, even if (1) the seller had taken reasonable care in its preparation and sale, and (2) the buyer or user did not have a contractual relationship with the seller. These two provisos disposed of negligence and privity, respectively. As the term "seller" encompassed a broad range of intermediate parties (wholesalers, distributors, and retailers), the Restatement eliminated many previous limitations on the liability of these parties. The justification was that consumers were thereby afforded the maximum protection, while defendants could adjust for the cost of liability through their contractual relationships.

The basic cause for action advanced by the Restatement was a "product in defective condition unreasonably dangerous to the user or consumer or to his property." A defective product was one unsafe for "normal use." A product defect could occur in the manufacturing process, in design, or in a manufacturer’s failure to warn of dangers in the product’s use (Cooter and Ulen, 1988: p. 434).

Note that the Restatement tacitly placed limits on the liability of defendants, by injecting the test of "unreasonably dangerous" (which connotes a negligence standard) and referring to "normal use" (which explicitly factors the plaintiff’s conduct into the equation). This has left room for varying interpretations of the precise definition of a defective product, the role of strict liability versus negligence, and the defenses that are available to defendants.
I.E. Summary of the Historical Development of the Law

The foregoing survey shows that product liability law, from the mid-19th century to about 1970, has seen the abolition of privilege and a move from a negligence standard to strict liability. Since 1970, product liability law has evolved primarily through the application of strict liability in a variety of settings. The widening application of legal doctrine has contributed to the perception that products litigation has exploded over the past two decades.

Another part of that perception, however, may stem from variations in the different states' statutes and interpretations of the strict liability rule, and from the lack of a national uniform law adopted and interpreted by the Federal courts. In a federal system, with the so-called commerce clause in effect, the patchwork of statutes and opinions may sow complexity and confusion. It may also provide incentives for firms to invest in finding the least-cost seams in the patchwork, rather than in making better (including safer) products.

In the next section, we survey the major differences in product liability law across states.
II

AN OVERVIEW OF STATE DIFFERENCES IN PRODUCT LIABILITY LAW

The perhaps inevitable result of the several states' reactions to the general principles outlined in part I has been a lack of uniformity in their application. Some states have adopted only part of the principles, while others have fashioned their own particular versions. Differences across states in the prevailing product liability law fall into four categories:

(A) the extent of liability: Who can be held liable and for what damages?
(B) the standard of liability: What must be proven, by whom, to trigger liability?
(C) allowable defenses: What actions by the plaintiff or defendant may bar full or partial recovery?
(D) procedural issues: Where and when can a suit be brought, and what evidence is allowable?16

A summary of the differences across states along these four lines suggests the spectrum of product-liability law that a producer selling in interstate commerce could face. This spectrum is more relevant than the specifics of any given state's law for understanding how the law affects firms' behavior, because (when production and safety decisions are being made) firms cannot be sure in which state their products will ultimately be sold or used and thus where products suits might be filed.

II.A. Extent of Liability: Who can be held liable for what damages?

In all states manufacturers can be held liable for defective products. However, state laws differ regarding the potential
liability of others in the marketing/distribution chain, including distributors and wholesalers, retailers, assemblers, and manufacturers of component parts. The Restatement (Second) of Torts, section 402A (Comment f), includes all "sellers" as potentially strictly liable for defective products (CCH, p. 4087), but not all states hold non-manufacturers to the same standard as manufacturers (Stupy, 1987: p. 221; CCH p. 4122-23). Several state legislatures have recently passed laws limiting the potential liability of non-manufacturers for defects over which they have no control (George, 1984; Stupy, 1987: p. 222-224). The Model Uniform Product Liability Act proposed limiting the liability exposure of non-manufacturers to negligence or breach of express warranty, except when recovery from the manufacturer was not possible (e.g., the manufacturer was judgment-proof) (Dworkin, 1981). Absent universal state adoption of this or another uniform rule, however, non-manufacturers continue to face a spectrum of liability standards.

While all states permit recovery of personal-injury and property damages under product liability law (CCH, pp. 3301, 3321, 414-45), differences regarding other types of damages remain. For example, some but not all jurisdictions allow recovery for economic loss (such as lost profits), even though such losses are covered by contract and warranty law and by the Uniform Commercial Code (CCH, pp. 3321, 4156-57). Although most states have held sellers liable for injuries to "reasonably foreseeable" bystanders (i.e., individuals who are not involved in the purchase or use of the product), there are differences in how broadly or narrowly foreseeable-
ity is defined (CCH, p. 4136). Responding to concerns about the scope of damages, several states have recently imposed legislative limits on the types and amounts of damages that are recoverable (CCH, p. 3301, 3331; Cooter and Ulen, 1988; pp. 458-459).\(^{17}\)

The states differ widely in the application of punitive damages.\(^{18}\) While punitive damages are imposed only in cases of reckless disregard for the safety of others (CCH, pp. 3331, 4166), both the threshold standard of conduct and the standard of proof vary across states (Gilmartin, 1987). Likewise, in attempting to control the level of punitive damages that are imposed, states have adopted various direct and indirect methods of capping punitive damage awards (Gilmartin, 1987).

Related to the types of damages allowed is the question of how liability for damages should be allocated in "joint tort" cases involving more than one defendant.\(^{19}\) Two controversial allocation rules have been used in joint tort cases: (i) joint and several liability; and (ii) market-share liability.

Under joint and several liability, one of a group of defendants may be held liable for the entire amount of damages regardless of the extent of one's contribution to the harm. Thus, the use of joint and several liability exposes sellers to potential liability for damages over which they have no control. In addition, insurers argue plausibly that its use necessitates much higher premiums than otherwise to cover the open-ended nature of the resulting risks they face. To address such concerns, several states have limited the use of joint and several liability (Lau-
Market-share liability originated in the context of suits in which the exact identity of the manufacturer of an offending product was not known. The classic case involves the use of a product (such as a drug), the detrimental effects of which are not known for a long time -- after records identifying the specific manufacturer have been lost (CCH, pp. 3171, 4094). As it is impossible for the plaintiff to name the specific manufacturer, some courts have apportioned liability among the manufacturers producing the drug at that time in relation to their market shares (Winslow, 1985). Under such a theory, liability for damages may be assigned to sellers who had nothing to do with manufacturing or distributing the offending product. As a result, few courts have adopted the market-share liability theory (Winslow, 1985), but no single alternative has yet gained favor in cases where the seller's identity cannot be established. Thus, a manufacturer's liability in such cases depends upon the state in which the suit is brought (Winslow, 1985).

II.B. The Standard of Liability: What triggers liability and recovery?

Despite several attempts to hold sellers liable for all damages resulting from their products -- under the doctrine of "absolute liability" -- most jurisdictions have rejected this standard. Instead, a finding of liability requires (1) that the product be "defective;" and (2) that the defect be the proximate
cause of the injury or damages (CCH, p. 4041). As noted previous-
ly, defects may arise (i) in construction or manufacturing; (ii) in
design; or (iii) from a failure to warn of a known danger from
product use.

The three possible theories under which a plaintiff can recov-
er for damages from a defective product are (i) breach of warranty;
(ii) negligence; and (iii) strict liability. All states allow
recovery under negligence; all except Louisiana allow recovery
under breach of warranty (Stuby, 1987); and most (though not all)
states allow recovery under strict liability.

On the face of it, these three theories differ considerably. 
Breach of warranty is based on the seller's representation to buy-
ers or users; negligence is based on the conduct of the defendant;
and strict liability is based on the quality of the product itself.
The abolition of privity, however, blurred the distinction between
warranty and strict liability; in fact, two states (Michigan and
Massachusetts) have rejected strict liability on the grounds that
breach of warranty affords plaintiffs equivalent protection (CCH,
p. 4016; Stuby, 1987). Likewise, the distinction between negli-
gence and strict liability is often blurred, because determining
"defectiveness" usually involves a balancing of factors that bor-
Thus, the differences across states hinge not so much on the theo-
ries of recovery that are allowed as on the definition of defec-
tiveness that triggers liability.
Under strict liability, most states have followed the lead of the Restatement (Second) of Torts and thus view a product as defective if it is "unreasonably dangerous" (or the near equivalent). However, the specific applications of "unreasonably dangerous" differ across states. Some use a "consumer-expectations" definition, which asks whether the risk exceeds what an ordinary consumer, with ordinary knowledge, would expect (Robb, 1983, p. 155). This test reflects the implied-warranty basis of strict liability (Dworkin, 1981, p. 56).

Alternatively, a "risk-benefit" or "risk-utility" test builds directly on the negligence foundations of strict liability (Dworkin, 1981, p. 55). This test defines a product to be defective if a prudent manufacturer would not have marketed the product, knowing of the risk involved in its use (Dworkin, 1981, p. 55). For design defects, this is equivalent to asking whether a product’s risks outweigh its usefulness or benefits: Presumably a prudent and knowledgeable manufacturer would not market the product under these conditions (Robb, 1983, p. 155). Recovery under negligence requires proving that the manufacturer actually knew of the risks, while under strict liability the manufacturer’s knowledge of the risk is presumed. Dworkin (1981: p. 58) notes, however, that this distinction may not be very significant, because even under negligence the manufacturer is often considered to be an "expert" on the use of the product and thus is presumed to know of the risks.

For manufacturing defects involving an individual product rather than an entire product line, it is generally easy to deter-
mine if the above tests have been met. There is a clear standard against which to judge an individual item: the "normal" quality of that product (CCH, p. 4053; Dworkin, 1981, p. 53). Presumably, a product that differs from the normal specifications in a way that results in an injury would be judged defective under either the consumer-expectations or the risk-benefit test. In such cases, therefore, it appears that a manufacturer's expectations regarding the standard of liability would be the same under the two tests.

For design defects, however, a clear standard does not exist (CCH, p. 4053; Dworkin, 1981, p. 53). There is no obvious definition of "defective design," because we usually lack a clear norm against which to judge a product line. Further, states vary in their interpretation of the imputed manufacturer's knowledge under the risk-benefit test. In some states, a manufacturer would be held liable under strict liability only if the risk was foreseeable at the time of manufacture -- clearly, a "fault" basis for liability. Other states have gone further and held manufacturers strictly liable for risks that were not foreseeable at the time of manufacture but later became apparent (Dworkin, 1981, p. 58). The latter approach borders on absolute liability, since it makes manufacturers liable for nearly any injury resulting from the use of their products (Robb, 1983, p. 168). In response to the expansion in the scope of manufacturers' liability implicit in this approach, several states have passed legislation allowing "state-of-the-art" defenses, which limit liability to risks foreseeable at the time of manufacture (see further discussion below, section II.C.2).
Related to the issue of foreseeability is the duty to warn of dangers. While manufacturers and others with expertise generally have a duty to warn unknowing users about dangers inherent in a product (CCH, p. 4085-15), states disagree in their specific requirements on warnings (Dworkin, 1981: pp. 61-62). All states require warnings of some kind, but some prohibit warnings about obvious dangers on the theory that routine warnings will reduce the attentiveness of users to warnings (Schwartz and Mahshigian, 1987).  

Finally, the question of foreseeability arises in the context of injuries to bystanders and other third parties (non-users). The issue is whether the risk to such a non-user was foreseeable. Courts vary in how broadly or narrowly they define foreseeability in this context (CCH, p. 4136).

II.C. **Allowable Defenses: What actions bar or limit recovery?**

Defenses that bar or limit recovery by plaintiffs may arise from either the defendant's own behavior or that of the plaintiff. At issue here is "negligence," which refers to the extent to which unreasonable behavior by the plaintiff or the defendant contributed to an injury. In contrast, strict liability requires no judgment about either side's behavior, at least in principle. Nevertheless, there has been considerable debate over whether behavior is relevant in strict-liability contexts (LaPointe, 1984). Some have argued that considering behavior transforms strict liability into a fault-based system; see CCH, p. 443, and footnotes in LaPointe,
1984. Nonetheless, most states have allowed (either judicially or statutorily) some defenses based on the plaintiff’s or defendant’s behavior even in strict liability cases.

II.C.1. Defenses Related to the Plaintiff’s Behavior

The core defenses here are "contributory" and "comparative" negligence, sometimes combined under the heading of "comparative fault." Under "contributory negligence," recovery is barred if a plaintiff’s own negligence -- defined as the lack of prudent or reasonable actions to avoid harm -- contributed to the injuries. Carelessness, inattentiveness, or failure to heed warnings are examples of negligent plaintiff behavior (CCH, p. 3011). A finding of contributory negligence bars recovery if the defendant can prove that the plaintiff’s actions contributed in any way to the injury. 3° Thus, most states have adopted the more flexible comparative-negligence standard, under which a plaintiff’s negligence merely reduces the amount recoverable in proportion to its relative contribution to the injury (Woods, 1984; CCH, p. 3031, 4447). For reasons of administrative cost, some states use modified comparative negligence, which pegs recovery to whether the plaintiff was more than 50% at fault (CCH, p. 447; LaPointe, p. 461). Note that a few states still do not allow contributory or comparative negligence as a defense in a product liability suit (Woods, 1984, pp. 409-410).

Many states have adopted (either judicially or statutorily) specific defenses derived from contributory or comparative negligence: misuse, product alteration, and assumption of risk (CCH, p. 3069-3072). Under the misuse defense, the defendant must prove
that (i) the plaintiff used the product in an abnormal way; (ii) the misuse was not foreseeable; and (iii) the misuse caused the injury (CCH, p. 4479; Woods, p. 402-403). The product-alteration defense requires proving that the product was substantially altered, after it left the defendant's control, in a way that led to the injury (CCH, p. 4491). The assumption-of-risk defense rests on showing that the plaintiff knowingly, voluntarily, and unreasonably subjected himself to the risk (CCH, p. 3041, 4459) -- for example, by voluntarily using a product known to be defective and risky.

These three specific defenses clearly fall under the heading of comparative fault (Woods, 1984, p. 399). In fact, some states have combined the comparative negligence and assumption of risk defenses (Woods, 1984, p. 401-403, LaPointe, 1984, p. 462; CCH, p. 4459). Distinctions, however, may be drawn. For example, the standard used for determining comparative negligence is the knowledge and behavior of an ordinary, "reasonable" person, whereas assumption of risk turns on the actual knowledge of the injured party (CCH, p. 4459). Thus, assumption of risk is an allowable defense in some of the (few) states that do not recognize contributory or comparative negligence (CCH, p. 4459).

Finally, some states permit a defense that bars recovery if an injury results from the plaintiff's use of the product beyond its intended "useful life" (CCH, p. 3069). The useful-life defense is in fact a special case of assumption-of-risk. Several states have codified it in the form of "statutes of repose" (CCH, page 4497.38), which limit a manufacturer's liability to injuries that
occur during a given time period starting from the date of sale of the product. The idea is that one assumes a known risk by using a product beyond that time.\textsuperscript{32}

II.C.2. Defenses Related to the Defendant's Behavior

Defenses based on defendants' behavior usually seek to prove either that the defendant was not negligent (in negligence actions) or that the product was not defective (in strict liability actions). The main defense of this type holds that a defendants' actions or product conformed with the state of the art at the time of manufacture, where "state of the art" reflects the scientific knowledge available at that time (CCH, p. 3049, 4497.5). As evidence of conformity with this standard, courts may look to compliance with industry standards or government standards, regulations, or statutes. While such compliance may be evidence of nondefectiveness, it does not constitute an absolute defense against liability, because industry or government standards are usually viewed simply as minimums, not optimums (Dworkin, 1981, pp. 66-67).

Because of concerns that manufacturers were being held liable for risks not knowable at the time of manufacture (see section II.B.), several states have statutorily adopted state-of-the-art defenses (Dworkin, 1981, p. 58-59; CCH p. 3049). Even so, considerable uncertainty remains as to whether proof of conformance with the state-of-the-art will absolve a manufacturer of liability (see Schwartz and Mahshigian, 1987).
II.D. **Procedural Issues: Where and when can suits be brought, and what evidence is allowable?**

Under traditional contract principles, a suit for breach of contract would be brought in the state in which the product was sold. Under tort law, however, the relevant jurisdiction is usually the state in which the injury occurred. Many states use the tort rule for product liability suits (CCH, p. 3145). In cases where neither of these rules seems appropriate -- e.g., a person from state x is injured because of an allegedly defective automobile produced in state y, while driving through state z -- courts have applied a "most significant relationship" rule to determine the jurisdiction (CCH, p. 3145).

The resulting discretion in the choice of jurisdiction, combined with plaintiffs' obvious incentives to seek the jurisdiction with the most favorable procedural provisions, has led to the practice known as "forum shopping" (CCH, p. 3145). One source of forum shopping is state differences in the statutes of limitations for bringing suits under contract, negligence, and strict liability theories (CCH, p. 3471-3483, 4497.8-4497.9). These statutes specify a time period beyond which a suit for an injury can no longer be brought. In contrast to the statutes of repose, which use the date of sale as a reference point, statutes of limitation use the date of injury as a point of reference. Besides the length of the period during which a suit may be filed, states also vary in their interpretations of when the statutory time begins to run (CCH, p. 4497.8-4498.8). This becomes particularly important in cases where the injury is not immediately apparent. For example, with diseases
resulting from prolonged exposure to hazardous substances, the statute could begin to run at the time of exposure, the time the disease was actually contracted, or the time that it was discovered.

To reduce incentives for forum shopping, many states have enacted "borrowing statutes" (CCH, p. 3145). These statutes permit defendants to "borrow" any bar to an action that is available to them in the state in which the cause of the action occurred (CCH, p. 3145). The existence of borrowing statutes reduces the impacts of state differences in statutes of limitation and also offers greater protection to defendants.

In contrast to borrowing statutes, the "long-arm" statutes that many states have enacted are designed to protect plaintiffs. These statutes allow a state to extend its jurisdiction to out-of-state corporations that have injured in-state residents, thus preventing defendants from escaping suits filed in other states (CCH, p. 3131). As a result, manufacturers must be prepared to face suits in any state, thereby increasing the impacts of differences across states.

At first blush, it might seem that such impacts could be mitigated by the apparently common practice of referring multi-state product-liability suits to Federal courts. Thus, a defendant might be able to lessen the effects of varying state laws by transferring a multi-state case from the state courts to a Federal court. However, because we lack a uniform Federal product-liability statute, the Federal courts interpret state laws. Moreover,
interpretations of law may vary across Federal District courts, and even from one appellate circuit to another. Therefore, we conclude that transferring cases to Federal courts provides little relief from interstate variability in product liability law. Indeed, it may compound a defendant's problems by reducing the predictability of the law and by offering plaintiffs an additional forum among which to shop.

Regarding the types of evidence allowed, the main source of variation across states is in the admissibility of evidence (for plaintiffs) of subsequent remedial actions a manufacturer may have taken to reduce risks (CCH, p. 3281; Schwartz and Mahshigian, 1987). Redesign or repairs after an injury occurred may constitute evidence of product defectiveness that should be admitted (CCH, p. 3281). However, if liability is based on the state-of-the-art at the time of manufacture, then later remedial measures (which could reflect knowledge obtained after the time of manufacture) should not be allowed as evidence of negligence or defectiveness. In addition, using subsequent repairs as a basis for increased liability reduces manufacturers' incentive to improve products as more information becomes available.

II.E. Implications of Differences among States: A Framework

The above discussion suggests that in many respects products liability law is similar across states. At a minimum, one can identify some general rules that apply in all or most states: the abolition of privity, the prevalence of strict liability, the use of a risk-benefit test in defining design defects, and the temper-
ing of strict liability with contributory or comparative negligence (including allowance of misuse or alteration defenses).

In other significant respects, however, various states permit exceptions to the rules or apply them differently. Differences relate to the extension of liability to non-manufacturers; the recovery of economic losses; the application of punitive damages; the use of joint-and-several liability and market-share liability; the precise definition of "defectiveness;" the duty to warn; the application or allowance of specific defenses; statutes of limitations; the existence of borrowing or long-arm statutes; and the use of evidence relating to remedial actions. As a result of such differences, the outcome of a product liability case can differ markedly, depending on the state in which the suit is brought (or which state law a Federal court applies). The question then becomes: What are the implications of these interstate differences?

At the time of manufacture, the total dollar amount that a given producer\(^\text{35}\) (or its insurer) will ultimately have to pay out in product liability claims for a given product is uncertain. The sources of the uncertainty are two. First, the number and extent of injuries arising from use of the product are unknown; they will depend (among other things) on the design and construction of the product and how it is used. Second, the extent of the manufacturer's liability for those injuries is unknown, because of differences across states in the prevailing law and its application. The manufacturer can influence the first source of uncertainty (by producing a safer product) but not the second source, which will
vary with the laws in the state in which the suit is brought.\textsuperscript{36} In this section we focus on this second source of uncertainty, deferring discussion of the first source to section III.

Suppose that the number of product-related accidents is known. Let $S$ denote the total associated monetary damages for which the producer will be held liable. $S$ may range from zero (no liability) to a very large number (with large awards for non-pecuniary damages and the assessment of punitive damages). At the time of production (and purchase of any insurance), $S$ is unknown, because the product liability law that will ultimately be applied is unknown.

Formally, at the time of production $S$ is a random variable with a frequency distribution, $f(S)$.\textsuperscript{37} That distribution will have an expected (average or mean) value, $E[S]$, reflecting the expected liability given an injury.\textsuperscript{38} In addition, $f(S)$ will have a variance, $V[S]$, reflecting the likelihood that $S$ will be far from its expected value.\textsuperscript{39} Figure 1 illustrates two possible distributions of $S$ with the same expected value but different variances, indicating different degrees of uncertainty about $S$. A smaller $V[S]$, as in Figure 1(a), suggests that the extent of future liability can be predicted fairly accurately, whereas a larger variance, as in Figure 1(b), implies great difficulty in predicting the level of $S$ at the time of production.

The distribution of $S$ may be either symmetric or skewed. If the distribution is symmetric, its form is the same above and below its expected value and the most likely (i.e., highest-probability) level of $S$ is $E[S]$.\textsuperscript{40} In contrast, for a skewed distribution, val-
ues of $S$ to one side of the expected value are more likely than those to the other side. Figure 2 illustrates symmetric and skewed distributions with the same expected value and variance. The difference in their shapes stems solely from the difference in skewedness.

In terms of state product liability laws, $E[S]$ represents the expected, or average, level of damages one can expect, given the differences across states. This reflects the common rules regarding product liability on which there is consensus across states. Our discussion (in section I) of the history of products liability law suggests that this expected value has been increasing over time, due primarily to the abolition of the privity requirement and the move to strict liability.

The variance $V[S]$ reflects individual state deviations from the general rules or (absent general rules) the dispersion of the state rules. In effect, $V[S]$ represents those issues on which there is no consensus. If deviations or the lack of general rules has large impacts on the ultimate damages owed by the producer, the variance of $S$ will be large; and conversely.

The skewedness of $f(S)$ may be more important than the variance. If the variations in the law across states have given rise to very large awards in a small number of states, then $f(S)$ will be skewed "rightward" and the producer will face the possibility of ruinously large judgments, however infrequent.

In determining whether state differences have contributed to the product-liability "crisis," and whether a uniform Federal stat-
ute would reduce the associated problems, it is important to identify the precise sources of the crisis. Not surprisingly, the stated opinions on these issues differ.

Cooter and Ulen (1988: p. 462) argue that the crisis has arisen because the law has moved beyond strict liability (with defenses of product misuse and assumption of risk) toward a standard of absolute liability. In other words, the expected level of damages (rather than its variance or skewedness) is the root of the problem. Cooter and Ulen argue that the historical trend in U.S. products law since the mid-19th century towards stricter liability standards (see section I) has gone too far; recently enacted state laws limiting producer liability suggest that several state legislatures share their view. Our framework suggests, however, that (if the trend itself is the problem) a uniform Federal products liability statute that simply ratified this trend would do little to relieve the crisis.

Cooter and Ulen's argument implies that the problems would remain, even if all state laws were identical. Others, however, have identified state differences per se as the source of the problem. For example, Schwartz and Mahshigian (1988) argue that uncertainty in the tort law is the prime culprit and call for a uniform Federal law. This argument implies that improving firms' abilities to predict damages more accurately -- i.e., simply reducing the variance of $S$ (even without reducing its expected value) -- would ease the crisis. For example, changing the distribution of $S$ from that shown in Figure 1(b) to that shown in Figure 1(a) would
increase predictability and thereby address the concerns of producers and insurers, despite the continued existence of a long upper tail (i.e., the possibility of very large awards in a very small number of cases).

In fact, arguments that ostensibly focus on variance may really have to do with skewedness. To the extent that exceptions to the general rules take the form of very high rather than very low awards, the distribution of $S$ will be skewed upward, as in Figure 2(b). It is the upper tail -- the mere possibility of a very large award even if its likelihood is very small -- that is reflected in concerns about the "open-ended" nature of current product liability laws. Schwartz and Mahshigian (1988), for instance, focus on state differences that have allowed exceptionally high awards or otherwise strongly favored plaintiffs. If the upper tail of the distribution is particularly important to producers and insurers in making their decisions on product design, pricing, and insurance premiums, then proposals that merely reduce the variance of the distribution without eliminating the upper tail will do little to ease the liability crisis.

To ascertain which of these parameters -- mean, variance, or skewedness -- matter to firms confronted with product liability laws, we must set this framework in a general analysis of how those laws affects firms' costs. This is the task of the next section.
III

PRODUCT LIABILITY AND FIRMS' COSTS

We begin by examining the relationship between differing liability rules for product-related accidents and the rate of such accidents with a general model of precaution first developed by Brown (1973). This model posits an economic actor who engages in an activity that creates the risk of injury to a potential victim or victims. The risk of the injury, however, can be reduced in several ways. First, the actor can invest in precautionary behavior. For manufacturers of dangerous products, this could involve more extensive testing or development of a safer design for the product, both costly activities. Potential victims (consumers and workers) too can take precautions to reduce the risk of accidents, for instance by reading directions carefully or by using a product only for its intended use and in the prescribed manner. Again, these precautions involve costs to the victims. Finally, given the level of precaution by actors and victims, the risk of accidents can be reduced if the manufacturer simply produces less output.

The social objective in choosing each of these risk-reducing activities is to maximize the net social benefits of the product, comprised of its consumption benefits minus (i) the costs of products, (ii) the expected accident costs, and (iii) the costs of precaution (by both sellers and victims). This implies that each activity should be conducted up to the point where the marginal benefits of the activity equal marginal costs. For example, the manufacturer of a product should invest in precautionary behavior to
the point where the reduction in the expected cost of an accident from an additional unit of precaution just equals that unit's cost. The same criterion determines efficient precaution by a consumer of the product. The efficient output would be the level at which the consumption benefits of the last unit produced just equal the marginal cost of production (inclusive of precautions) plus marginal accident costs. An important implication here is that some accidents will occur, given that precaution is costly and consumers benefit from consuming the product. For example, producing automobiles completely free of mechanical defects would be so costly that few consumers could afford them, yet discontinuing production to avoid mechanical failures clearly would not be desirable.

In this setting, the function of legal rules (ideally) is twofold: first, to allocate accident costs among the parties involved in a way that encourages the efficient choice of precaution and output; and second, to compensate victims of accidents when they do occur. How well existing product liability law achieves these goals is an empirical question with important implications for the ongoing debate over tort reform.

Our primary interest is in the impact of product liability law on one party to the debate, producers. We consider three costs of product liability for producers: (i) the cost of precautionary behavior, or product safety; (ii) the cost of liability for accidents, including litigation and settlement costs; and (iii) the cost of liability insurance for those firms that choose to carry it. For each type of cost, we first review the theory, drawing on
the law and economics literature, and then discuss the implications of firm size and the variability of product liability law across states. Finally, we examine the supra-firm, market impacts of product liability.

III.A. The Cost of Precaution

III.A.1 Theory

In deciding how to produce a given product, a firm must choose a design, decide on the materials to be used in manufacturing the product, and establish and enforce quality control in the production process itself. We shall refer to this clutch of decisions as precaution; its role in production is to determine product safety.

Let the firm's cost of precaution, or product safety, be $C(x,q)$, where $x$ is the level of precaution and $q$ is the firm's output. $C(\cdot)$ is increasing in $x$: Safer products are costlier to produce.

III.A.2 The Impact of Firm Size on Precaution Costs

The firm's output enters $C(\cdot)$ to reflect possible scale economies in precautionary behavior. If these are present, $C(\cdot)$ will be decreasing in $q$, holding $x$ fixed: A larger firm will face a lower cost of a given level of safety, all else equal. Scale economies may arise from spreading "overhead" costs of testing or of a "product safety office" (Eads and Reuter, 1983) over more units of output. Spending on in-house R&D (more likely in larger firms) will raise costs but may be cheaper than buying or leasing
the necessary technology. Economic theory suggests that, with lower unit costs of product safety, larger firms will produce safer products, all else equal.

III.A.3 The Impact of Variable State Laws on Precaution Costs

The impact of differences in state product liability laws on precaution costs depends upon how firms respond to the variability. Suppose, for example, that firms simply base their investments in product safety on the average stringency of state product liability laws. In this case, the variability of state laws will have little effect on precaution and hence on costs. True, firms would respond to the increase in average stringency by increasing their precautions, given that higher liability increases the marginal benefit of producing safer products (all else equal). But the increased precautions would be attributable to the more stringent producer liability rather than to variability of laws across states. A uniform Federal statute that incorporated the higher average stringency of state laws would provide firms no relief.

Suppose instead that firms respond to the variance in product liability laws and thus tailor products sold in different states to their respective product liability laws. The attendant need for multiple product specifications and production lines would raise costs of precaution. At the same time, in the U.S. Federal system with its "commerce clause," producers cannot be sure that products designed for one state will not be used in other jurisdictions.

Finally, suppose that firms respond to varied state laws by basing their product safety decisions on the most stringent stan-
dards (Eads and Reuter, 1983). They could be trying to avoid excessive judgments,49 or acting on the belief that such standards signal the future trend of the law. In this case, the level of precaution, hence also the associated costs, will be greater than if firms simply responded to the average stringency across states.

III.B. Liability Costs

III.B.1 Theory

Our theoretical discussion of liability costs proceeds by stages. First, we analyze a firm’s total liability costs as a function of its own level of precaution, the precaution taken by consumers, and the prevailing legal rule. Second, we explore the implications of three particular aspects of the legal-rule variable: punitive damages; joint and several liability; and market-share liability. Third and last, we add to the analysis the litigation decisions by both victims and injurers.

* * * * *

A firm’s total liability costs will equal its expected liability costs per accident, times the expected number of accidents.

Expected liability costs per accident will depend on the amount of producer precaution, the amount of consumer precaution, and on the prevailing legal rule. We write those costs per accident as

\[ L(x,y,s) , \]

where \( x \) (as above) is the amount of precaution taken by the producer; \( y \) denotes the user’s precaution, which we are treating as
exogenous; and \( s \), defined as the share of actual damages a producer expects to bear if a lawsuit is filed (i.e., \( 0 \leq s \leq 1 \)), \(^{50}\) is a summary variable for the prevailing legal rule. \( L(\cdot) \) is decreasing in \( x \) and \( y \): Greater precaution (by either party) will result in fewer accidents and lower damages per accident, hence lower accident costs.\(^{51}\) \( L(\cdot) \) will be increasing in \( s \): a greater expected share of total damages will increase a firm's expected liability costs.\(^{52}\) Indeed, it is common to write \( L(\cdot) \) as \( sD(x,y) \), where \( D(\cdot) \) is actual damages:

\[
L(x,y,s) = sD(x,y). \tag{1}
\]

The expected number of accidents equals the probability of an accident per unit of output, \( r(x,y,q) \), multiplied by output, \( q \):

\[
r(x,y,q)q.
\]

The probability \( r(\cdot) \), like \( D(\cdot) \), is assumed to be decreasing in \( x \) and \( y \), because greater precaution reduces the probability of an accident. Output \( q \) is included in \( r(\cdot) \) to capture any scale effects in the accident rate (see III.B.2 below).

A firm's total liability costs, equal to the accident-probability per unit of output, times output, times the expected liability given that an accident occurs, are thus:

\[
r(x,y,q)qsD(x,y). \tag{2}
\]

Combining this expression with the firm's cost of precaution from III.A.1 yields its total expected costs of precaution and liability:

\[
C(x,q) + r(x,y,q)qsD(x,y). \tag{3}
\]
A firm’s liability costs are also affected by three aspects of the legal rule that are at the center of the debate over reforming product liability law: (i) punitive damages; (ii) joint and several liability; and (iii) market-share liability.\(^{53}\)

(i) \textit{Punitive damages} are meant to punish the defendant for egregious conduct, beyond simply compensating the victim. In products cases, punitive damages would be awarded for "reckless indifference to safety, gross negligence, and concealment by the manufacturer of the dangerousness of his product from consumers" (Landes and Posner, 1987: p. 302).\(^{54}\) With punitive damages, the defendant’s liability costs may exceed the damages caused by the accident. In terms of the firm’s costs in expression (3), when punitive damages are possible, the second term becomes

\[
r(x,y,q)(s+m)D(x,y),
\]

where \(m\) is an adjustment factor reflecting the possibility that punitive damages will be awarded; \(mD(x,y)\) is the expected punitive damages, and \((s+m)>1\) is of course possible.\(^{55}\)

While it may seem unfair to inflict total costs that exceed actual damages from an accident, punitive damages have been defended on efficiency grounds as a correction for imperfect enforcement or legal error, which reduce incentives for manufacturers to invest in precaution (Cooter and Ulen, 1988: pp. 394-5). Suppose, for example, that expected liability costs of \$1,000 are necessary to achieve the desired level of precaution, but manufacturers erroneously escape liability half of the time they fail to invest that
amount. Then actual damages of $2,000 must be imposed whenever underinvestment is detected.

(ii) Joint and several liability exposes any party contributing to an accident to liability for the full amount of the damages, even if that party’s contribution was minimal.\(^\text{56}\) This controversial doctrine partially severs the causal relationship between the actions and the liability of a defendant — a relationship that is usually a crucial component of a tort action.

(iii) Market share liability goes even further in severing the causal link between behavior and liability. This doctrine applies to cases in which a single firm’s product actually caused an accident, but the exact identity of the seller of the injuring product cannot be determined (Shavell, 1985; Miceli and Segerson, 1991b). Rather than leave victims uncompensated in such cases, market share liability eliminates the plaintiff’s burden of proving the injurer’s identity, and instead apportions liability among all sellers of the product who could have sold it to the victim in proportion to their market shares of output at the time of the sale (Rose-Ackerman, 1990; Marino, 1991).\(^\text{57}\) As noted earlier, few jurisdictions have yet adopted market share liability, but sellers clearly should be concerned about the extension of this doctrine.

* * * * *

Thus far we have ignored the decisions of victims to file claims and those of injurers to contest the actions. Those decisions, which turn on expected costs and benefits, determine the
number of suits filed and (of that number) how many ultimately settle and how many go to trial.

Victims’ litigation costs (which determine, among other things, the fraction of accidents that result in legal claims) consist of filing fees, attorney’s fees, and time costs. If the expected value of a claim -- the expected trial award or settlement amount -- exceeds these costs, a victim will assert the claim (Cooter and Rubinfeld, 1989). The value of a claim will vary directly with the magnitude of the victim’s injuries and the prevailing liability rule: The greater the injuries and the more favorable the liability rule for plaintiffs (e.g., the higher are our D and s), the more likely that an accident will result in a claim, given the plaintiff’s litigation costs. Litigation costs clearly prevent some accidents from turning into lawsuits. Thus, higher victim litigation costs benefit defendants.58

Once a claim is asserted, defendants incur litigation costs of their own, which must be included in expected product liability costs along with those shown in (1). Not all claims go to trial; in fact, the vast majority of product liability suits are settled out of court.59 A settlement can only occur, of course, if both parties agree on the amount. Thus, the high rate of settlement reflects a common interest of plaintiffs and defendants in avoiding the costs of a trial as well as the uncertainty about the outcome. The few cases that do go to trial therefore usually result from (i) divergent expectations by the opposing parties about their chances of winning (Priest and Klein, 1984);50 (ii) breakdowns in the pre-
trial bargaining process (Cooter and Rubinfeld, 1989); or (iii) the divergent interests of clients and their attorneys (Miller, 1988).

These arguments imply that the expected settlement amount, if one is to be agreed upon, must be no greater than the expected cost of a trial to the defendant, and no less than the expected value of a trial to the plaintiff. It can be shown that such an amount, denoted $T$, will always exist if the two parties broadly agree on the likely outcome of a trial, and if settlement costs are low. Let $c_s$ and $c_t$ be (respectively) the defendant's litigation costs in the event of a settlement and of a trial; it is customary to assume that $c_s < c_t$. Further, let $p_t$ be the probability of a trial given that a suit has been filed. Then the defendant's expected liability costs per suit in the presence of litigation costs and possible settlement are

$$L(x,y,s) = p_t(sD(x,y)+c_t) + (1-p_t)(T+c_s), \quad (4)$$

where $sD(x,y)$ is defined as in expression (1) above.61

Recall, however, that not all accidents result in claims, because of victims' litigation costs. Let $a$ be the fraction of accidents that result in claims.62 Then expression (3), for a firm's expected costs of precaution and liability, may be rewritten as a more general expression that includes the impact of the litigation and settlement costs of both injurers and victims:

$$C(x,y) + r(x,y,q)aL,$$

where (as before) $C(x,y)$ is the firm's cost of precaution; $r(x,y,q)a$ is the expected number of accidents; and $L$ is given by expression (4).
III.B.2 The Impact of Firm Size on Liability Costs

Large firms produce more output than small firms; hence they are likely to face more product liability suits and thus have higher total liability costs, all else equal. However, to understand the relative impact of product liability law on large vs. small firms, we must ask whether they differ in their average liability costs -- that is, liability costs per unit of output. It is these average costs that determine the profitability of firms otherwise similarly situated.

The accident rate, $r(x,y,q)$, for some products may have output-scale effects. Conflicting effects are possible here, depending on the nature of the product's risk. On the one hand, greater output may increase users' familiarity with a product, reducing the accident rate, as, for example, with chain saws (a scale economy). On the other hand, if a product's negative effects are cumulative, as for some drugs, then more output may increase the accident rate (a scale diseconomy). Note, however, that the relevant output variable for these scale effects is the output of the industry, not the firm. Thus, small firms in a large industry may not perceive their output as affecting the accident rate. If so, we have a moral hazard problem: Small firms will invest in too little precaution, resulting in inefficient industry output (either too little or too much, depending on the nature of the scale effects). Large firms, in contrast, are more likely to perceive these scale effects and, depending on the legal rule, take them into account in choosing precaution and output.
A firm's size may also affect the amount of punitive damages it expects to incur, since the law typically allows evidence of the defendant's income or wealth to influence the determination of the size of punitive damages (Abraham and Jeffries, 1989). Thus, to the extent that larger firms earn higher profits or have greater assets (i.e., "deeper pockets") than small ones, they may expect to pay larger punitive damage awards. In terms of the theoretical justification for punitive damages above, the deep-pocket result is efficient only if larger firms escape liability more often than small firms. Any such correlation, however, would be purely empirical and has no obvious theoretical basis.

Joint and several liability is also a deep-pocket rule, because it increases the expected liability costs of firms with larger assets relative to those with smaller assets. Note that, unlike punitive damages, joint and several liability may give smaller firms an incentive to ride free on larger firms -- that is, to invest in less precaution and to carry less liability insurance than they would otherwise -- to the extent that smaller firms do not expect to be held liable for the full amount of damages caused by their products.

Market-share liability seems to contain no systematic bias based on firm size, provided all firms produce equally safe products. However, if small firms produce less safe products -- for example, because of scale economies in safety production -- then market-share liability will work to their benefit by understating their true contribution to damages. Moreover, in cases in which
market-share liability is likely to be used -- for example, where the damages appear years after production and sale of the offending product -- small firms may be less likely still to be in business when damages are actually paid, further reducing their exposure to liability. Market share liability may, of course, lead firms of all sizes to underinvest in accident prevention, because none of them faces the full marginal social cost of its decisions on precaution (Marino, 1991).

A firm's size may also affect its litigation and settlement costs. First, there may be scale economies in litigation costs; to the extent that larger firms have more accidents and thus more experience in dealing with litigation, they may have a staff of attorneys whose sole responsibility is to manage the firm's accident claims. In contrast, a smaller firm may have to hire outside attorneys unfamiliar with the firm's operation when claims arise. If valid, this factor suggests that larger firms' litigation costs per claim may be lower than those of smaller firms.

In addition, small firms may be less able pre-trial bargainers and hence settle for larger amounts than would large firms facing the same claims. Also, larger firms may be better able to deter "nuisance suits" (in which the net value of the plaintiff's case at trial is negative). Larger firms could have an advantage in this regard if, as more experienced participants in the litigation process, their threats not to settle such claims are more credible (Rowe 1984; Galanter 1974). Finally, large firms may be more likely than small firms to suffer "non-monetary" losses, such as bad
publicity leading to consumer boycotts, from successful product liability suits against them, if name recognition is especially important to them. 68

III.B.3 The Impact of Variability in State Laws on Liability Costs

To the extent that variability of product liability laws across states increases firms' precaution (see III.A.), it will also reduce the accident rate and thus decrease their liability costs. However, the uncertainty generated by interstate variability in the law tends to increase the volume of litigation that firms face for a given accident rate. The theory of legal disputes outlined earlier in this section suggests that greater uncertainty about the law increases the probability that a dispute will go to trial rather than settling -- i.e., increases our variable $p$, (Priest and Klein, 1984; Priest, 1987a). Because the costs of a trial exceed those of a settlement, this will in turn raise litigation costs. In addition, litigation costs can increase simply because of the increased information costs required to keep up with the legal environments in many different states.

III.C. Insurance Costs

Some firms anticipating product liability claims against them purchase liability insurance. Indeed, a prominent issue in the debate over product liability reform has been the increasing cost, and declining availability, of such insurance, especially for small firms. Together with insurers' resistance to payment of certain large claims, 69 the rising premiums and rationing of cover-
age have led some large firms to self-insure -- that is, to drop market insurance coverage (Eads and Reuter, 1983). Also, product prices have increased, and in some cases firms have withdrawn products from the market because of their inability to insure against expected products claims (Weber, 1987; Priest, 1987b, 1988). To explain these responses requires an understanding of the nature of liability insurance and how insurers respond to increases in producer liability.

III. C.1 Theory

A seller of potentially dangerous products buys liability insurance primarily to protect against large declines in assets (Priest, 1987b); in the extreme, a firm wants to insure against "ruin" -- going bankrupt as a result of a large claim. An individual firm may self-insure by assuming the full risk of large losses in the event of an injury. Market insurers, however, are able to offer aggregations of uncorrelated risks that most firms cannot duplicate on their own. The pooling of a variety of risks by a single insurer allows it to charge premiums that are lower than the expected cost of self-insurance for most single firms. Hence, many companies are willing to pay fixed, periodic premiums to an insurer in return for the insurer's promise to pay at least a portion of large losses should they occur.

A profit-maximizing insurer will offer insurance coverage to sellers of potentially dangerous products, provided the stream of premiums is large enough to cover the expected damages, plus a margin for administrative costs and a (risk-adjusted) market return.
Thus, the premiums for a given amount of coverage will depend on the expected liability costs arising from a product-liability suit, the probability that a victim will file a suit once an accident has occurred, and the expected number of accidents. (See the discussion in section III.B.1.) Thus, to the extent that product liability laws affect these three factors, those laws could play a role in determining premiums.

Firms may reduce their insurance premiums through their own actions: Bearing more of the risks themselves and exercising greater precaution (thereby reducing the likelihood of products suits) both lower their insurers' expected payouts. The core issue here is "moral hazard," which refers to the tendency of an insured to take less care to prevent the covered losses. Such common features of insurance policies as deductibles, exclusions, coverage limits, and minimum-care requirements reduce moral hazard by returning some of the risk to the insured, thus providing a greater incentive to avoid accidents (Shavell, 1979)

Consider, for example, how deductibles work. From the insurer's perspective, deductibles serve two purposes. First, they reduce the insurer's expected payout on any given successful suit by requiring the insured to bear part of the damages. Second, they give the insured an incentive to reduce the likelihood of suits, reducing its own costs and (in the process) those of the insurer as well. Reducing both the expected payout and the accident rate should in turn reduce insurance premiums.
A given seller's premium will depend, however, not only on its own accident rate but also on the accident rates of other firms covered under the same kind of policy. Recall that an important function of market insurance is to aggregate, or pool, similar but uncorrelated risks. When the risks (or accident rates) of members of the pool differ, the problem of "adverse selection" arises. Since the premium for the pool is based on the average risk across all members, low-risk members pay a premium that is larger than they would pay in a pool of only low risk members, while high risk members pay a lower premium than is dictated by their risks. This creates an incentive for the low risk members to opt out of the pool, an action which further increases the average risk and hence the premium for the remaining members. Low risk members may be willing to stay in the pool, even in the presence of adverse selection, because of the benefits of aggregation noted above. However, if the gap between low and high risk members becomes large enough (i.e., if the adverse selection problem becomes severe), self-insurance may become preferable to market insurance for low risk members.

Priest (1987b) has argued that the exit of low risk members from insurance pools due to adverse selection was a major cause of the liability insurance crisis of the mid-1980s. According to his argument, the increase in tort liability of producers increased the average risk of individual firms, as well as the variance of their risks. The increased variance in turn aggravated the adverse selection problem to the point where low risk firms were more likely
to withdraw from the insurance pool and self-insure. As a result, the average risk of the pool increased, causing premiums to increase and resulting in a further withdrawal of low risk firms from the pool. In this way, the pool progressively unraveled, premiums skyrocketed, and coverage was reduced.

The reduction in coverage took the form of increased deductibles, lower coverage limits, exclusion of some types of coverage altogether, and the loss of insurance coverage by some firms who still wished to purchase it. Insurers made these changes, Priest argues, to increase the attractiveness of insurance pools to low risk firms. A given limitation on coverage -- say, a deductible -- is cheaper for a firm with a lower probability of an accident because the firm is less likely to have to pay the deductible (that is, the expected deductible is lower).

III.C.2 The Impact of Firm Size on Insurance Costs

Firm size affects insurance costs in several ways. The first follows directly from the preceding argument: Small firms are simply less capable of self-insuring than large firms because they do not have enough assets to survive a large claim. Thus, they will be left in the pool with high-risk firms and pay correspondingly high premiums. Second, small firms will find it more difficult to absorb large deductibles. They may therefore have to purchase low-deductible policies with high premiums. Third, the bigger accounts that large firms offer insurance companies may lower average administrative costs, allowing the large firms to obtain
lower premiums (Settle and Spigelmyer, 1984). Fourth, if premiums for small firms cannot be based on experience ratings, because of the small number of claims, the accident rate of a particular firm and its insurance costs may not be closely related. Thus, an individual small firm may not be able to lower its costs through investments in safety measures. Finally, if as a group small firms invest less in safety than large firms and therefore have higher accident rates, then to the extent that individual firms' premiums are based on those rates, small firms premiums will tend to be higher than those for large firms.

III.C.3 The Impacts of Variability in State Laws on Insurance Costs

Variability in product liability laws across states may affect insurance costs in several ways. First, such variability increases the variance of possible liability outcomes across firms in a given risk pool. Because of the resulting decline in the predictability of outcomes, insurers have to set insurance premiums above what would otherwise be actuarially fair in order to guarantee a given level of reserves (Tort Policy Working Group, Update, 1987). In addition, the higher variance and reduced predictability of outcomes may cause a firm and its insurer to arrive at different estimates of the firm's risk, thus worsening the adverse selection problem identified above (Priest, 1987b: p. 1562). Finally, because most of the increased variance of outcomes has occurred in the range of very large awards to victims, the correlation of outcomes across firms in a given risk pool has increased (Priest,
1987b: p. 1563). As a result, insurers are less able to diversify risks and thus must charge higher premiums. This last effect suggests that the skewedness of the distribution of outcomes, in addition to its variance, is a source of higher insurance costs. (On skewedness, see II.E. above.)

III.D. **Market Impacts of Product Liability**

One aspect of product liability cases separates them from other torts: In product liability there is typically a contractual relationship between the injurer and potential victims. As a result, sellers may be able to pass some or all of their liability costs on to consumers through the terms of contracts.

Landes and Posner (1987: Chapter 10) show that an implication of the contractual relationship between a buyer and a seller is that the liability rule affects neither the choice of precaution by either party nor the seller’s choice of output, provided that transaction costs are negligible. All will be chosen efficiently under any rule; i.e., the value of our variable s (see section III.B) does not matter. The reason is that buyers will discount their willingness to pay for a product to reflect any damages that they will not be able to collect through the legal system; i.e., the demand curve for the product will shift down in proportion to buyers’ expected liability. At the same time, profit maximizing firms will demand a higher price if they expect to incur any share of accident costs; i.e., the supply curve will shift up in proportion to producers’ expected liability.
Landes and Posner's argument, if valid, would seem to minimize the role of the legal system and its impact on firms producing dangerous products. For example, one interesting implication of the argument is that the old privity doctrine in products liability law should not have affected investment in safety by manufacturers, even though it insulated them from lawsuits by other than direct purchasers. The argument, however, clearly relies on the strong assumption of negligible transaction costs. In particular, once we recognize the possibility of asymmetric information -- namely, that consumers misperceive product risks -- the liability rule again becomes important.

III.D.1 Consumer Misperceptions

There is considerable evidence that consumers do not accurately perceive very small risks (Opaluch and Segerson, 1989). When consumers underestimate risk, the liability rule will affect the decisions of both manufacturers and consumers regarding their investments in accident prevention.

Consider, first a strict liability rule that imposes all accident costs on manufacturers regardless of their level of care or that of consumers (i.e., s=1). In this case, consumers will underinvest in precaution, not only because they expect to be fully compensated for any accidents that do occur, but also because they underestimate the risk of accidents. Manufacturers for their part will set their investments in precaution based on the full costs of accidents -- inclusive of those caused by consumers' carelessness. As a result, expected accident costs will not be minimized, and the
price of the product will be too high (assuming that manufacturers pass on at least some of their liability costs to consumers).

Suppose instead that a negligence rule is adopted, imposing liability on manufacturers only when they do not invest efficiently in accident prevention. This rule will induce efficient precaution by manufacturers, who can avoid liability altogether by investing efficiently. With consumer misperception, however, a negligence rule will result in underinvestment by consumers. In contrast to strict liability, under a negligence standard the price of the product will be too low: producers (efficiently) do not bear the full costs of accidents, and consumers do not discount demand sufficiently to reflect the true product risk (Spence, 1977; Polinsky and Rogerson, 1983).

III.D.2 Market Impacts of Firm Size

Absent consumer misperceptions, the Coasian irrelevance argument above suggests that small firms may not be at a disadvantage relative to large firms regarding the product liability costs: Each firm's product price will reflect its own level of safety. The argument further suggests that variability of the law per se should not affect firms' costs.

With consumer misperception, however, these results no longer hold. Smaller firms may benefit if consumers form their expectations about a product's risk based on the accident rates of larger, more visible firms. In this case, small firms that produce similar but less safe products may be able to ride free on the mispercep-
tion by consumers, charging the same price that larger firms get for their superior products. By the same token, small firms considering whether to produce safer products may decide against it because of the difficulty of communicating the higher quality to consumers. Thus, consumer misperception would lessen the impact of product liability law on small business -- though the reasons are nothing to be proud of.

III.D.3 Market Impacts of Variability in State Laws

While in theory firms may be able to vary their prices across states to reflect differences in state product liability laws, in practice their ability, or inclination, to do so may be limited. Arbitrage across state boundaries may enforce the "law of one price." Also, firms may set a single price for all states for administrative convenience (Rice, 1985). If so, consumers in states with more stringent product liability laws are effectively subsidized by consumers in states with more lenient laws. Moreover, the price ceases to be an accurate signal of the true social cost of a product (inclusive of liability costs) in different jurisdictions. As a result, consumers in those states where the price is "too low" will purchase too much of the product, and consumers in those states where the price is "too high" will purchase too little.
III.E Summary of Product Liability and Firms' Costs

Table I presents a summary of the hypothesized impacts of firm size and state differentials on the costs a firm incurs in connection with product liability, and on its ability to pass those costs on to consumers through higher prices. A positive sign (+) indicates that an increase in firm size, or in state differentials would increase the corresponding component of costs or the pass-through ability of the firm; a negative sign (-) indicates the reverse. A question mark (?) indicates that the net impact could go either way.

As shown in Table I, the net effect of firm size on product liability related costs is unclear. In some ways, small firms appear to be better off (in the sense of bearing lower costs) than large firms, and in other ways they are worse off. Small firms are better off because (i) their lower outputs lead to fewer accidents; (ii) their smaller assets limit expected awards and steer plaintiffs toward deeper pockets; and (iii) their smaller investments in reputation limit reputational losses. On the other hand, small firms are worse off because (i) they cannot exploit scale economies in precaution and litigation, and in obtaining insurance coverage; (ii) they may be less able to bargain with potential plaintiffs; and (iii) their limited assets increase their need to rely on market insurance. Finally, small firms, with their relative lack of market power, are less able than large firms to pass costs onto consumers in the form of higher prices.
Whether small firms are on net burdened disproportionately by product liability laws depends on the relative magnitudes of these positive and negative effects. Those magnitudes can only be determined by an empirical analysis of the various relationships between firm size and product liability related costs outlined in Table 1.

In contrast to firm size, the overall effect of state differentials on total costs seems clear. In all of the ways that we have identified, an increase in the differences among state product liability laws increases costs to the firm and decreases its ability to recapture those costs through price increases. For example, state differentials increase the uncertainty of the law, resulting in higher costs of litigation per suit, a larger number of suits (for any given accident rate), and a higher cost of market insurance. In addition, legal uncertainty reduces the ability of firms to signal accurately to consumers (through their prices) the costs of liability in different jurisdictions. Thus, a move toward uniformity across states would decrease costs related to product liability. The question then remains: by how much? Answering this question requires empirical evaluation of the various components contributing to the overall impact of state differentials, as outlined in Table 1.
### Table 1

**Summary of Hypothesized Effects of Firm Size and State Differentials on Firms**

<table>
<thead>
<tr>
<th></th>
<th>Firm Size</th>
<th>State Differentials</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Costs of Precaution:</strong></td>
<td>(-)</td>
<td></td>
</tr>
<tr>
<td><strong>Liability Costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Litigation Costs</td>
<td>(-)</td>
<td>(+)</td>
</tr>
<tr>
<td>Number of Accidents(^a)</td>
<td>(+)</td>
<td></td>
</tr>
<tr>
<td>Probability of a Suit</td>
<td>(?)</td>
<td>(+)</td>
</tr>
<tr>
<td>Expected Award</td>
<td>(+)</td>
<td>(+)</td>
</tr>
<tr>
<td>Reputational Losses</td>
<td>(+)</td>
<td></td>
</tr>
<tr>
<td><strong>Insurance Costs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use of Deductibles(^b)</td>
<td>(-)</td>
<td></td>
</tr>
<tr>
<td>Moral Hazard Costs</td>
<td>(-)</td>
<td></td>
</tr>
<tr>
<td>Adverse Selection Costs</td>
<td>(-)</td>
<td>(+)</td>
</tr>
<tr>
<td>Required Profit Margins</td>
<td>(-)</td>
<td>(+)</td>
</tr>
<tr>
<td><strong>TOTAL COSTS</strong></td>
<td>(?)</td>
<td>(+)</td>
</tr>
<tr>
<td><strong>Passthrough via Prices:</strong>(^c)</td>
<td>(+)</td>
<td>(-)</td>
</tr>
</tbody>
</table>

\(^a\) Refers to increases due simply to increases in output, not differences in the level of precaution.

\(^b\) Refers to ability to reduce insurance costs by increasing deductibles.

\(^c\) Refers to ability to reflect product liability costs to product prices.
IV
EXISTING EVIDENCE ON THE EFFECTS OF PRODUCT LIABILITY

While economists and lawyers have paid considerable attention to the theoretical effects of alternative liability rules on behavior, relatively little work has been done to verify the predictions of the models empirically (Cooter and Rubinfeld, 1989). The lack of extensive empirical analysis stems primarily from the difficulties inherent in quantifying the impacts of liability in general (see Segerson, 1990), and of product liability in particular (see Litan, 1991). Nonetheless, a number of studies have tried to examine empirically some of the theoretical claims regarding the impacts of product liability. In this section, we briefly review the main findings of those studies. Table 2 summarizes the studies themselves, and Table 3 describes the data used and their sources.

IV.A. General Studies

The theoretical analysis in the previous section suggests that product liability will affect firms' litigation costs and, as a result, also both their insurance costs and incentives to make their products safer. Thus, in looking for empirical evidence of the effects of product liability, researchers have examined (1) litigation effects, (2) increases in insurance costs, and (3) evidence of improved safety, as three possible manifestations of product liability impacts.
<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ver Steeg (1974)</td>
<td>Investigate the effect of a change to strict liability on the amount of judicial resources devoted to product liability cases.</td>
<td>The number of appellate cases increased after adoption of strict liability, but the time devoted to each case did not appear to fall.</td>
</tr>
<tr>
<td>2. Viscusi (1991a)</td>
<td>Assess the factors underlying the product liability crisis.</td>
<td>The liability crisis is real, as evidenced by litigation rates in the 1970s and 1980s, and the declining availability of insurance. Changes in product liability law in the 1970s are identified as the major cause.</td>
</tr>
<tr>
<td>5. Viscusi (1986)</td>
<td>Examine the factors determining the disposition of product liability claims.</td>
<td>Most claims settle out of court, and awards are usually comparable to reported losses.</td>
</tr>
<tr>
<td>Study</td>
<td>Objective</td>
<td>Conclusion</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6. GAO Report (1989)</td>
<td>Determine whether certain features of the tort system are the cause of the product liability insurance crisis of the 1980s.</td>
<td>Damage awards correspond to injuries; posttrial activities reduce excessive awards, including punitive damages; negligence is basis for liability in most cases; state differences in laws do not seem to have a significant effect; and litigation costs are a large component of overall product liability costs.</td>
</tr>
<tr>
<td>7. Tort Policy Working Group (1986, 1987)</td>
<td>Examine the causes, extent, and policy implications of the crisis in liability insurance availability and affordability.</td>
<td>The major causes of the insurance crisis are the following features of the tort system: the move toward a no-fault system, erosion of causation, the increase in non-economic damages, and excessive litigation costs.</td>
</tr>
<tr>
<td>8. Viscusi (1990)</td>
<td>Assess the impact of state differences in product liability statutes on insurance costs.</td>
<td>Differences in product liability laws affect both the profitability and availability of insurance.</td>
</tr>
<tr>
<td>9. Barker (1991)</td>
<td>Examine the effects of state variations in product liability law on the performance of commercial liability insurers.</td>
<td>There is some evidence that states with more pro-plaintiff laws have higher underwriting risk and higher mean loss ratios.</td>
</tr>
<tr>
<td>10. Eads and Reuter (1983)</td>
<td>Examine the ways that firms have responded to the pressure to produce safer products.</td>
<td>Most firms have established product safety offices. Product liability law has been the most important influence on product safety efforts.</td>
</tr>
<tr>
<td>Study</td>
<td>Objective</td>
<td>Conclusion</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>11. Weber (1987)</td>
<td>Determine the impact on corporate decision making of the perceived crisis in tort law and liability insurance.</td>
<td>The overall impact has been minor among large firms. Insurance costs have increased slightly, most suits settle for small amounts, products have become safer, and some have been discontinued or recalled.</td>
</tr>
<tr>
<td>12. Litan (1991)</td>
<td>Determine the impact on safety and innovation of the expansion in producer liability.</td>
<td>The liability system sends a mixed signal to the private sector. The most important incentives for product safety come from regulation and consumer demand.</td>
</tr>
<tr>
<td>13. Higgins (1978)</td>
<td>Determine the impact on the accident rate of product liability laws.</td>
<td>The different product liability laws (negligence, strict liability and breach of warranty) have had indistinguishable effects. Enactment of any of these doctrines reduced the accident rate in states with a low level of education, and raised it in those with a high level of education.</td>
</tr>
<tr>
<td>14. Priest (1988)</td>
<td>Examine the impact of increased producer liability on the accident rate.</td>
<td>There is no evidence of a decline in the accident rate as a result of expanded producer liability.</td>
</tr>
</tbody>
</table>

Table continued)
<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>15. Huneycutt and Wibker (1988)</td>
<td>Determine the nature of the liability crisis as perceived by small businesses.</td>
<td>Many small businesses have substantially changed their operations in response to the liability crisis. Most believed that the judicial system is primarily responsible, and that consumers bear the ultimate burden in the form of higher prices.</td>
</tr>
<tr>
<td>Study</td>
<td>Description of Data</td>
<td>Source of Data</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Asbestos cases filed in federal courts.</td>
<td>Dungworth (1988)</td>
</tr>
<tr>
<td></td>
<td>Data on over 60,000 product liability insurance policies, 1980-1984.</td>
<td>Insurance Services Office (ISO)</td>
</tr>
<tr>
<td></td>
<td>Product liability premiums and loss ratios by industry (2 digit), 1980-1984.</td>
<td>ISO</td>
</tr>
<tr>
<td>Study</td>
<td>Description of Data</td>
<td>Source of Data</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
<td>----------------</td>
</tr>
<tr>
<td></td>
<td>Average punitive damage awards in product liability cases, Cook County, Ill., and San Francisco, 1986, 1987.</td>
<td>Institute for Civil Justice (ICJ), The RAND Corp.</td>
</tr>
<tr>
<td></td>
<td>Litigation costs in asbestos claims, 1986.</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>Average and expected product liability awards, 1987.</td>
<td>&quot;</td>
</tr>
<tr>
<td></td>
<td>Million dollar product liability awards in Cook County and S.F., 1987.</td>
<td>&quot;</td>
</tr>
<tr>
<td>Study</td>
<td>Description of Data</td>
<td>Source of Data</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>10. Eads and Reuter (1983)</td>
<td>Responses of nine large manufacturing firms to changes in product liability law.</td>
<td>Interviews</td>
</tr>
<tr>
<td>Study</td>
<td>Description of Data</td>
<td>Source of Data</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Product liability laws by state.</td>
<td>Hursch and Bailey, American Law of Products Liability, 2nd ed., 1974; and various court reporters.</td>
</tr>
</tbody>
</table>
IV.A.1 Effects on Litigation

Our theoretical analysis suggests that the effects of product liability come mainly through its impact on the amount of litigation and the size of awards. Several authors have tested for this relationship. Ver Steeg (1974) investigated the impact of the change from negligence to strict liability on the level of judicial resources devoted to product liability cases. Economic theory predicts conflicting effects. On the one hand, more cases should settle, because it is easier to predict the outcome of a case under strict liability than under negligence, and trials should be shorter because injurer care is no longer an issue. On the other hand, more cases should be filed, because strict liability is more favorable for plaintiffs. To evaluate these offsetting effects, Ver Steeg compared product liability appellate decisions in Illinois from 1960 to 1966, just before strict liability was adopted, with the period immediately following adoption, 1966-1972. He found, first, that the number of appeals increased after 1966 faster than the general growth in tort litigation; and, second, that the time devoted to court proceedings did not appear to decline. These results suggest that, at least in the short run, the tendency toward more suits under strict liability outweighs the tendency toward lower costs per suit.

Viscusi (1991a) examined non-statistically several broad trends in product liability law, focusing on the burden on industry. He concluded that the perceived crisis of the 1980s is real: Product liability claims escalated, and concurrently the size of
the market for liability insurance shrank. He traced the crisis to fundamental changes in products liability law in the 1970s -- which changes dramatically increased the liability burden on industry.

Viscusi's conclusions differ from those of two other recent studies, which found evidence that the product liability crisis abated in the mid-1980s. Dungworth (1988) examined the volume of product liability litigation in Federal district courts from 1973 to 1986. He found that, while most sectors of the economy experienced some products litigation during this period, a few industries predominated: asbestos, tools/machinery/equipment, pharmaceuticals, and motor vehicles. Furthermore, while product liability litigation as a percentage of all federal litigation did increase in every year beginning in 1974, a few asbestos and pharmaceutical defendants bore the brunt of the increase. All other product liability litigation increased at a much slower rate, about that for nonproduct tort suits.

Henderson and Eisenberg (1990), also studying product liability cases brought in Federal district courts but from 1979 to 1987, found the trend of decisions by the mid-1980s to be increasingly pro-defendant. For example, from 1983 to 1987 plaintiffs' success rates declined from 40% to 32%. The authors caution, however, that this trend could reflect an increase in the filing of marginal cases, in response to the favorable legal climate for plaintiffs, as well as the response of industry to produce safer products, resulting in fewer meritorious suits. They reject the hypothesis that the trend was merely a part of a general pro-defendant trend.
in all tort cases: The pro-defendant trend is not as pronounced in other areas of torts as in product liability.

Henderson and Eisenberg also examined plaintiffs' expected recovery in product liability cases -- the success rate multiplied by the average recovery conditional on success. Using the ratio of the expected recovery in product liability cases to that in non-product torts and other civil litigation in order to control for other legal trends and inflation, they again found a general decline from about 1983 to 1987.

Finally, Henderson and Eisenberg examined filings of product liability suits and the rate at which those cases went to trial. The economic theory of litigation outlined in section III predicts that a pro-defendant shift in legal doctrine should lead to fewer filings as plaintiffs' success rates fall, but at the same time to a higher rate of cases going to trial (rather than settling) due to the increased uncertainty accompanying legal change. The authors found evidence for both effects.

Viscusi (1986) examined the factors that determine the disposition of product liability claims -- whether they are dropped, settle out of court, or tried to a verdict. His explanatory variables were the victim's financial loss; whether the accident occurred on the job; the presence of safety regulations; whether the victim had collateral insurance against losses; dummy variables representing the legal theory under which the case was brought (strict liability, negligence, absolute liability, or breach of warranty); and a dummy variable indicating whether the state in
which the accident occurred had adopted strict liability. Neither the legal theory nor the presence of state strict liability had a significant effect in any of the regressions. The only significant effects were that cases brought under a negligence theory were slightly more likely to be dropped, and those brought under strict liability were more likely to succeed in court, both as expected.

In this same article, Viscusi also examined the determinants of the victim's expected compensation from filing a claim. He included all of the variables listed above in the estimating equation. As expected, the victim's financial loss had a strong positive effect. In addition, the presence of safety regulations and of state strict liability were positive and significant -- consistent with the fact that both increase the strength of the plaintiff's case.

The effects of product liability variables on the outcome of litigation were also examined in a recent study by the U.S. General Accounting Office (GAO) (1989). Using product liability cases in five states over the period 1983-1985, the GAO examined six issues: (i) the size and number of awards in product liability cases; (ii) the size and number of punitive damage awards; (iii) posttrial adjustments to awards; (iv) the cost of processing product liability cases; (v) the legal basis for liability; and (vi) variability in state laws. (We consider item (vi) in IV.C below.)

The GAO found, first, that plaintiffs received awards in less than half of the cases studied (45%), and, when damages were awarded, they were closely related to the actual injuries of victims.
Thus, the perception of excessive awards seems to stem from a small number of large awards that skew the distribution to the right. For instance, the average award was $845,000, while the median award was only $157,000. In addition, the 20% of cases in which the award exceeded $1 million accounted for 81% of the total amount awarded. Punitive damages were awarded in only 9% of those cases in which plaintiffs prevailed (20% of all cases reaching a verdict), in amounts ranging from $500 to $7 million.

Posttrial activities (e.g., appeals, court adjustments, and posttrial settlements), which are often neglected in studies of litigation, also affected the payments that defendants actually made to plaintiffs. Fully 30% of the verdicts in the sample were adjusted, posttrial, and in most cases the adjustment reduced the plaintiff's award. For example, total payments actually made were 43% less than initial awards, with the greatest reductions occurring in the cases with the largest awards. In addition, most punitive damage awards were either reduced or overturned on appeal.

The GAO did find evidence that the tort system is very costly and time consuming. The average case took two and a half years from filing date to trial, and cases that were appealed took an additional ten months on average. Although it is hard to estimate the dollar amount of these costs, they are clearly considerable. The average attorneys' fees per case were $168,000.

In addition, GAO found that most cases studied were decided based on defendant's negligence (66%), with only a minority of decisions depending on strict liability (27%) or breach of warranty
This is an important finding, because a major criticism of recent changes in product liability law has been that they have moved the system away from fault to ability to pay. For example, adoption of strict liability and joint-and-several liability has enabled plaintiffs to seek recovery from deep-pocket defendants who need be only minimally responsible for the injuries. The GAO findings suggest, however, that a return to a fault-based (negligence) system would not have a significant impact on the majority of cases. GAO similarly found that other proposed reforms would have had little impact on the outcome of the cases studied (see further discussion below).

IV.A.2 Effects on Insurance Premiums

One would expect the rising incidence and cost of product-related litigation to increase the cost of product liability insurance by raising insurers' expected payouts. Indeed, a perceived crisis in product liability insurance has spawned much of the recent concern about current liability law. Several studies have looked specifically to the insurance industry for empirical evidence of the impacts of recent changes in the law.

In 1985 the U.S. Attorney General organized the Tort Policy Working Group to study the affordability and availability of liability insurance. The initial report of the Working Group (1986) began by examining the financial condition of the insurance industry as a possible cause of the putative crisis. The industry had indeed suffered large losses in 1984 and 1985 as a result of low premiums charged in the 1970s and early 1980s in response to the
high interest rates of the time. Nevertheless, while those losses contributed to increases in premiums in the mid-1980s, the Working Group concluded that recent developments in tort law were the major cause of the crisis in liability insurance. Those developments were (i) the move toward a no-fault liability system; (ii) an erosion of causation as a basis for liability; (iii) a sharp increase in non-economic awards such as pain and suffering and punitive damages; and (iv) the excessive transaction costs of the system. In addition, the Group concluded that the uncertainty created by rapid changes in tort doctrines, as well as the absence of uniformity across states, made it difficult for insurers to predict the liability risks of their customers, raising the cost and reducing the availability of insurance. Based on these conclusions, the Report suggested several reforms of the tort law system.

In 1987, the Tort Policy Working Group issued a second report, which updated the status of the insurance crisis and presented additional data on the tort system. The update concluded that, while the insurance situation had improved, most of the problems identified in the initial report remained. It also discussed in greater detail the tort reforms proposed in the initial report and the likelihood that those reforms would significantly affect the cost and availability of insurance.

In a statistical study, Viscusi (1990) focused on factors influencing the cost of product liability insurance. The dependent variable was insurance premiums, and the explanatory variables were the extent of insurance coverage, economic conditions reflecting
the expected cost of claims and the performance of insurers' portfolios, and the presence of various statutory provisions relating to product liability. Most of the variables in Viscusi's estimating equation were significant and of the predicted signs.

Consistent with previous studies, Viscusi found that differences in the legal theories under which a plaintiff could seek recovery (i.e., strict liability, negligence, and breach of warranty) were not significant. However, statutory provisions designed to reduce the sizes of awards did have a significant effect. Thus, Viscusi concluded (p. 834), "overall, the regression analysis provides strong evidence that legal doctrines affect the insurance market for products liability."

Finally, Barker (1991) looked at the effects of variations in product liability laws across states on the performance of commercial liability insurers. For her dependent variable, Barker used several measures of product liability risk (total, relative, and systematic), and also the mean loss ratio (which measures the relative price of insurance) by state, over the period 1977-1986. Her explanatory variables, consisting of measures of the variation in state product liability laws, included variables for (i) the form of strict liability adopted by a state; (ii) whether a state allowed "state of the art" defenses; (iii) whether a state had adopted joint and several liability for products cases; and (iv) whether a state allowed punitive damages. Barker's hypothesis was that states with more pro-plaintiff laws should create greater risks for insurers, leading to higher insurance costs. Her results provide
some support for the hypothesis. The legal variables explained some of the variation in systematic risk and the mean loss ratio, but they were not significant in explaining total and relative risk. The legal doctrines most frequently significant as explanands were punitive damages and joint-and-several liability.

IV.A.3 Effects on Safety

If increased producer liability has raised firms' costs of litigation and insurance, economic theory suggests that firms will respond by trying to produce safer products. Several studies have examined the safety responses of firms to product liability law, either directly (by examining decisions related to safety) or indirectly (by examining accident rates).

Eads and Reuter (1983) examined the impact of increased producer liability on investment in product safety by large manufacturers. From interviews with product safety officials in a number of firms, they found that most firms self-insured or purchased policies with high deductibles (reflecting a general trend among large firms). They found that product liability law has a strong influence on product design decisions, overshadowing the effect of regulations in most industries (except for those most highly regulated).

Weber (1987) also investigated the responses of large U.S. corporations to the perceived crisis in tort law and liability insurance. Weber's results, obtained from a survey of risk managers in 232 large corporations (with sales of $100 million or more), showed that the overall impact of the alleged crisis had been
small. Liability insurance coverage had remained stable; although premiums and deductibles had both risen, the resulting increases in prices to consumers had been small -- less than one percent for two-thirds of the firms that could make estimates. Similarly, the costs of litigation had been minor for most firms: Most cases settled out of court (64 percent), and for relatively small amounts; of the cases tried to a verdict, two-thirds were decided in favor of the defendant. Weber found that the most significant impacts of product liability law centered on the products themselves -- modifications in products to make them safer, or the discontinuance of products. The increase in safety took a variety of forms -- for instance, improved labels, safer designs, and product recalls.

Litan (1991) summarizes a series of Brookings Institution studies, completed in 1989, of the impacts of expanded producer liability on safety and innovation. The study focused on five sectors of the U.S. economy: private aircraft, automobiles, chemicals, pharmaceuticals, and the medical profession. The principal findings were that, because the liability system sends a mixed signal to producers, it has only a limited impact on product safety. More important determinants were government regulations and consumers' demands for safety. Moreover, there was some evidence that beneficial innovations have been inhibited by the expansion in producer liability. For example, several researchers involved in the study found that the threat of liability deterred changes to safer designs because manufacturers feared that this would be used as evidence that the prior design was defective.
Lacking data on firm-level responses, some authors have examined the impact of product liability indirectly by considering changes in the accident rate. Higgins (1978) used regression analysis to examine the impact of increasing producer liability on consumer accidents related to products. Unfortunately, his measure of the accident rate -- the rate of fatal nontransport accidents in the home -- is flawed. As he admitted, only one-eighth to one-quarter of such accidents are product-related. In addition, the measure omits non-fatal product-related accidents. Higgins' measures of producer liability -- dummy variables indicating whether a state had adopted strict liability, implied warranty, or negligence -- had similar effects in his regressions. This suggests that differences in the legal theories under which suit could be brought are not very important for producers marketing nationwide.

The main result of Higgins' analysis was that the effect of greater producer liability on the accident rate depended on the educational level of the population. He found that greater producer liability reduced the accident rate in low-education states and increased it in high-education states. This result may reflect consumers' responses to changes in the law, which was not included in Higgins's equation. For example, more educated consumers may be more likely to anticipate that greater producer liability will lead to safer products, which may in turn cause them to take less care themselves. Higgins' result seems inconsistent with a consumer-misperception explanation: One would expect more education to reduce the extent of misperceptions of product risk.
Priest (1988) also considered the impact of greater producer liability on the accident rate, including both accidental deaths and injuries requiring hospitalization in his measure of the latter. As proxies for increased liability, Priest used trends in the volume of accident litigation (i.e., the number of suits filed) and the sizes of damage awards in successful suits. Although his analysis is descriptive rather than statistical, he claimed (p. 222) that "there is no empirical evidence whatsoever of an effect of the tremendous expansion of products liability on the number or rate of product-related accidents." Again, however, his inability to account for consumers' response to changes in the law reduces the force of this conclusion.

IV.B. Studies of Effects on Small Firms

The above studies deal primarily with the general impacts of product liability, without regard to the size of firms. A few studies have, however, focused on how product liability law has affected small firms in particular.

Huneycutt and Wibker (1988) used a survey of small firms to assess the overall cost of product liability for small business. Survey respondents identified three major sources of increased product liability costs for small businesses. The first was the size of awards in successful suits, which the respondents claimed was unrelated either to the injuries suffered by victims or the fault of defendants.81 Awards for punitive damages and for pain and suffering were seen as the main components of this problem.
The second source of increased costs was the increased willingness of victims to file lawsuits. Most respondents thought that contingent fees were largely responsible here and favored regulating them. The third source of higher product liability costs identified in the survey was the insurance industry's drive for profits, which had helped raise the cost of liability insurance. The survey respondents uniformly agreed that the ultimate effect of the product liability crisis will be higher prices for many consumer goods.

A recent survey of Massachusetts businesses and national trade associations (Hammett, 1987), examined the nature and extent of the liability insurance crisis for small and large businesses. Their results also indicate a continuing crisis, both in the availability and the cost of liability insurance, especially for small firms. For example, small businesses appeared to be charged rates disproportionate to their size, and they were less able than large firms to self-insure or join insurance pools. At least 75% of small businesses in the survey responded to the insurance crisis by "going bare" (i.e., doing without liability insurance). Other responses included dropping or modifying products and modifying manufacturing processes. Although many large firms had adopted similar strategies, such responses appeared to be more common among small firms.
IV.C. **Studies of the Effects of State Differences**

Adoption of a uniform Federal product liability law has frequently been proposed as a way of eliminating variability among state laws. (Rep. Rowland and Sen. Kasten co-sponsored such a bill in the Congress that just adjourned.) Interstate variation in product liability law is thought to be important because of the uncertainty it creates, especially for insurance companies attempting to predict the liability of companies involved in interstate commerce. Three of the studies discussed above included the role of state differentials in their analyses.

From their survey, Eads and Reuter (1983) found that both the expected liability of manufacturers and the variance in liability across states were important determinants of safety-related decisions. The variability of the law caused firms to monitor several jurisdictions. In addition, Eads and Reuter found that firms, rather than responding to an "average" of the laws across states, instead tended to base safety decisions on the laws of the state with the strictest standard.

GAO (1989) examined the impacts of state differentials by considering how a uniform product liability law embodying many of the recently proposed reforms would have affected the cases in their sample. They concluded that such a law would have had little impact. Most cases would not have been affected by the proposed reforms, and most of those that would have been affected involved larger awards. Of the reforms considered, two -- allowing comparative negligence, and wider use of workers' compensation as
a collateral source -- would have had the greatest effects. Both of these reforms would limit the size of allowable awards. GAO notes, however, that its conclusions regarding the impacts of these reforms did not include consideration of their impact on pretrial or posttrial activities.

Viscusi in one study (1990) also looked at the impacts of differences in product liability laws across states. As noted above, his explanatory variables included measures of the legal doctrines in different states. Using cross-sectional data (across states), he found that insurance premiums were higher in states with more pro-plaintiff laws. Thus, a major impact of state product liability law may be felt through the cost of insurance.

Barker (1991) got results that echo Viscusi's. She also found some evidence that liability insurers face greater underwriting risks in states with more pro-plaintiff product liability laws. Especially significant was the presence of joint-and-several liability and punitive damages.

In interpreting the results of GAO (1989), Viscusi (1990), and Barker (1991), however, it is important to distinguish between the impacts of uniformity across states per se (through reductions in the variance of the distribution of awards) and the impacts of reforms aimed at limiting producer liability (through reductions in the expected value or the skewedness of the distribution). All three studies consider reforms that limit producer liability, but none addresses the impacts of uniformity per se, without a change in "average" liability. Thus, their results should not be inter-
interpreted as evidence of the impacts of state differentials per se. Rather, they suggest merely that reforms aimed at reducing the potential for large awards would affect the outcomes of some cases (those in the upper tail of the distribution) and could thus have significant impacts on insurance costs. In particular, the three studies combined imply that, if insurers base premiums on the skewedness of the distribution of possible payouts rather than on its expected value, then even if reforms in product liability law would not affect the outcomes of very many cases (as suggested by GAO 1989), reductions in skewedness through product liability reform could substantially reduce insurance costs.

IV.D. General Conclusions of Previous Studies

Three broad themes emerge from the above studies regarding the overall impacts of product liability.

IV.D.1 The Causes of the Liability Insurance Crisis

Several of the studies asked whether the crisis in product liability insurance during the 1980s was caused by insurance companies or by changes in tort law. The conclusion was that, while some of the increase in premiums in the mid-1980s originated in underwriting losses by insurers tracing to the late 1970s and early 1980s, the primary cause was changes in the tort system. The problem areas identified are excessive damage awards (compensatory as well as punitive), uncertainty due to non-uniform laws across states and unpredictable juries, movement away from fault as the basis for liability, and the administrative costs of the system.
IV.D.2 Size and Distribution of Awards

Nearly all studies looking at damage awards concluded that, in contrast to the above perceptions, compensatory damages were closely related to the actual losses of victims. In addition, litigation seems to have been heavily concentrated in only a few industries, as evidenced by the Federal product liability cases studied by Dungworth (1988). The perception of excessive awards seems to have arisen from a few cases in which large damages were awarded. That is, the distribution of awards appears skewed to the right, which would explain why mean awards are typically much larger than median awards. The incidence of punitive damages also appears to be much less than perceptions indicate. Both the GAO and Institute for Civil Justice (ICJ) data reviewed by the Tort Policy Working Group suggest that punitive damages are in fact awarded infrequently in product liability cases. In addition, because of posttrial activity, the actual payments that defendants make, both compensatory and punitive, are often considerably less than the initial awards. Lack of publicity about this phase of the litigation process, which has received little research attention, may significantly bias people’s perceptions.

The conclusion that awards are not generally excessive is not necessarily inconsistent with the previous conclusion that the tort system is a contributing cause of the liability insurance crisis. In setting insurance rates, insurers may look primarily to the upper tail of the distribution of possible payouts, because either (i) they view the tail as the best predictor of future trends in
liability, or (ii) they must base underwriting decisions on "worst case" scenarios in order to maintain solvency. Thus, even if the large awards are limited to a few cases, those few cases may play a disproportionate role in determining insurance costs.

IV.D.3 Reforms to Reduce Producer Liability

Many calls for reform of product liability law focus on a need to reduce the liability of defendants -- i.e., to lower the mean of the distribution of awards. Reforms that would reduce defendant liability include a return to a fault-based system based on negligence, caps on awards, and elimination of joint and several liability. Two of the studies summarized earlier question the need for some of these reforms. GAO (1989) reported that defendants won a majority of the cases in its sample, and that most cases won by plaintiffs were decided based on defendant negligence rather than strict liability or breach of warranty. The GAO further concluded that most cases would not have been affected by the above (and other) proposed reforms. Henderson and Eisenberg (1988) similarly detected a trend toward pro-defendant verdicts in Federal product liability cases in the mid-1980s. These studies suggest that reforms aimed at reducing producer liability may not affect a large number of cases. However, as noted above, if the reforms limited the upper tail of the distribution, they could have significant impacts on insurance premiums.

We pointed earlier that reforms such as those just discussed could be counter-productive. For instance, individual states' caps on producer liability may have increased the dispersion of possible

75
outcomes. Moreover, adopting a uniform national product liability law set at the most stringent level would actually raise producers' average liability. Finally, it is not clear to us that a uniform Federal law less stringent than the most stringent state law would effectively reduce firms' uncertainty about product liability law.

IV.E. Specific Conclusions about Variability in State Laws and Small Business Impacts

In addition to the foregoing general conclusions, the existing empirical evidence regarding the role of state differentials and the impacts on small firms suggests the following.

IV.E.1. Uniformity in State Product Liability Laws

Greater uncertainty about product liability awards is thought to lead to higher insurance costs, all else equal, because it makes more difficult the accurate prediction of producers' liability risks. Since a major source of uncertainty is variability in the law across states, one proposed solution is a uniform Federal product liability law. Most proposals for a uniform law, however, are aimed at reducing not only the interstate uncertainty but also the average size of awards in product liability cases, and it is difficult to disentangle the two goals in the proposed bills. While the interviews of Eads and Reuter (1983) suggest that firms respond specifically to the lack of uniformity across states, the other empirical studies -- e.g., Viscusi (1990) and GAO (1989) -- deal with the impacts of reducing the size of awards. Thus, at
present there is little empirical evidence available regarding the likely effects of increased uniformity per se.

IV.E.2 Impacts on Small Firms

The studies that have focused specifically on the impacts of product liability on small firms suggest that these firms may be harder hit than their larger counterparts, particularly through insurance costs. The study by Huneycutt and Wibker (1988) is based only on the perceptions of small firms; it does not present evidence on actual impacts, nor does it compare small and large firms. Nevertheless, to the extent that both insurance premiums and firm-level responses are based on perceptions -- or on uncertainty (variance) or the tails of the distribution (skewedness) -- rather than on actual average experiences, current product liability law could translate into increased costs for small business. The results of the Abt study (1987), which surveyed firms' actual responses to liability and insurance availability and compared small and large firms, suggest that many of the impacts of product liability vary with firm size, particularly those related to firms' precautionary responses and insurance, again suggesting a greater burden for small firms.
V

ISSUES IN THE DESIGN OF AN EMPIRICAL STUDY OF PRODUCTS LIABILITY

From section III just concluded, it appears that further empirical work is required in order to resolve certain outstanding questions, and to test others for the first time, regarding the effects on small business of product liability law, and of cross-state differences in that law. In this section, we examine four issues that one would have to confront in designing an empirical study to get at those questions.

V.A. Statistical vs. Non-statistical Analysis

Empirical analysis of the effects of liability on firms may take one of two forms: statistical analysis and non-statistical analysis. The latter consists primarily of comparisons of trends over time or averages across groups. For example, one might compare average awards in product-liability cases involving small and large firms. Statistical analysis, in contrast, applies formal techniques from probability theory and statistics (such as regression analysis) to determine both the directions and magnitudes of the impacts of individual factors on a variable of interest. For example, a statistical analysis might try to determine the relative importance of product-liability laws, safety regulations, firm size, and other factors in decisions relating to product safety and their effects in the market-place.

Non-statistical analysis is generally easier to carry out than statistical analysis, since it usually requires fewer data. Unfor-
tunately, the results are often difficult to interpret, because of the difficulty of disentangling the effects of multiple contributing factors. In addition, non-statistical analyses may not adequately distinguish between systematic and random effects. For example, while the amounts of product-liability awards may appear to be related to firm size, the relationship between the two may be more random than systematic. To settle the question requires statistical analysis.

Statistical analysis is not without its own problems, of course. To be successful, it requires, for a sufficiently large sample, (i) that the researcher be able to observe and measure the "endogenous" variables -- those that are to be explained (e.g., the cost components in Table 1 or some suitable proxy for those variables); (ii) that the researcher be able to observe and measure (at acceptable cost) the "exogenous" variables -- those that theory predicts affect the endogenous variables in particular ways (e.g., differences in state product liability laws and firm size); and (iii) that the exogenous variables vary sufficiently across the sample to allow the effects of alternative exogenous variables to be distinguished. The sample data may be either cross-sectional (observations across a given population, such as firms or states, at a given point in time) or time-series (observations over time for a given subset of the population). 

Statistical analysis is frequently hampered by the difficulties in measuring some of the variables, and by the lack of sufficient variability in those variables either cross-sectionally or
over time. Unfortunately, product liability law is no exception. We address these problems, together with a problem of coverage (consumer-product vs. workplace safety) in the next three sections.

V.B. Measurement Problems

Empirical analysis of the effects of product-liability in general, and of the roles of firm size and state differentials in particular, faces problems of both measurement and variability.

V.B.1 Quantifying Stringency Within and Across States

Consider first the task of quantifying the stringency of state product liability laws and the associated variability across states. As state laws differ along many dimensions (see Part II), there is no single dimension along which to measure relative stringency. Thus, there is no easy way to summarize or average the differences across states. It may even be difficult to determine the relevant law within a given state at a given point in time, especially if the legal doctrines of that state have been formed under common (rather than statutory) law. Common law tends to evolve slowly over time. Thus, it is difficult to determine what the applicable rule was or will be at any given point in time. While it may be possible to compare observations before and after completion of the change (i.e., to conduct "event" studies), the time periods may be sufficiently far apart to make ceteris paribus analysis difficult.

Even if the applicable legal doctrine were clear, that doctrine may not be the sole determinant of the law's stringency.
Decisions regarding the imposition of liability are ultimately made by judges and juries, and empirical evidence suggests that those decisions can deviate from the prescriptions of tort law (Croyle, 1978; Wittman, 1986). For example, studies have shown that juries render harsher decisions against "deep pockets," in clear violation of the principles of tort law (Hammitt, et al., 1985). Likewise, the results of Schmit et al. (1990) suggest that, in joint and several liability cases, the magnitude of damage awards appears to depend on the status of the plaintiff relative to that of the defendant (e.g., corporate vs. individual).

Uncertainty over the appropriate legal standard is reduced when liability is specified by statute rather than common law. However, the uncertainty is not eliminated. If the statute allows joint-and-several strict liability, the share of damages that any given firm expects to be held liable for will still be uncertain. In particular, a small firm may not expect to be held liable for any damages that occur, anticipating instead that larger, "deep pocket" contributors would be forced to bear all costs. Thus, the specified legal rule would not be a good indicator of the stringency of the law as applied to small firms.

V.B.2 Precaution by Firms

Difficulties with empirical measurement also plague this important variable. Firms can reduce the total accidents from their products in two ways -- by reducing output, or by increasing their precaution -- that are substitutes in the reduction of product-related risks. Thus, measuring a firm's response to product
liability would require observations on both its level of output and its level of precaution.

While the output of a firm may be readily observable, as a rule its level of precaution will not be. If the level of precaution is an important factor in determining damages, then considering only the impact on the (observable) output level will tend to underestimate the impact of liability. In addition, it would be difficult to determine the extent to which changes in output were the result of potential liability rather than other market-related factors.

V.B.3 Externally Visible Evidence

An approach that would not require observations on firms' choices would be to focus on the impact of product liability on product-related damages. Unfortunately, this approach provides information only on the net effect of liability on damages. It does not address the extent to which firms are responding to potential liability.

Consider a case involving bilateral care. A change from no liability to strict liability need not change the level of damages, but it will almost certainly change the incentives for damage-reducing activities. Absent producer liability, victims have clear incentives to take steps to reduce damages. Imposing strict liability would reduce the victims' incentives and create incentives for firms to take precaution. The net effect on damages of the decrease in care by victims and the increase in precaution (or reduction in output) by firms might be relatively small, but the
imposition of strict liability would have changed the behavior of both parties.

V.B.4 Measuring Damages

Even when damages are a suitable proxy for the firm's decisions, it may be difficult to measure them accurately. Two possible proxies for actual damages are (i) the number of accidents of a particular type, and (ii) the dollar amounts awarded in a particular type of case. Neither proxy is without problems, of course. Use of the number of accidents ignores differences in the severity of damages across accidents, while use of dollar totals ignores possible discrepancies between damages and amounts awarded.\textsuperscript{89}

V.B.5 What "Industry" Does a Case Involve?

An obviously interesting question is whether product liability cases differ (in number, kind, severity, and so on) across industries. Empirical research into this question is complicated by an elemental but critical problem of measurement: In which "industry" (e.g., Standard Industrial Classification, or SIC, code) does a given case fall? A related complication of relevance here is whether a multi-firm case is "small-business" or "large-business" dominated. More important, it is possible that the prevailing legal doctrine in a given state may itself determine which firms -- hence, also which "industries" -- are involved in a particular case.

Take the simplest example, a case that involves an injured party suing a single firm. Not infrequently, the defendant will produce products in a number of different SIC codes (a convenient
A common practice in collecting firm-level data is to assign a firm to the SIC code of its "primary" or "most significant" activity. For present purposes, however, that practice could mask the really important underlying relationships. Yet attempting to override the practice in order to identify the specific industry at issue in the case could well be expensive and make it difficult if not impossible to use existing data.

Multi-firm cases may or may not pose problems here. The defendants in a given suit could be quite similar firms (e.g., in the context of "market-share" liability). However, they could also differ markedly (e.g., in a "deep-pockets" case in which the plaintiff sues the producer and a distributor). Of special concern for this study, if one was trying to ascertain the relative product-liability burdens of small firms, data from suits in which the defendants were both large and small firms could muddy the waters.

Finally, the number and industrial composition of firms named as defendants in a product liability action may be sensitive to the legal doctrine prevailing in a given state. For instance, under a joint-and-several liability rule, plaintiffs have an incentive to name more firms as defendants than under narrower legal rules. Such an incentive, to the extent it is effective, will compound the statistical problems in isolating the industry effects of product liability law.
V.C. Insufficient Variability in Data

As noted in section IV, many empirical studies of product liability have relied on aggregate (e.g., state-level) data. To determine the impacts of product liability on a specific type of firm -- namely, small firms -- we need data disaggregated by firm size.

The specific nature of the disaggregated data needed would depend on the objective of the study. To study the impacts of product liability on small firms without regard to how they fare relative to large firms, a data set consisting only of observations on small firms would suffice. This could be either a cross-sectional data set, with observations from a number of small firms at a given point in time, or a time-series data set for a group of small firms viewed over time.

Alternatively, to study the comparative impacts of product liability on small and large firms (either within or across industries), one would need observations on firms of different sizes. Most likely, this data set would be cross-sectional, since the size of a given firm (or group of firms) is unlikely to change sufficiently over time to provide enough variability to isolate the effects on large vs. small firms.

A pragmatic reason for using cross-sectional data arises if the required data do not currently exist. The need to collect data (for instance, through a survey) will in most case limit one to the use of a cross-sectional approach. Collecting sufficient time series data could require a much longer time period, or involve too
great an expense, unless the sampled firms were willing to provide historical as well as current data.

The use of cross-sectional data in the present context may, however, pose problems. In particular, some of the exogenous variables of interest may not vary sufficiently across firms to permit isolation of the effects of those variables. For example, the average stringency of the law across states would not vary across firms engaged in interstate commerce (or, by definition, across states). The same problem would arise if the relevant variable were the stringency of the law in one or more key states, or an index of interstate variation (e.g., the variance of state laws along some dimension). Thus, it would not be possible to isolate the impact of differences in the stringency of the law in a cross-sectional study, unless one somehow "created" variability in these variables. We discuss this possibility in section VI below.

Lack of variability also poses problems for measures of average compensation in successful product liability suits and for average punitive damages. As noted above, these variables are important determinants of the costs of product liability, both directly (through the amount that must be paid in a successful suit) and indirectly (through the probability that a suit will be filed). However, a variable such as the average award across all product liability suits would be the same for all firms. Thus, there would be no way to isolate the effects of such a variable.

Finally, the extent of safety regulation -- which also affects firms' decisions on product safety -- would be an important compo-
nent in an estimating equation for costs of precaution. Unfortunately, this variable too would lack cross-sectional variability if the operative safety regulations are primarily federal (rather than state) and apply to all firms (both large and small) producing a given product.

V.D. Workplace vs. Consumer Product Accidents

For ease of exposition, our discussion thus far has focused on consumer products. Product liability cases may also arise, however, in the workplace. Estimates of the importance of workplace accidents in product liability law vary. Viscusi (1991b) reports that only 13% of the cases studied involved workplace accidents, but GAO (1989) found 42% of its cases to be work-related.

There is some evidence that courts treat consumer and workplace risks differently (Interagency Task Force Report, 1977). In addition, in cases arising from workplace accidents, product liability law interacts with the workers' compensation system (Viscusi, 1991b). In fact, GAO (1989) found that changes in workers' compensation would be among the product liability reforms with the greatest impact. For these reasons, it may not be advisable to lump consumer product and workplace accidents together in empirical analysis. While some kinds of data (e.g., accident rates) distinguish between the two types of accidents, others (e.g., litigation data) may not.
VI

STUDY DESIGN

One may base an empirical study of the impacts of non-uniform product liability laws on small firms either on existing data or on primary data (e.g., from surveys). On the one hand, working with existing data is often expeditious and relatively low-cost, but the data currently available may limit the scope and content of the analysis. Primary data collection, on the other hand, may be both costly and time-consuming, but it permits one to tailor the data to the specific needs of the study. In this section, we discuss possible ways to study the impacts of product liability using each approach. In particular, we suggest (i) how existing data could be used to address some of the key relationships identified in earlier sections; and (ii) how primary data could be used to address those relationships for which existing data are insufficient.

In what follows, it is useful to distinguish between three types of analysis: (1) the impacts of product liability on small firms only (within a given industry or across industries); (2) relative impacts on small and large firms across industries; and (3) relative impacts on small and large firms within a given industry. Which type of analysis is appropriate depends upon the objective of the study, and each has different data requirements (whether existing or primary).

The first type of analysis, focusing only on small firms, would most likely be the simplest of the three in terms of data requirements. Should primary data be required, one could get by
surveying only small firms. Such an analysis could reveal problem areas in product liability for small business. However, it would not address whether those problem areas were unique to small firms or general to all firms. Hence, any policy conclusions (e.g., to change the product liability laws in some way) would be suspect. Thus, this relatively easiest type of analysis would appear to yield the least useful insights into the product liability crisis.

Approaches (2) and (3) would, of course, allow comparisons of large and small firms. The second type of analysis would require less in the way of data than the third type, but it would also yield more limited results. At the same time, the data requirements of approach (3) could be so daunting as not to make the effort worthwhile.

Suppose that the main objective of a study was simply to determine whether product liability affects small and large firms differently. If not, then policy changes need not address the issue of firm size. (If so, of course, one would have to go on and attempt to sort out the causes of the differences; see below.) Given this objective, the second type of analysis, working with aggregate data stratified into small and large companies but randomly distributed across and within industries, would probably suffice.

To get at the the sources of any differences between small and large firms, one could not use aggregate data across industries. The reason is that, with such data, one cannot tell whether any differential impacts arise from firm size per se or from the types
of product produced by small (as opposed to large) firms. Even if one were to divide the industries sampled into small-business and large-business-dominated, any observed differences could again be attributable either to firm-size differences or to differences in the nature of the products produced in those industries.

If the objective of the study is to isolate the role of firm size per se, one would need to ask whether small firms producing a given product bear a larger burden from product liability than large firms producing the same product. To answer this question would require the use of approach (3). By looking at small and large firms within the same industry, thereby controlling for differences in products produced, one can attribute any observed differences in impacts between small and large firms directly to firm size. We stress that (for the control to be reliable here) the definition of "industry" must be quite narrow -- at least the 3-digit and preferably the 4-digit SIC level.

Data covering multiple industries could be used in the third type of analysis, but there would have to be sufficient observations within each industry to allow industry effects to be disentangled from firm-size effects. For certain types of data, especially those related to litigation, it may be difficult to obtain enough observations for many industries, particularly if a cross-sectional survey must be used, because only a few cases may involve firms in a given industry.
VI.A. Uses of Existing Data

VI.A.1 Existing Data Sources

As is apparent from the review of previous empirical studies (section IV), a number of data sources currently exist that could be used to study the impacts of product liability. The types of data and the sources used in the studies reviewed are summarized in Tables 2 and 3. The existing data fall into five categories: (i) accidents of a given type (e.g., those related to the use of consumer products and to the workplace); (ii) legal proceedings of a given type (e.g., number of filings and awards); (iii) insurance data (e.g., loss ratios and premiums); (iv) firm characteristics (e.g., size and SIC code); (v) information on the provisions of product liability laws in different states.

i. Accident Data The U.S. Consumer Product Safety Commission (CPSC) gathers and reports annual data on the number of accidents arising from the use of consumer products. The CPSC statistics cover both injuries and deaths. The injury data are collected from a sample of hospital emergency rooms that participate in the National Electronic Injury Surveillance System (NEISS); the death data come from a sample of death certificates. The CPSC classifies its data by type of product, based on the NEISS, rather than by industry; however, the NEISS classification appears to be sufficiently disaggregated that conversion to an SIC classification would be possible. With such a conversion, it would be possible to obtain accident numbers by industry rather than product type. However, firm-level information on accident rates are not available.
from this source, since the data relate to the victim rather than to the firm producing the product.

For present purposes, the CPSC data on accidents have two drawbacks. First, the data include all accidents related to product use, regardless of whether the product contributed to the accident. Thus, these data presumably overstate the number of accidents that could potentially lead to product liability suits. Second, the data pertain to numbers of accidents rather than accident rates. In particular, they are not corrected for either the number of products sold or the frequency of use. As a result, although it may be appropriate to compare the data within a given industry over time (where one can perhaps adjust for changes in industry size and use), comparisons across industries most likely would not be appropriate.

Data on workplace accidents are reported by the U.S. Occupational Safety and Health Administration (OSHA). These data, which are obtained from reports filed by employers with OSHA area offices, are reported by the SIC code of the employer and in the form of incidence rates per 100 full-time workers. Thus, comparisons of accident rates across industries are possible. In addition, the OSHA data on fatalities are disaggregated by "cause", defined as the "object or event associated with the fatality." However, as with the CPSC data, it is not apparent from the OSHA data which accidents were actually caused by products, and could thus lead to product liability cases, as opposed to merely being associated with given products. Moreover, accident rates are reported by the in-
dustry in which the victim was employed, not by the industry that made the product in question. These two characteristics sharply limit the usefulness of the OSHA data for studying the impacts of product liability law.

ii. Litigation Data  Information on actual product liability cases is available in both aggregated and disaggregated form. The aggregated data on product liability cases generally cover statistics on the number of cases filed. A few sources also include information on the disposition or outcome of cases, on damage awards, and on plaintiff/defendant characteristics (e.g., corporate vs. non-corporate).

Data on product liability cases filed in Federal courts are included in the Integrated Federal Court Data Base; one study has broken down these data by industry, using the principal SIC code of the lead defendants (Dungworth, 1988). In addition, the Administrative Office of the United States Courts provides similar data by circuit and district, classified in a sense by industry group; however, the classification -- aircraft, marine, motor vehicle, asbestos, and other -- is not by conventional SIC codes. Some states collect aggregated information on product liability cases in their courts; this information is available from the Office of the U.S. Court Administrator (GAO, 1989).

Disaggregated information on specific product liability cases (e.g., the names of plaintiffs and defendants, the nature of the case, the legal theories applied, and any apportionment of damages among defendants) is available, but collecting this information in
usable form is likely to be expensive and time-consuming. It requires either gaining access to and combing through court records and attorneys' files, or using the synopses provided by the various product liability reporters. For example, the Product Liability Reporter published by Commerce Clearing House (CCH) summarizes this information for product liability cases filed in Federal and upper state courts.

Unfortunately, data on the outcomes of product liability cases are generally limited to cases that go to trial -- only a small percentage of all cases filed. Thus, we largely lack information on cases that are dismissed or settled prior to a trial. In addition, little information is available on post-trial activities, which can yield final outcomes that differ significantly from the initial trial outcomes (GAO, 1989). Nevertheless, the data from trials may still provide useful information on overall litigation effects of products liability, because both settlement and post-trial activities are related to expected or actual trial outcomes.

iii. Insurance Data The insurance industry collects information on insurance policies, including those for product liability. Viscusi (1990), for instance, used data on premiums for individual policies, by industry, collected by the Insurance Services Office, for use in rate setting. Other insurance groups, such as the Alliance of American Insurers and the Insurance Information Institute, collect similar information. Many of the insurance data are reported in aggregated form (e.g., total premium dollars). To use these data to make comparisons across industries, one must find
some way to correct for differences in industry size (e.g., GNP originating, or value of shipments). In addition, the data are not adjusted for changes in amounts of coverage or the size of deductibles within an industry, making it difficult to interpret comparisons within a given industry over time.

iv. Data on Firm Characteristics

Information on firm characteristics, in particular the size distribution of firms, is available at both the industry level and the individual firm level. As with data on litigation, data on the characteristics of individual firms are expensive and time-consuming to collect.

The Small Business Data Base of the U.S. Small Business Administration contains information on the distribution of employment by firm size, by industry. From this information, it is possible to classify industries as "small business dominated", "large business dominated", or "indeterminate," depending on the share of total industry employment accounted for by firms of a given size. From such information on employment and other dimensions of firm size (e.g., sales), one can obtain measures of the relative importance of small firms across industries.

v. Data on Product Liability Laws

Information on state product liability laws is available in product liability reporters such as the CCH Product Liability Reporter. For example, CCH collects, summarizes, and updates state statutes relating to product liability. In addition, it provides an overview of common law aspects of product liability, noting differences among states. It does not, however, provide a state-by-state description of all
aspects of the relevant common law. For a complete description of the common law in a given state, one would have to examine the actual decisions for individual cases within that state.

V.A.2 Proposed Uses of Existing Data

i. Industry-Level Analysis For each of the first four types of data described above, there is an existing source that reports the relevant statistics at the industry level. While these data are not perfect for our purposes, one could take a first cut at exploring the impacts of product liability on small firms by combining each of the first three categories (accident, litigation, and insurance data) with the fourth category (firm size data). Below, we suggest a way of doing this; in section VII, we provide two illustrations of the approach, using the litigation and insurance data.

Note that all of the analyses suggested here are examples of approach (2) discussed earlier, namely, comparisons of small and large firms across industries. Thus, while these analyses would allow us to determine whether the impacts on small firms differ from those on large firms, they would not tell us whether any differences are attributable to firm size or instead to interindustry differences in products.

Consider first the litigation data. As noted above, Dungworth (1988) has analyzed data on product liability cases in Federal District Courts, classified by the SIC code of the lead defendant, for the period 1973-1986. From these data, one could readily ob-
tain a distribution of cases across industries or industry groups. (To correct for industry size, one would want to divide each industry's cases by, for instance, GNP originating, total sales, or employment.)\(^98\) As a proxy for the relative importance of small firms in different industries, data on employment by firm size, by SIC code, from the Small Business Data Base, could be used to determine the percentage of total employment within a given industry that is accounted for by small firms.\(^99\) Table 4 combines these two sets of data.

To determine the relative product liability burden borne by small business, one could compare the percentage of products litigation in a given industry with the percentage of employment in small firms in that industry. Correlation or (preferably) regression analysis could reveal whether there is any relationship between the firm-size distribution of employment in the industry and its share of product liability cases. We provide an example of this type of analysis in Section VII. Such an analysis could not isolate the cause of any relationships, but it could indicate whether any systematic effect was present.

One could also conduct a similar analysis using industry-level insurance data, such as those reported in Viscusi (1991a). Viscusi reports total premiums paid for product liability insurance by SIC code (averaged over 1980-1984). To adjust for differences in industry size, again one would want to divide premiums by sales, GNP originating, or employment. See Table 5. As with the litigation data, the distribution of the size-adjusted measure of product
Table 4

RELATION BETWEEN S.I.C. CODES DOMINATED BY LARGE OR SMALL BUSINESS, AND INCIDENCE OF PRODUCTS SUITS

<table>
<thead>
<tr>
<th>Industry Name</th>
<th>SIC #</th>
<th>% of Total Emplt., 1986 in Firms with Fewer than X Employees:</th>
<th>No. of Cases</th>
<th>Cases/$10^9 of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$X = 100$</td>
<td>$X = 500$</td>
<td></td>
</tr>
<tr>
<td>Food &amp; Kindred Products (LBD)</td>
<td>20</td>
<td>14.92</td>
<td>29.85</td>
<td></td>
</tr>
<tr>
<td>SBD: 2013, 2026, 2037, 2048, 209</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tobacco Manufacturers (LBD)</td>
<td>21</td>
<td>1.74</td>
<td>5.26</td>
<td>2,357 cases</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textile Mill Products (LBD)</td>
<td>22</td>
<td>12.91</td>
<td>30.68</td>
<td></td>
</tr>
<tr>
<td>SBD: 224, 2252, 2253, 2257, 226, 2261,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2262, 2282, 229</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apparel and Other Textile Products (IND)</td>
<td>23</td>
<td>26.56</td>
<td>53.62</td>
<td></td>
</tr>
<tr>
<td>SBD: 233, 2331, 2335, 2337, 2339, 2341,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2361, 238, 2391, 2392, 2396</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leather &amp; Leather Products (IND)</td>
<td>31</td>
<td>17.51</td>
<td>39.28</td>
<td>2,602 cases</td>
</tr>
<tr>
<td>SBD: 311, 3144, 316, 317</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\$20+21: 14.44\% 28.96\%                   
\$22+23+31: 20.69\% 43.84\%               
33.43/\$10^9 GNP                          

1. SOURCES: S.I.C. employment data from Handbook of Small Business Data: 1988 (Washington, 1988), Tables 6.9 and 9.1. SBD = "Small Business Dominated;" LBD = "Large Business Dominated;" IND = "Indeterminate." An SIC Code is SBD if more than 60\% of industry employment is in firms with fewer than 500 employees; LBD if more than 60\% of industry employment is in firms with more than 500 employees; and IND if 40-60\% of employment is in firms with fewer/more than 500 employees.

Cases data from Terence Dungworth, Product Liability and the Business Sector: Litigation Trends in Federal Courts, R-3668-ICJ (Santa Monica, CA: RAND Corp., 1988); the cases are from the period 1973-1986. Combinations of SIC codes (between solid lines) are those that Dungworth uses.
Table 4 (continued)

<table>
<thead>
<tr>
<th>Industry Name</th>
<th>SIC #</th>
<th>X = 100</th>
<th>X = 500</th>
<th>No. of Cases</th>
<th>Cases/$10^9$ of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumber &amp; Wood Products (SBD)</td>
<td>24</td>
<td>43.02</td>
<td>63.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furniture &amp; Fixtures (SBD)</td>
<td>25</td>
<td>28.04</td>
<td>49.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper &amp; Allied Products (LBD)</td>
<td>26</td>
<td>11.68</td>
<td>24.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Printing &amp; Publishing (LBD)</td>
<td>27</td>
<td>38.14</td>
<td>54.53</td>
<td>2,735 cases</td>
<td>28.70/$10^9$ GNP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#24-27:</td>
<td>31.62%</td>
<td>48.75%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemicals (LBD)</td>
<td>28</td>
<td>12.21</td>
<td>20.69</td>
<td>15,992 cases</td>
<td>287.63/$10^9$ GNP</td>
</tr>
<tr>
<td>Pharmaceuticals &amp; Health Products (LBD)</td>
<td>283</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petroleum &amp; Coal Products (LBD)</td>
<td>29</td>
<td>9.41</td>
<td>16.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Metal Industries (LBD)</td>
<td>33</td>
<td>10.76</td>
<td>22.92</td>
<td>2,152 cases</td>
<td>34.21/$10^9$ GNP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>#29+33:</td>
<td>10.52%</td>
<td>21.85%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubber &amp; Miscellaneous Plastics Products (IND)</td>
<td>30</td>
<td>22.48</td>
<td>43.81</td>
<td>2,280 cases</td>
<td>111.76/$10^9$ GNP</td>
</tr>
<tr>
<td>SBD: 3079</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stone, Clay &amp; Glass Products (LBD)</td>
<td>32</td>
<td>25.22</td>
<td>39.93</td>
<td>14,105 cases</td>
<td>105.25/$10^9$ GNP</td>
</tr>
<tr>
<td>SBD: 3271, 3272, 3273</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Asbestos Suits et al.</td>
<td>3292</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td>&lt;24.4% of all cases&gt;</td>
</tr>
</tbody>
</table>
Table 4 (continued)

<table>
<thead>
<tr>
<th>Industry Name</th>
<th>% of Total Emplt., 1986 in Firms with Fewer than X Employees:</th>
<th>No. of Cases of GNP</th>
<th>SIC #</th>
<th>X = 100</th>
<th>X = 500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabricated Metal Products (IND)</td>
<td>29.60 48.06</td>
<td></td>
<td>34</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBD: 3433, 3441, 3442, 3444, 3446, 345, 3451, 3452, 346, 3462, 3469, 347, 3471, 3479, 349, 3494, 3496</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Electrical Machinery (LBD)</td>
<td>25.64 38.71</td>
<td></td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBD: 3535, 354, 3542, 3544, 3545, 355, 3552, 3555, 3563, 3564, 3566, 3599</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical &amp; Electronic Equip. (LBD)</td>
<td>11.06 22.19</td>
<td></td>
<td>36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBD: 3612, 3632, 3641, 3645, 3671-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transportation Equipment (LBD)</td>
<td>6.44 12.80</td>
<td></td>
<td>37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Motor Vehicles (LBD)</td>
<td>371</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SBD: 3713</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Motorcycles, Bicycles, &amp; Parts (SBD/LBD/IND)</td>
<td>3751</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#371+3751:</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Aircraft (LBD)</td>
<td>372</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#372+376:</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Aerospace (LBD)</td>
<td>376</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

18,058 cases
92.89/$10^9 GNP
11,462 cases
163.04/$10^9 GNP

2. Employment data include SIC 348. Case data exclude SIC 348 (See "Firearms plus Miscellaneous Manufacturing" below).
Table 4 (continued)

<table>
<thead>
<tr>
<th>Industry Name</th>
<th>% of Total Emplt., 1986</th>
<th>SIC #</th>
<th>X = 100</th>
<th>X = 500</th>
<th>No. of Cases</th>
<th>Cases/$10^9 GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ship &amp; Boat Bldg. &amp; Repair 373 (SBD: 3732) III</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Railroad Equipment (SBD) 374</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Misc. Trans. Equipt. (LBD) 379</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#373+374+379:</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instruments &amp; Related Products (LBD) SBD: 3823, 383</td>
<td>38</td>
<td>16.74</td>
<td>29.89</td>
<td></td>
<td>1,251 cases</td>
<td>55.60/$10^9 GNP</td>
</tr>
<tr>
<td>Firearms 3483</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous Manufacturing (SBD) 39</td>
<td></td>
<td>42.44</td>
<td>62.49</td>
<td></td>
<td>1,513 cases</td>
<td>138.81/$10^9 GNP</td>
</tr>
<tr>
<td>#348+39:</td>
<td></td>
<td>NA</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Bldg. Contractors (SBD) 15</td>
<td></td>
<td>70.89</td>
<td>84.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy Constrn. Contractors (SBD) 16</td>
<td></td>
<td>43.99</td>
<td>65.53</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special Trade Contractors (SBD) 17</td>
<td></td>
<td>77.49</td>
<td>91.60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local and Interurban Transit (IND) SBD: 412, 415</td>
<td>41</td>
<td>32.82</td>
<td>52.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finance, Insurance, &amp; Real Estate Total (IND) SBD:</td>
<td>60-67</td>
<td>30.56</td>
<td>44.49</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6023, 6024, 61, 6122, 614, 616, 64, 65, 651, 653, 655</td>
<td>(#15-17, 41,60-67):</td>
<td>46.46%</td>
<td>61.11%</td>
<td></td>
<td>7,170 cases</td>
<td>11.18/$10^9 GNP</td>
</tr>
</tbody>
</table>

3. See footnote 2 above.
Table 4 (continued)

<table>
<thead>
<tr>
<th>Industry Name</th>
<th>% of Total Empl., 1986 in Firms with Fewer than X Employees:</th>
<th>No. of Cases Cases/$10^9 of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SIC #</td>
<td>X = 100</td>
</tr>
<tr>
<td>Wholesale Trade Total (SBD)</td>
<td>50-51</td>
<td>56.52</td>
</tr>
<tr>
<td>Retail Trade, Total (SBD/IND)</td>
<td>53-59</td>
<td>47.92</td>
</tr>
<tr>
<td></td>
<td>50-51</td>
<td>53-59</td>
</tr>
</tbody>
</table>
Table 5: Insurance Premiums by Industry

<table>
<thead>
<tr>
<th>Average Premiums Paid ($M)</th>
<th>Average Premium Paid/ $100 Billion GNP</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>07-09</td>
<td>Agriculture, forestry, fisheries</td>
<td>1626.9</td>
<td>1150.9</td>
<td>85.5</td>
<td>19.028</td>
<td>13.461</td>
</tr>
<tr>
<td>12-14</td>
<td>Mining</td>
<td>295.7</td>
<td>198.2</td>
<td>125.3</td>
<td>2.360</td>
<td>1.582</td>
</tr>
<tr>
<td>15-17</td>
<td>Construction</td>
<td>6647.4</td>
<td>8024.9</td>
<td>147.5</td>
<td>45.067</td>
<td>54.406</td>
</tr>
<tr>
<td>20</td>
<td>Food,kindred prod</td>
<td>909.8</td>
<td>430.3</td>
<td>60.8</td>
<td>14.963</td>
<td>7.078</td>
</tr>
<tr>
<td>21</td>
<td>Tobacco products</td>
<td>6.3</td>
<td>0.0</td>
<td>9.7</td>
<td>0.650</td>
<td>0.000</td>
</tr>
<tr>
<td>22</td>
<td>Textile mill products</td>
<td>129.2</td>
<td>76.7</td>
<td>16.0</td>
<td>8.074</td>
<td>4.792</td>
</tr>
<tr>
<td>23</td>
<td>Apparel</td>
<td>409.9</td>
<td>60.9</td>
<td>19.3</td>
<td>21.240</td>
<td>3.157</td>
</tr>
<tr>
<td>24</td>
<td>Lumber</td>
<td>264.6</td>
<td>261.5</td>
<td>19.2</td>
<td>13.782</td>
<td>13.822</td>
</tr>
<tr>
<td>25</td>
<td>Furniture, fixtures</td>
<td>501.5</td>
<td>69.5</td>
<td>10.1</td>
<td>49.654</td>
<td>6.886</td>
</tr>
<tr>
<td>26</td>
<td>Paper,allied products</td>
<td>141.8</td>
<td>128.6</td>
<td>27.0</td>
<td>5.252</td>
<td>4.762</td>
</tr>
<tr>
<td>28</td>
<td>Chemicals</td>
<td>730.1</td>
<td>583.4</td>
<td>55.6</td>
<td>13.131</td>
<td>10.492</td>
</tr>
<tr>
<td>29</td>
<td>Petroleum, coal</td>
<td>34.7</td>
<td>56.4</td>
<td>23.8</td>
<td>1.465</td>
<td>2.368</td>
</tr>
<tr>
<td>30</td>
<td>Rubber,misc plastic</td>
<td>563.3</td>
<td>319.8</td>
<td>20.4</td>
<td>27.612</td>
<td>15.678</td>
</tr>
<tr>
<td>31</td>
<td>Leather</td>
<td>115.6</td>
<td>20.2</td>
<td>3.9</td>
<td>29.702</td>
<td>5.171</td>
</tr>
<tr>
<td>32</td>
<td>Stone,clay,glass</td>
<td>309.0</td>
<td>273.1</td>
<td>20.0</td>
<td>15.450</td>
<td>13.653</td>
</tr>
<tr>
<td>33</td>
<td>Primary metals</td>
<td>245.6</td>
<td>295.2</td>
<td>39.1</td>
<td>6.281</td>
<td>7.550</td>
</tr>
<tr>
<td>34</td>
<td>Fabricated metals</td>
<td>2135.8</td>
<td>1353.1</td>
<td>48.6</td>
<td>43.947</td>
<td>27.841</td>
</tr>
<tr>
<td>35</td>
<td>Industrial machinery</td>
<td>1652.9</td>
<td>836.0</td>
<td>81.5</td>
<td>20.281</td>
<td>10.258</td>
</tr>
<tr>
<td>36</td>
<td>Electronic equip</td>
<td>799.8</td>
<td>721.2</td>
<td>64.3</td>
<td>12.438</td>
<td>11.216</td>
</tr>
<tr>
<td>37</td>
<td>Transportation equip</td>
<td>648.2</td>
<td>263.5</td>
<td>70.3</td>
<td>9.221</td>
<td>3.748</td>
</tr>
<tr>
<td>38</td>
<td>Instruments</td>
<td>418.2</td>
<td>153.0</td>
<td>22.5</td>
<td>18.585</td>
<td>6.801</td>
</tr>
<tr>
<td>39</td>
<td>Misc manufacturers</td>
<td>5185.9</td>
<td>2832.6</td>
<td>10.9</td>
<td>475.769</td>
<td>259.876</td>
</tr>
<tr>
<td>42</td>
<td>Trucking, warehousing</td>
<td>18.8</td>
<td>27.0</td>
<td>48.7</td>
<td>0.387</td>
<td>0.555</td>
</tr>
<tr>
<td>44</td>
<td>Water transportation</td>
<td>116.1</td>
<td>35.9</td>
<td>7.5</td>
<td>15.483</td>
<td>4.792</td>
</tr>
<tr>
<td>47</td>
<td>Transportation service</td>
<td>41.1</td>
<td>11.3</td>
<td>7.6</td>
<td>5.411</td>
<td>1.490</td>
</tr>
<tr>
<td>49</td>
<td>Electric, gas, sanitary</td>
<td>478.3</td>
<td>524.8</td>
<td>91.4</td>
<td>5.233</td>
<td>5.742</td>
</tr>
<tr>
<td>50-51</td>
<td>Wholesale trade</td>
<td>1677.3</td>
<td>1087.8</td>
<td>223.1</td>
<td>7.518</td>
<td>4.876</td>
</tr>
<tr>
<td>52-59</td>
<td>Retail trade</td>
<td>4525.6</td>
<td>2171.6</td>
<td>293.3</td>
<td>15.430</td>
<td>7.404</td>
</tr>
<tr>
<td>70</td>
<td>Hotels</td>
<td>166.8</td>
<td>24.7</td>
<td>22.5</td>
<td>4.747</td>
<td>1.099</td>
</tr>
<tr>
<td>72</td>
<td>Personal services</td>
<td>6.3</td>
<td>4.5</td>
<td>21.5</td>
<td>0.293</td>
<td>0.210</td>
</tr>
<tr>
<td>73</td>
<td>Business services</td>
<td>78.7</td>
<td>76.6</td>
<td>94.0</td>
<td>0.837</td>
<td>0.815</td>
</tr>
<tr>
<td>75</td>
<td>Auto repair, services</td>
<td>100.5</td>
<td>58.5</td>
<td>24.7</td>
<td>4.070</td>
<td>2.367</td>
</tr>
<tr>
<td>79</td>
<td>Amusement, recreation</td>
<td>0.0</td>
<td>0.0</td>
<td>15.3</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>80</td>
<td>Health services</td>
<td>18.9</td>
<td>6.7</td>
<td>139.9</td>
<td>0.135</td>
<td>0.048</td>
</tr>
<tr>
<td>86</td>
<td>Membership organ</td>
<td>59.7</td>
<td>33.7</td>
<td>30.7</td>
<td>1.945</td>
<td>1.099</td>
</tr>
<tr>
<td>89</td>
<td>Misc services</td>
<td>270.6</td>
<td>202.7</td>
<td>48.0</td>
<td>5.638</td>
<td>4.223</td>
</tr>
</tbody>
</table>
liability premiums across industries could be compared with the percentage of employment in small firms (see Table 6) to determine whether "small business dominated" industries pay higher product liability insurance premiums than "large business dominated" businesses. Again, one could use correlation or regression analysis. We present an illustration of such an analysis in Section VII.

One could, in principle, apply the same type of analysis to the accident data reported by the Consumer Product Safety Commission (CPSC) and the Occupational Safety and Health Administration (OSHA). However, researchers would encounter some difficulties.

For the CPSC data, three problems would arise. First, the NEISS classification of product types would have to be matched with the SIC codes for industries. The conversion might be time-consuming, but it could be done. Second, the CPSC data do not correct for industry size or for "exposure" (here, extent of use of the product).100 Adjustment for size would not be a problem, but there would apparently be no way, using existing data, to correct for differences in exposure across consumer products. Third, the accidents reported by the CPSC are "associated with" particular products but not necessarily caused by them; thus, these data overstate the number of accidents that could lead to product liability suits.

Despite these problems, it may still be possible to obtain a rough idea of the relationship between the accident rate for a given industry and the role of small firms in that industry by comparing the CPSC data with the data on the distribution of employment. Without further information (not readily available), it
Table 6: Distribution of Employment by Industry

Percentage of Employment in Firms with Fewer than

<table>
<thead>
<tr>
<th>SIC</th>
<th>Industry</th>
<th>100 Employees</th>
<th>500 Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>07-09</td>
<td>Agriculture, forestry, fisheries</td>
<td>65.64</td>
<td>77.54</td>
</tr>
<tr>
<td>12-14</td>
<td>Mining</td>
<td>28.19</td>
<td>38.92</td>
</tr>
<tr>
<td>15-17</td>
<td>Construction</td>
<td>70.23</td>
<td>85.46</td>
</tr>
<tr>
<td>20</td>
<td>Food and kindred products</td>
<td>14.92</td>
<td>29.85</td>
</tr>
<tr>
<td>21</td>
<td>Tobacco products</td>
<td>1.74</td>
<td>5.26</td>
</tr>
<tr>
<td>22</td>
<td>Textile mill products</td>
<td>12.91</td>
<td>30.68</td>
</tr>
<tr>
<td>23</td>
<td>Apparel and other textile products</td>
<td>26.56</td>
<td>53.62</td>
</tr>
<tr>
<td>24</td>
<td>Lumber and wood products</td>
<td>43.02</td>
<td>63.10</td>
</tr>
<tr>
<td>25</td>
<td>Furniture and fixtures</td>
<td>28.04</td>
<td>49.64</td>
</tr>
<tr>
<td>26</td>
<td>Paper and allied products</td>
<td>11.68</td>
<td>24.30</td>
</tr>
<tr>
<td>28</td>
<td>Chemicals and allied products</td>
<td>12.21</td>
<td>20.69</td>
</tr>
<tr>
<td>29</td>
<td>Petroleum and coal products</td>
<td>9.41</td>
<td>16.78</td>
</tr>
<tr>
<td>30</td>
<td>Rubber and misc plastic products</td>
<td>22.48</td>
<td>43.81</td>
</tr>
<tr>
<td>31</td>
<td>Leather and leather products</td>
<td>17.51</td>
<td>39.28</td>
</tr>
<tr>
<td>32</td>
<td>Stone, clay, and glass products</td>
<td>25.22</td>
<td>39.93</td>
</tr>
<tr>
<td>33</td>
<td>Primary metal products</td>
<td>10.76</td>
<td>22.92</td>
</tr>
<tr>
<td>34</td>
<td>Fabricated metal products</td>
<td>29.60</td>
<td>48.06</td>
</tr>
<tr>
<td>35</td>
<td>Industrial machinery and equipment</td>
<td>25.64</td>
<td>38.71</td>
</tr>
<tr>
<td>36</td>
<td>Electronic and other electronic equip</td>
<td>11.06</td>
<td>22.19</td>
</tr>
<tr>
<td>37</td>
<td>Transportation equipment</td>
<td>6.44</td>
<td>12.80</td>
</tr>
<tr>
<td>38</td>
<td>Instruments and related products</td>
<td>16.74</td>
<td>29.89</td>
</tr>
<tr>
<td>39</td>
<td>Misc Manufacturers</td>
<td>42.44</td>
<td>62.49</td>
</tr>
<tr>
<td>42</td>
<td>Trucking and warehousing</td>
<td>36.84</td>
<td>51.64</td>
</tr>
<tr>
<td>44</td>
<td>Water transportation</td>
<td>8.98</td>
<td>14.73</td>
</tr>
<tr>
<td>47</td>
<td>Transportation services</td>
<td>56.49</td>
<td>71.84</td>
</tr>
<tr>
<td>49</td>
<td>Electric, gas, and sanitary products</td>
<td>11.00</td>
<td>17.65</td>
</tr>
<tr>
<td>50-51</td>
<td>Wholesale trade</td>
<td>56.52</td>
<td>70.46</td>
</tr>
<tr>
<td>52-59</td>
<td>Retail trade</td>
<td>47.92</td>
<td>59.03</td>
</tr>
<tr>
<td>70</td>
<td>Hotels and other lodging places</td>
<td>26.93</td>
<td>49.33</td>
</tr>
<tr>
<td>72</td>
<td>Personal services</td>
<td>66.00</td>
<td>78.95</td>
</tr>
<tr>
<td>73</td>
<td>Business Services</td>
<td>32.79</td>
<td>48.77</td>
</tr>
<tr>
<td>75</td>
<td>Auto repair, services, garages</td>
<td>74.90</td>
<td>82.40</td>
</tr>
<tr>
<td>79</td>
<td>Amusement and recreation services</td>
<td>50.04</td>
<td>67.44</td>
</tr>
<tr>
<td>80</td>
<td>Health services</td>
<td>14.73</td>
<td>33.37</td>
</tr>
<tr>
<td>86</td>
<td>Membership organizations</td>
<td>39.27</td>
<td>59.42</td>
</tr>
<tr>
<td>89</td>
<td>Misc professional services</td>
<td>39.02</td>
<td>51.25</td>
</tr>
</tbody>
</table>
would be difficult to interpret that relationship. Therefore, we have not attempted an illustration in section VII comparable to those for the litigation and insurance data. The OSHA data on workplace-related accidents, unlike the CPSC data, correct for differences in exposure, because they include incidence rates (injuries per 100 full-time workers). However, many of the accidents reported in the OSHA data are unrelated to specific products. While the data are broken down by cause of the accident (e.g., over-the-road motor vehicles, falls, heart attacks, industrial vehicles or equipment, fires, explosions, etc.), it is not easy to determine which accidents were even associated with products, let alone caused by product defects. Thus, as with the CPSC data, it would be difficult to determine the number of accidents that could have led to product liability suits. Finally, and most importantly, the OSHA data are reported by the SIC code of the industry in which the accident occurred, not that of any product involved in the accident. Thus, one could not usefully compare the distribution of accidents across SIC codes as reported by OSHA with information about the prevalence of small firms by SIC code. This would be a serious limitation on the use of these data to study the impacts of product liability on specific industries.

(ii) Firm Level Analysis While industry-level analyses could identify problem areas for small business -- in the present study, for instance, whether small business dominated industries are more prone to harm from product liability suits than large business dominated industries -- they could not tell us how serious
the problems were for small firms, nor could they offer much guidance on specific policy remedies. To get at the direct impacts of firm size (either within or across industries) in product liability, we would need to make direct comparisons between firms of a given size and the corresponding variable of interest (litigation, insurance premiums, or accident rates). Such comparisons would require firm-level (rather than just industry-level) data.

The existing data on insurance and on accidents are unlikely to be of much use at the level of individual firms. As noted, neither the CPSC nor the OSHA data on accidents include information on the producers of any products involved; CPSC accident rate data relate to victims, and OSHA accident data are reported by the industry of the employer, not of the product involved. Thus, disaggregation of the existing accident data to the firm level does not appear feasible. 101

The same appears true of the industry-level insurance data, although for different reasons. The insurance data are, of course, drawn from policies purchased by individual firms, but it is doubtful that the identities of firms who purchased given policies would be revealed. Thus, from the existing data, one could not match a given firm (or its associated characteristics) with a given premium, deductible, and so on. As a result, disaggregation of the existing insurance data to the firm level does not seem possible either.

For the data on litigation, however, it would be possible to recover the underlying firm-level data from any industry aggregate.
As noted above, one can collect firm-level data related to litigation by going either to the original case files or to case synopses published in a product liability reporter, such as the CCH Product Liability Reporter. With a reporter, for example, one could construct a data set consisting of (1) the names of all defendants in a sample of cases; (2) the decisions; (3) the legal theories applied; (4) the awards (in the successful cases); and (5) any apportionment of the award among defendants. Given the names of defendant firms, one could then gather information about firm characteristics (e.g., firm size) from the Small Business Data Base, or from standard sources of data about firms (Dun and Bradstreet, Moody's, or Standard and Poor's).

Constructing a data set in that manner would be time-consuming, but it would allow a fairly precise comparison of the litigation burden of small vs. large firms. For example, the data could be divided in sub-samples according to firm size, and comparisons could be made across the sub-samples. Average awards against small-firm defendants could be compared with average awards against large firms. Similarly, variables such as plaintiff success rates and the likelihood and magnitude of punitive damage awards could be compared for small vs. large firms.

Analyses based on firm-level litigation data would not answer every question of interest in this study. First, neither the product liability reporters nor court records provide information on defendants' litigation costs (i.e., amounts spent on attorneys, court fees, etc.). Thus, one could not detect differences in liti-
gation costs across firms of different sizes from these sources. Second, information on posttrial activities, and of course on rates and amounts of pretrial settlements, is meager at best. Thus, any differences in these activities between small and large firms (due, for example, to differences in bargaining positions) could not readily be determined.

In addition, analyses based on actual product liability cases can reflect only actual litigation costs. They cannot capture the costs incurred by non-litigants to avoid litigation (e.g., costs of precaution), nor firms' costs to insure against the financial burden of a suit. As discussed in section III, these are significant areas for inquiry into the effects of product liability on firms, but they do not appear amenable to analysis using existing data. Nor, of course, are product-liability effects on the outputs and prices of products.

VI.B. Collection of Primary Data

Clearly, existing data would leave some holes in the fabric of our understanding of the effects of product liability. At least some of those holes could be patched with primary data collected through surveys of firms and other actors in product liability law. In what follows, we explore the types of data that could be collected in a survey and how analysts could use them. Depending on which holes are of particular interest, one can envision two different kinds of survey, each with different target groups.
VI.B.1 A Survey of Firms Involved in Product Liability Suits

If the primary concern was with the actual litigation costs of small vs. large firms, then the target population for the survey sample would be firms involved in actual litigation during a specified time period. One could select a sample of firms who had recently been defendants in product liability actions from the CCH Product Liability Reporter. Such firms could provide information about actual cases that is not available from the Reporter or from court records. For example, the defendants (or their attorneys) could be asked for information on the litigation costs incurred in the suit and about the outcomes of any posttrial activities. The U.S. General Accounting Office (GAO, 1989) surveyed the attorneys of defendants and plaintiffs involved in a sample of 305 cases. The GAO was not interested specifically in the characteristics of the firms involved in the cases, but such information could have been obtained either directly through the survey instrument or from other sources, given the names of the individual defendants. Adding this information to the kinds of data in the GAO survey would allow comparisons of the variables they studied (such as the frequency and size of awards, the effects of posttrial activities, and the costs of litigation) across firm of different sizes.  

As noted above, one could well be interested in obtaining information on other costs arising from product liability, such as insurance costs and the costs of precaution, that is not available from data on actual cases. It would be straightforward to include
questions related to such costs in a survey of recent defendants; their attorneys would probably not have the information.

Note, however, that a random sample of all firms recently involved in product liability litigation would most probably not be a random sample of all firms affected by product liability. Firms that have been involved in litigation may produce riskier products (inclusive of exposure) than their counterparts who have not been involved in such suits. As a result, litigants' costs of insurance and precaution may not be representative of those of all firms. Moreover, it is likely that not all firms potentially facing product liability suits, and who therefore have taken costly steps otherwise not worthwhile, have actually been sued. For cost information that is representative of all firms, a survey that targets a more general population of firms would be needed.

VI.B.2 A Survey of Firms Generally

Using any of a number of data bases giving firm characteristics, one could survey a random sample of firms (chosen without regard to their size), or of all firms within given industries. Such a sample could be chosen with the aid of the Small Business Data Base or a commercial data base (such as those sold by Dun and Bradstreet). If the objective of the study was to isolate the role of firm size per se (as distinct from the impact of product type), then a sufficient number of observations would have to come from the targeted industries to control for product effects. Alternatively, if the objective was simply to determine the relative impacts on small vs. large firms, then the sample could be
taken randomly across industries. However, each firm-size category would have to contain sufficient data points to allow reliable comparisons across the categories.

As noted earlier, existing, industry-level data will not support analyses of the firm-level effects of product liability laws on (1) the costs of precaution or safety; (2) the costs of insurance; and (3) the prices and outputs of products. With the present study as the point of departure, one would be interested in how those effects vary with firm size and with differentials in state product liability laws. To get at these questions, a survey should be designed to collect the following information from the individual firms in the sample:

(i) changes in total expenditure on product safety related activities due to potential product liability;

(ii) expenditures on and important features (e.g., deductibles) of product liability insurance;

(iii) output levels by product (separated by SIC codes, if possible), and changes in output due to potential product liability;

(iv) changes in product prices due to product liability (potential or actual);

(v) firm size (in several dimensions -- e.g., sales, employment, assets);

(vi) perceptions regarding both current product liability laws, and the likely impacts of changes in those laws; and

(vii) recent litigation experience, if any, including costs and outcomes (damage awards, settlement, etc.)
VI.B.3 Issues in Data Collection

A series of issues would confront anyone setting out to design a survey to gather information on the seven items above.

(i) Expenditures on product safety These cover what we referred to in section III.A as "precaution" -- safety inspections, safety-related research and development, extra safety devices or design features, and similar additional (costly) measures attendant on producing safer products. We saw in III.A that the costs of precaution are influenced by many variables, only one of which is product liability laws. It would be a daunting task to control for enough of the non-legal factors to permit isolating the effects of changes in the law. Hence, we are not sanguine about prospects for saying much about this important variable. Nevertheless, it would be worth at least trying to do so if one was going to the trouble of conducting a survey of firms.

A survey instrument should ask firms about both current and past costs of precaution, with the goal of creating a pooled time-series, cross-sectional data set. With such a data set, one could attempt to isolate the effects of product liability laws on safety expenditures over time, provided that most of the other factors could somehow be controlled for. Careful attention should be paid to this problem in designing any survey-based study.

It might also be possible to use the pooled data set to test whether the lack of a uniform national product liability law causes differences in behavior across firms at a given point in time. An obstacle here could be the lack of variability in the law across
firms, to the extent that most firms in the sample engage in inter-
state commerce and thus respond to the full range of state product
liability laws (rather than to those of one or a few key states).
This obstacle could be mitigated if markets are regional and firms
concentrate on particular regions, and if the firms do not worry
about the small probability of a large judgment from a suit in a
case outside their region. The survey instrument could include
questions about sub-national regional markets. Keep in mind,
though, that constructing firm-specific measures of the "average
stringency" of product liability laws would be very time-consuming.

It would be well to ask firms not only about their outlays
over time but also about their perceptions of how the law had
changed over time. Of particular interest here would be the chang-
es that had affected their product-safety decisions, including
product abandonment. Perceptions of the laws probably would vary
across firms; see the further discussion below, under (vi). If so,
differences perceptions could be used to explain variations in
firms' responses. Again, though, one would face the difficulty of
constructing firm-specific measures.

(ii) Expenditures on product liability insurance As with
product safety, a survey instrument should ask firms about both
current and past insurance costs, with the goal of creating a
pooled time-series, cross-sectional data set. With such a data
set, one could attempt to isolate the effects of product liability
laws on insurance expenditures (and coverage as well) over time,
provided that one could control for other factors influencing insurance costs (such as interest rates). Capturing the pure effect of interstate variability in product liability laws may again be difficult, if the relevant product liability laws do not vary much across firms at a given point in time.

As mentioned, it would be essential to include in the survey instrument questions on features of product liability insurance, such as deductibles and coverage limits, other than just premiums. These features of insurance policies may well vary considerably across firms (particularly firms of different sizes) and may thus help to explain inter-firm differences in premiums. These questions should extend to past as well as current features, so that one could study how firms with different characteristics have responded to changes in insurance costs over time.

(iii) Output levels  Product liability can, as we have seen, alter a firm’s decisions on how much to produce. It may make sense to produce less of a given product, in order to reduce the potential for a product liability suit: Since the number of product-related accidents depends on the quantity of the product that is sold, reducing output (and sales) can reduce the number of accidents. In the extreme, a firm could decide to abandon existing products, or not to develop certain products likely to give rise to product liability suits. The survey should seek information about firms’ output responses to product liability.

The questions should not, however, be confined simply to the firm’s current and past output levels. Statistical analysis would
require controlling for the large number of factors other than product liability that affect output decisions; this may or may not be feasible. However, by including questions in the survey instrument about changes in output levels or decisions not to produce certain products specifically in response to changes in potential product liability, at least one would have direct evidence (from a well-designed survey that controls qualitatively for other factors) of the incremental effects of product liability on output decisions.

(iv) Product prices As with output, product prices are affected by a number of factors, only one of which is product liability. Thus, for the same reasons outlined above, the survey instrument should include question about how product prices have changed in response to increased costs related to product liability. Note that price increases due to changes in product liability law should be included among the factors that possibly would affect firms' output decisions.

(v) Firm size Information on firm size would be of obvious relevance in the present context. In non-statistical analysis, one could simply compare costs or responses for firms of different sizes. In statistical analysis, firm size could enter as an explanatory variable, perhaps explaining observed differences in those costs or responses. In addition, with information on firm size one could convert total costs into average costs, which may be a more meaningful measure of the relative burdens borne by small as opposed to large firms.

109
Various measures of firm size are possible, and some measures would be more appropriate for some purposes than others. Three possible measures are sales, employment, and assets; the survey instrument should include questions about all three. Sales could be used to study the impacts of product liability law within a given industry; across industries, however, sales would most likely not be the best measure of firms size. Information on assets might be useful in explaining differences in deductibles across firms: Assets (perhaps corrected for debt) might determine the sizes of deductibles that firms can absorb. Finally, as many definitions of "small firm" are based on employment levels, information on employment could be the best means of disaggregating a sample by firm size.

(vi) Perceptions of current product liability laws

As already noted, although the array of product liability laws facing firms engaged in interstate commerce may not vary much, firms' perceptions of those laws may vary noticeably. After all, it is firms' perceptions that will drive decisions on product safety, insurance, and output levels. Two interesting research questions are whether firms' perceptions about product liability law are uniform or varied, and whether any variation is related to firm size or market region. For these reasons, the survey instrument should include questions about firms' perceptions of the stringency of the product liability laws that they face. These questions should extend to changes in the law over time and prospects for future changes.
It would be useful if information about firms' perceptions could somehow be quantified. One possible way of doing so would be to ask firms to register their perceptions on a scale of (say) 0 to 10, corresponding to different probabilities that the firm would be held liable for damages in a product liability suit. A "0" would correspond to never being held liable (no producer liability), while a "10" would imply that firms are always held liable ("absolute liability"). A 5 would indicate a 50% chance of being held liable.

Similarly, the survey could try to record perceptions about the likely size of the award in a successful case. This could be done by asking firms to register, on a scale of 0 to 10, the likely award in a typical case. A "0" could indicate an expected award near zero. A "5" could indicate an award equal to the actual economic value of the victim's injury (with no non-economic or punitive damages). A "10" would then imply an award far in excess of economic damages, as a result of the awarding of large non-economic damages (e.g., pain and suffering) or punitive damages.

Finally, the survey instrument should include a series of questions designed to get at the impact on firms (if any) of the lack of uniformity in state product liability laws, or the lack of a uniform Federal law. To determine the role of uniformity per se, the survey should ask the firms to respond to different specifications of uniformity in product liability law -- e.g., of comparable average stringency with current state laws, or of greater stringency. One could also include here questions about reform proposals
that merely reduce sellers' liability (e.g., by capping certain kinds of damages, or by allowing certain defenses). Firms could be asked how such changes would affect their decisions regarding product-safety outlays, output, and purchases of product liability insurance. Again, to quantify the responses, the questions could be couched in terms of whether the changes would cause the respondent to reduce expenditures on product safety by 0%, 1% to 5%, 6% to 10%, and so on.

(vii) Recent product liability litigation A firm's perception of and response to product liability could be influenced by recent lawsuits in which it has been involved. For this reason alone, it would be useful to control for firms' recent experience with product liability litigation: An interesting research question is whether firms "once burned" by recent litigation are "twice shy" compared with their counterparts who have not yet been sued. In addition, such information would be useful in determining the frequency, outcomes, and costs of product liability litigation.

For those firms that have been involved in a suit, survey questions should cover the following topics:

(a) where the suit was filed (including appeals);
(b) the outcome(s) of the case, including pretrial or posttrial changes;
(c) if the case went to verdict, the legal theory or theories applied (e.g., strict liability, negligence, or breach of warranty);
(d) the amount and composition of compensatory damages awarded, if any, including posttrial adjustments;
(e) the amount of non-economic and punitive damages awarded, if any, including posttrial adjustments;
(f) the firm's share in the burden of damages, if they were apportioned among multiple defendants;
(g) the litigation costs incurred by the firm; and
(h) any reimbursement by the firm's insurance company for damages or costs incurred as a result of the case.
VII

SOME ILLUSTRATIVE RESULTS

In the previous section, we discussed a number of possible empirical approaches to studying the effects of product liability laws on small firms. In this section, we illustrate one of those approaches: the use of existing industry-level data on product liability insurance premiums, cases, and employment by industry, to calculate correlations between cost-related variables and firm size. Our purpose here is to show concretely the steps that such an analysis would entail. Into the bargain, we are also able to present some preliminary results that support the predictions of the theoretical analysis set out in section III and elsewhere above.

VII.A. Insurance Premiunns and Firm Size

The theoretical analysis of Section III suggested the hypothesis that small firms would tend to pay higher product liability insurance premiums than large firms, all else equal (see Table 1). To test this hypothesis, we applied simple regression analysis to cross-section, industry-level data on premiums and numbers of employees (as the measure of firm size).

VII.A.1 Insurance Premium Data

The premium data, which were taken from Viscusi (1991), represent more than 60,000 product liability insurance policies -- the entire ratemaking files for 1984-1988 of the Insurance Services Office (ISO). Viscusi constructed the shares of total premiums
paid by industry (using SIC codes) for both bodily injury and property damage coverage (Viscusi, 1991, Table 6). To construct a measure of total premiums paid by industry, we multiplied Viscusi's share data by his figures on total premiums paid by all industries, averaged over 1980-1984 (see his Table 4). We reported these dollar amounts in Table 5 (section VI). Since the data represent a population rather than a sample, there is no problem (such as sample-construction bias) in comparing the premium figures across industries.

The total dollar figures reported in Table 5 are not by themselves very useful for measuring the relative burdens of product liability borne by different industries, since the amounts paid by different industries depend on the sizes of the industries. For example, one industry may pay twice as much in premiums as another simply because it is twice as large. A more meaningful measure of relative burdens would be premium data that are adjusted for industry size. To adjust for industry size, we divided the premiums paid in each industry (from Table 5) by the size of the industry, measured by the average GNP originating in that industry in 1980-1984 (the years of the premium data). The adjustment yielded size-adjusted, industry-level data on premiums (dollars paid per billion dollars of GNP originating), which we also reported in Table 5.

Examination of these data suggests several conclusions about the relative burden of product liability across industries.
(i) It is important to adjust for industry size when comparing the insurance burdens borne by different industries. The ranking of industries based on total premiums paid differs substantially from the ranking based on premiums per dollar of GNP. In addition, the relative magnitudes of the differential burdens differ between the two measures. For example, the total premiums paid by the industrial machinery and equipment industry (SIC 35) were over three times those paid by the furniture and fixtures industry (SIC 25). Yet, when adjusted for differences in industry size, the relative burden of SIC 25 was more than twice that of SIC 35. Similarly, while chemicals (SIC 28), food (SIC 20), electronic and other electric equipment (SIC 36), and transportation equipment (SIC 37) all paid large total premiums, their size-adjusted premiums were well below those of other industries with smaller total premium payments -- apparel (SIC 23), furniture and fixtures (SIC 25), rubber and plastics (SIC 30), and leather (SIC 31)).

(ii) As would be expected, the burden of product liability insurance was much lower (for both bodily injury and property damage) in the service sector (SIC 70-89) than in other sectors such as manufacturing. However, manufacturing was not alone in bearing one of the heavier burdens. For example, construction (SIC 15-17) paid the second highest size-adjusted premiums for bodily injury coverage and the highest ones for property damage. Agriculture paid substantial size-adjusted premiums, in both insurance categories, as well. Similarly, the retail trade industry (SIC 52-59) paid relatively large size-adjusted premiums for bodily injury
coverage, perhaps driven by coverage for eating and drinking places (SIC 58).

(iii) The burden of product liability insurance varied considerably across industries. For example, even within manufacturing, the size-adjusted bodily injury premiums range from a high of $475.80 for miscellaneous manufacturing (SIC 39) to a low of $0.65 for tobacco manufacturers (SIC 21), with a mean of $25.58 and a standard deviation of $78.25. The range is slightly lower for property damage ($259.88 to $0.00, with a mean of $14.42 and a standard deviation of $43.22) but still indicates considerable variability within the manufacturing sector.

(iv) Some individual industries were especially hard hit by high premiums. Firms in SIC 39, "Miscellaneous Manufacturing," paid size-adjusted premiums for both bodily injury and property damage coverage that were nearly 10 times greater than those of any other manufacturing industry. As the premium data are not reported for 3-digit SIC codes, it is not possible to determine the specific industry or industries within SIC 39 that bore the brunt of this effect. We hypothesize that it may have been driven by manufacturers of toys and recreation equipment, the category of products associated with by far the largest number of consumer product accidents according to data published by the U.S. Consumer Product Safety Commission.

(v) Industries differ in the relative importance of coverage for bodily injury vs. property damages, presumably reflecting differences in products. For most industries, bodily injury premi-
ums exceeded those for property damage, sometimes by a large margin. For example, in apparel (SIC 23), premiums for bodily injury were nearly seven times those for property damage. This seems reasonable, since one might expect clothing and textile products to cause more bodily injuries than damages to property. In a few cases, however, property damage premiums were higher. For example, in the construction industry (SIC 15-17), property damage premiums were about 20% higher than those for personal injury coverage. Again, this is not surprising, since many products used in construction could potentially cause substantial property damage as well as personal injury.

VII.A.2 Firm-Size Data

The premium data by themselves tell us nothing about whether product liability insurance premiums hit small firms harder than large firms. In order to analyze how the relative insurance burden varies with firm size, we needed to compare the distribution of premiums in Table 5 with information on the relative importance of small firms in each of the industries. The firm size data are taken from the Handbook of Small Business Data 1988, Table 6.9. We used two possible definitions of "small firm:" (i) firms with fewer than 100 employees, and (ii) firms with fewer than 500 employees. For each definition and each industry, we calculated the ratio of total employment in small firms to total industry employment. We reported the resulting percentages in Table 6 in section VI. These figures indicate the relative importance of small firms in each industry. For example, 65.64% of total employment in the agricul-

118
VII.A.3 Statistical Analysis

To quantify the relationship between product liability insurance premiums and firm size, for each of the combinations, we ran an ordinary least squares linear regression with size-adjusted premiums as the dependent variable and the percentage of employment in small firms as the independent variable. Table 7 reports the results of these calculations for the full sample of industries as well as for five subsamples. The industries covered are agriculture, mining, construction, manufacturing, utilities, wholesale and retail trade, and services.

The regression results suggest that, over the entire sample (A), there is little relationship between the relative burden of product liability insurance premiums and the importance of small firms in an industry. Industries with greater percentages of small firms do not appear systematically harder hit by product liability insurance premiums than industries with smaller percentages of small firms. The simple correlation coefficients (while positive) are all less than 0.200. None of the regression coefficients is statistically significant: The largest t-statistic is only 1.16. The R²'s are minuscule: Relative small-business "domination" of industries explains only a tiny percentage of the total variation in size-adjusted insurance premiums.

The full-sample analysis, however, masks some significant relationships that only become apparent from analysis of subsamples. We divided the sample into two groups: (i) SIC 07-39 (agri-
culture, mining, construction, and manufacturing), which for convenience we term "production-oriented industries" (B and C); and (ii) SIC 42-89 (transportation and utilities, wholesale and retail trade, and services), which we term "service-oriented industries" (D). As can be seen in Table 7, the differences between the two subsamples are striking.

In the service-oriented industries, there is little relationship between premiums paid and the importance of small firms. The correlation coefficients are small, and the role of small firms is not a significant predictor of insurance premiums. In fact, to the extent that a weak relationship does exist, it is negative: Larger premiums are paid in service-oriented industries in which small firms play a smaller role. It may be that small, service-oriented firms view product liability insurance as unnecessary, while the larger-firm industries (technically classified as service-oriented) are in fact diversified into products that warrant having product liability coverage. Regardless of the explanation, the evidence here would not lead one to conclude that a systematic relationship exists between the magnitude of premiums paid in the service-oriented group and the importance of small firms in that group.

When we focus solely on the production-oriented subsample (SIC 07-39), the results are quite different. Because the size-adjusted premiums for SIC 39, "Miscellaneous Manufacturing," were so much higher than those for any other industry, and because of the disparate nature of the products in this "industry," we analyzed the production-oriented group both with and without SIC 39. With SIC
### Table 7: Employment vs. Insurance Premiums

<table>
<thead>
<tr>
<th></th>
<th>Premiums for Bodily Injury</th>
<th>Premiums for Property Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fewer than 100 Employees</td>
<td>Fewer than 500 Employees</td>
</tr>
<tr>
<td><strong>A. Full Sample (SIC 07-89)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.113</td>
<td>0.164</td>
</tr>
<tr>
<td>Regression Coefficient</td>
<td>0.440</td>
<td>0.592</td>
</tr>
<tr>
<td>t-statistic</td>
<td>0.662</td>
<td>0.467</td>
</tr>
<tr>
<td>R²</td>
<td>0.013</td>
<td>0.027</td>
</tr>
<tr>
<td><strong>B. All Production Oriented Industries (SIC 07-39)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.301</td>
<td>0.341</td>
</tr>
<tr>
<td>Regression Coefficient</td>
<td>1.673</td>
<td>1.638</td>
</tr>
<tr>
<td>t-statistic</td>
<td>1.411</td>
<td>1.623</td>
</tr>
<tr>
<td>R²</td>
<td>0.091</td>
<td>0.116</td>
</tr>
<tr>
<td><strong>C. Production Oriented Industries Except SIC 39 (SIC 07-38)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.537</td>
<td>0.642</td>
</tr>
<tr>
<td>Regression Coefficient</td>
<td>0.431</td>
<td>0.448</td>
</tr>
<tr>
<td>t-statistic</td>
<td>1.760</td>
<td>3.648</td>
</tr>
<tr>
<td>R²</td>
<td>0.288</td>
<td>0.412</td>
</tr>
<tr>
<td><strong>D. Service Oriented Industries (SIC 42-89)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>-0.173</td>
<td>-0.298</td>
</tr>
<tr>
<td>Regression Coefficient</td>
<td>-0.044</td>
<td>-0.074</td>
</tr>
<tr>
<td>t-statistic</td>
<td>-0.608</td>
<td>-1.083</td>
</tr>
<tr>
<td>R²</td>
<td>0.030</td>
<td>0.089</td>
</tr>
<tr>
<td><strong>E. All Manufacturing Industries (SIC 20-39)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.554</td>
<td>0.487</td>
</tr>
<tr>
<td>Regression Coefficient</td>
<td>5.181</td>
<td>3.158</td>
</tr>
<tr>
<td>t-statistic</td>
<td>2.742</td>
<td>2.301</td>
</tr>
<tr>
<td>R²</td>
<td>0.307</td>
<td>0.237</td>
</tr>
<tr>
<td></td>
<td>Premiums for Bodily Injury</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td></td>
<td>Fewer than 100 Employees</td>
<td>Fewer than 500 Employees</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. All Manufacturing Industries Except SIC 39 (SIC 20-38)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.604</td>
<td>0.670</td>
</tr>
<tr>
<td>Regression Coefficient</td>
<td>0.798</td>
<td>0.586</td>
</tr>
<tr>
<td>t-statistic</td>
<td>3.035</td>
<td>3.610</td>
</tr>
<tr>
<td>R²</td>
<td>0.365</td>
<td>0.449</td>
</tr>
</tbody>
</table>
39 excluded, the results suggest that industries "dominated" by small firms tend to pay higher size-adjusted product liability premiums. All four correlation coefficients exceed 0.5, and the t-statistics indicate that, in three of the four cases, the role of small firms is a strongly significant predictor of product liability premiums paid by an industry. In the case of premiums for property damage, the importance of firms with fewer than 100 employees alone explains more than half of the variation in premiums across industries ($R^2=.506$). With SIC 39 included in the subsample, the results were qualitatively similar, although the coefficient on the firm-size variables was at best barely significant at the 5% level.

Finally, we considered the relationship between premiums and firm size solely within the manufacturing sector (SIC 20-39). Again, we ran the regression both with (E) and without (F) SIC 39. The results show a significant, positive relationship between premiums and the prevalence of small firms. All but two of the simple correlations exceed 0.5, and all t-statistics show significant explanatory power.

The above analysis suggests the following conclusion. Overall, industries in which small firms "dominate" do not necessarily pay higher (size-adjusted) product liability premiums than industries "dominated" by large firms. By contrast, in the production-oriented sectors (agriculture, mining, construction and manufacturing), as well as in the manufacturing sector alone, the burden of product liability premiums is greater for industries with many small firms than for those with many large firms. This conclusion
is supported by the evidence for both types of premiums (bodily injury and property damage) and both definitions of small firm (fewer than 100 employees and fewer than 500 employees). Also, it is consistent with the predictions of our analysis in Section III.

However, in interpreting this conclusion, we should keep in mind the limitations of the above analysis. First, we used another analyst's secondary data on insurance premiums because they were readily available; ideally, one would like to tailor the data more closely to the hypotheses to be tested. Second, and more important, we have not compared the premiums of small firms within a given industry with those paid by large firms in that same industry; thus, we cannot conclude that firm size per se is a problem -- i.e., that small firms producing a given set of products bear a greater burden from product liability insurance than do large firms producing that same product. All we can conclude is that those production-oriented industries that tend to be heavily burdened by product liability insurance also tend to have large numbers of small firms in them.

VII.B. Cases and Firm Size

We argued earlier (Section III) that changes in product liability laws can affect the number of product liability suits filed, thereby also affecting the expected litigation and liability costs faced by firms and their insurers. However, the incentive to file a suit is influenced by a number of other factors, some of them favorable to small firms, others not. Thus, we concluded (see
Table 1) that economic theory could not predict whether small firms would likely face a greater or a smaller number of cases than large firms. The relative burden would depend upon the magnitudes of the countervailing influences.

As a preliminary test of the relationship between product liability cases and firm size, we analyzed data on the number of product liability cases, by industry, and the relative importance of small firms in those industries. We took the cases data from Dungworth (1988), who reported by industry, or group thereof (by SIC code of the lead defendant), the number of product liability cases filed in Federal district courts between 1973 and 1986 (a total of 84,132 cases). Dungworth defined his industry categories at the 2- or 3-digit SIC level, with some industries broken up and recombined into ad hoc groupings. To make use of these data, we re-aggregated his data entirely to the 2-digit level to allow comparisons with 2-digit employment data. Table 4 (section VI) reported the resulting numbers of cases and their distribution across industries or groups.

As with the premium data, the numbers of cases filed against firms in a given industry need to be adjusted for the size of the industry. Thus, we divided Dungworth’s cases data by the average GNP originating in that industry during 1980-1984. Table 4 also reports these data.

Examination of the cases data suggests several conclusions about the relative burden of product liability across industries.
(i) As with the premium data, the size-adjusted numbers of cases indicate a pattern of relative burdens across industries quite different from that of the unadjusted data. For example, the total number of cases filed against firms in SIC 34-36 (fabricated metal products, industrial machinery, and electronic equipment) exceeded the number for both the chemical industry (SIC 28) and transportation equipment (SIC 37). Yet, each of the latter pair of industries bore a much larger relative burden, measured by the size-adjusted cases, than did the former. In fact, the chemical industry faced three times the burden as firms in SIC 34-36.

(ii) As we would expect, wholesale and retail trade (SIC 50-59) faced a much lower size-adjusted burden of cases than the production-oriented industries -- despite facing more suits than many of the latter. The number of cases per $10,000 of GNP originating in wholesale and retail trade fell far below those of the other reported industries.

(iii) The size-adjusted burden of cases varied considerably across industries. In manufacturing, cases per $10,000 of GNP originating ranged from 705.25 to 28.70, with a mean of 157.89 and a standard deviation of 207.93. The large mean and standard deviation were heavily influenced by the industry with the highest relative burden, "Stone, Clay and Glass Products" (SIC 32), which includes asbestos cases.120

Removing that industry from the sample reduces the range significantly, but even so considerable variability remains: The next highest burden was that of "Chemicals" (SIC 28) (itself dominated
by "Pharmaceuticals and Health Products," SIC 283). Omitting SIC 32, the mean was 97.07, with a standard deviation of 83.84.

To examine whether the industries facing larger case burdens also had larger numbers of small firms, we combined the above industry-level case data with data on the percentage of industry employment in small firms (the same as used in the analysis of insurance premiums, including the same alternative definitions of small firm: fewer than 100 employees, or fewer than 500 employees). Again, we ran simple linear, ordinary least squares regressions between the two variables. The results are reported in Table 8, for the full sample (A) and three subsamples (B-D).

For the full sample of industry groups (A), the regression analysis suggests that there was no systematic relationship between size-adjusted caseloads and the importance of small firms in a given industry. If anything, the negative correlation coefficients indicate weakly that industries with more large firms tended to face more cases per unit of GNP. However, the small t-statistics on the coefficients (indicating a lack of statistical significance) warrant caution in drawing conclusions from the negative correlation coefficients.

In direct contrast to the analysis of insurance premiums in section VII.A., the results obtained here for the manufacturing sector (SIC 20-38) alone (B) indicate no systematic relationship (positive or negative) between cases and firm size. Indeed, the relationship between cases and importance of small firms is even weaker within the manufacturing sector than for the sample as a
### Table 8: Employment vs. Cases

<table>
<thead>
<tr>
<th></th>
<th>Fewer than 100 Employees</th>
<th>Fewer than 500 Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Full Sample</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>-0.175</td>
<td>-0.189</td>
</tr>
<tr>
<td>Regression coefficient</td>
<td>-2.345</td>
<td>-2.138</td>
</tr>
<tr>
<td>t-statistic</td>
<td>-0.591</td>
<td>-0.639</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.031</td>
<td>0.035</td>
</tr>
<tr>
<td><strong>B. All Manufacturing Industries</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>0.053</td>
<td>-0.032</td>
</tr>
<tr>
<td>Regression coefficient</td>
<td>0.973</td>
<td>-0.415</td>
</tr>
<tr>
<td>t-statistic</td>
<td>0.160</td>
<td>-0.096</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.003</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>C. Full Sample Excluding SIC 32</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>-0.416</td>
<td>-0.432</td>
</tr>
<tr>
<td>Regression coefficient</td>
<td>-2.289</td>
<td>-2.012</td>
</tr>
<tr>
<td>t-statistic</td>
<td>-1.446</td>
<td>-1.516</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.172</td>
<td>0.187</td>
</tr>
<tr>
<td><strong>D. Full Sample Excluding SIC 28,32,37</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlation coefficient</td>
<td>-0.075</td>
<td>0.139</td>
</tr>
<tr>
<td>Regression coefficient</td>
<td>-0.238</td>
<td>0.420</td>
</tr>
<tr>
<td>t-statistic</td>
<td>-0.211</td>
<td>0.396</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.006</td>
<td>0.019</td>
</tr>
</tbody>
</table>
whole. The correlation coefficients are smaller in absolute value, as are the t-statistics and R^2 values.

One possible reason for these disappointing results is that the sample in fact consisted of two different subsamples. We did not have enough observations to test statistically for any difference, but there was an a priori basis for stratifying the data. Dungworth (1988) found that three industries -- asbestos, pharmaceuticals, and motor vehicles -- accounted for a very large percentage of total cases; indeed, products case growth in other industries did not differ markedly from the trend growth of other kinds of cases. The truly big "outlier" of the above three industries was asbestos. As noted above, nearly two-thirds of all asbestos cases came from SIC 32, "Stone, Clay, and Glass Products," and virtually all products cases in that SIC code were asbestos cases.

Accordingly, we regressed the size-adjusted number of cases on firm-size industry characteristics, first, for the full sample excluding SIC 32 (C) and, second, for the full sample excluding not only SIC 32 but also SIC 28 (which includes pharmaceuticals) and SIC 37 (which includes motor vehicle equipment) (D). As Table 8 shows, variant D made little difference in the results. Those for variant C did improve quite a bit compared with variant A, but not to the point of 5%-level statistical significance of the firm-size coefficient.

The above analysis suggests the following conclusion. Industries in which small firms are relatively more important do not
appear to face higher (size-adjusted) numbers of product liability cases than industries in which large firms are more important. In fact, there appears to be little or no systematic relationship (positive or negative) between cases and firm size. This conclusion holds for both definitions of small firm (fewer than 100 employees and fewer than 500 employees). It is also consistent with the lack of a clear prediction from our theoretical analysis in section III.

Again, however, the limitations of our analysis should be kept in mind. In particular, we have not compared the case burdens of small firms within a given industry with those of large firms in that same industry. Hence, we cannot draw conclusions about how the case burdens of small firms producing a given product mix compare with those of large firms producing that same mix. Instead, all we are entitled to conclude is that the industries facing the greatest numbers of cases (adjusting for industry size) are not necessarily those with relatively large numbers of small firms in them.

VII.C Implications

At first glance, one might view the above analyses as presenting conflicting evidence on the impact of product liability on small firms, particularly within the manufacturing sector. The evidence for insurance premiums suggests that industries with relatively more small firms face a greater burden, while the evidence for cases suggest that they do not. However, the theoretical anal-
ysis in Section III shows that these two conclusions are not inconsistent.

As is clear from Table 1, the costs of product liability to a firm depend on a number of factors, only one of which is the number of product liability cases filed (or expected to be filed) against that firm. Thus, while analysis of (size-adjusted) case data may tell us something about how product liability law affects firms, they clearly do not tell the whole story. We must also give consideration to the many other avenues through which firms may be affected, including the many factors (other than case numbers) that determine the cost of insurance and a firm’s reliance on it.

The preliminary results discussed above suggest that, to the extent that small firms do bear a larger burden from product liability than large firms, it is not because they face relatively more suits than large firms. One part of the reason is more likely to be that they depend more heavily on commercial product liability insurance and are at a cost disadvantage relative to large firms in purchasing that insurance.
REFERENCES


2. Landes and Posner (1987: pp. 284-285) suggest that this history reflects, among other things, the growing complexity of products, the small size of most 19th-century manufacturers (making them judgment-proof), and the increasing ability to identify the precise point in the chain of distribution at which a product becomes defective.


4. Winterbottom v. Wright: 10 M.&W. 109, 152 Eng.Rep. 402 (Ex. 1842). The driver of a mail coach was injured when his coach broke down, allegedly because the defendant neglected to maintain the coach properly. Because the defendant was not the plaintiff's direct employer, the case was dismissed. The court justified invoking privity in part because it would prevent a flood of litigation under a general negligence standard.


7. This implication is apparently at odds with the administrative-cost justification for a negligence standard just noted. However, while a negligence standard leads to higher costs per case, it results in fewer cases overall compared with strict liability (Landes and Posner, 1987: pp. 65, 287).


car her husband had recently bought went out of control because of a faulty steering mechanism. The court found (first) that explicit contractual waivers of hability by both the manufacturer and the dealer were superseded by an implied warranty of fitness, and (second) that the absence of privity did not bar recovery. In Greenberg, a retailer was sued by a woman who was injured by metal slivers in a tin of salmon bought by her father. The court allowed recovery, again despite the absence of privity.


13. Published in 1965 by the American Law Institute, this document was a summary of the Institute's reading of current tort law, including product liability.

14. The Restatement did not address whether liability extended to (a) harm to bystanders, or (b) sellers of a product requiring further processing or assembly.

15. The Federal courts do try products cases, but they apply the relevant state laws in doing so.

16. Throughout this discussion, Louisiana law (which has its roots in the Code Napoleon) must be viewed as an exceptional case, requiring individual attention.

17. Limits on the amounts recoverable for non-pecuniary damages were also proposed in the Model Uniform Product Liability Act. See Dworkin (1981) for a discussion of their likely effectiveness.


19. See Landes and Posner (1987: Chapter 7) and Miceli and Segerson (1991b) for discussions of the economics of joint torts.

20. Alternative theories include alternative liability, concerted action, and enterprise liability. Winslow (1985) discusses the application of these theories in different jurisdictions.


23. See CCH, pp. 4026-27; Stuby (1987); Robb (1983); and Schwartz and Mahshigian (1987) for discussions of the adoption of strict liability by individual states.
24. An implied warranty is generally interpreted as a guarantee of product quality, defined in terms of either the fitness or the merchantability of the product (CCH, p. 1057). In addition, no showing of fault is necessary to recover under a warranty; see CCH, p. 1021, and Robb (1983: p. 158). Thus, absent privity, an implied warranty closely resembles strict liability.

25. In New York, for instance, the definition is "not reasonably safe", and in Ohio and Pennsylvania it is not "safe for its intended use" (CCH, pp. 4026-27 and 4079-80).

26. Some (e.g., Keeton, fn. 51, in Dworkin, 1981) have argued that near-absolute liability is the only way to separate strict liability from negligence.


28. Even in states that limit liability to injuries from risks knowable at the time of manufacture, a producer is still required to warn of risks that become apparent later. Thus, state-of-the-art defenses do not apply to the duty to warn. See Dworkin (1981: p. 60).

29. Under the Model Uniform Product Liability Act, manufacturers would not be held liable for injuries resulting from failure to warn about obvious dangers (Dworkin 1981, fn. 74). The next question is then, of course, what is "obvious?"

30. Normally, the burden of proof is on the defendant, although in some states the plaintiff must prove that he was not negligent (CCH, p. 3011).

31. The "useful life" defense was also included in the Model Uniform Product Liability Act. See Dworkin (1981, p. 68).

32. Statutes of respose were excluded from the Model Uniform Product Liability Act, in favor of the rebuttable useful life defense. See (Dworkin, 1981: p. 69).

33. By "multi-state" suits, we mean cases in which plaintiffs come from one or more states and defendants from a different set of states. Dungworth (1988: pp. 9-10) found that products cases are "more likely than other kinds of [tort] suits to be removed [from state courts] to federal district courts on the basis of a claim of diversity of citizenship jurisdiction." He also observes (fn. 6) that "the jurisdiction of the federal courts extends to suits between parties who are citizens of different states, and either party can claim federal jurisdiction (28 U.S.C. 1332)." Also, Henderson and Eisenberg (1990: p. 520) note that Federal suits "constitute a surprisingly high fraction of all products filings," but that the Federal share varies across states; and that the Fed-
eral share of products cases has grown over time (fn. 166).

34. It could, however, be allowed as evidence (for the plaintiff) of the technical feasibility of an alternative design (CCH, p. 3281).

35. The defendant in most product liability suits is the producer of the good at issue. However, our remarks apply equally to non-manufacturers who could be potentially liable for product-related injuries.

36. While firms may be able to influence these laws indirectly through lobbying, at the time of production they will not as a rule control what determines where a suit arising from an injury is brought.

37. The frequency distribution gives the probability of any level of $S$. For example, $f(1,000,000)$ is the probability that the amount ultimately paid out will be $1$ million. This probability depends on the factors noted in the previous paragraph.

38. If both injuries and the extent of liability were random, $E[S]$ would also depend on the covariance between these two underlying random variables.

39. Formally, the variance is defined as $E[(S-E[S])^2]$. 

40. Formally, the weights in the upper and lower tails are identical.

41. Economic theory lends support to this view. Insurers may be viewed as risk neutral because of the risk-pooling nature of their business. Likewise, firms that purchase (nearly) full insurance with small deductibles, as many small businesses do, would also be (nearly) risk neutral. According to economic theory, if the distribution of $S$ is known, then the behavior of risk-neutral agents will depend only on the expected value of $S$ and not on its variance or skewness. For example, prices can be based on expected product-related damages, with the low-damages states effectively subsidizing the high-damages states. For a discussion of this cross-subsidization effect, see Rice (1985).


43. There is little mention of (or apparent concern over) state differences that may have led in some cases to excessively low levels of damages. It is not clear whether such cases do not exist (i.e., there is no lower tail to the distribution) or are simply not of concern to producers and insurers.
44. Individuals or firms may overweight the probabilities associated with "low probability-high consequence" events, perhaps out of a fear of (uninsurable) ruin; see Opaluch and Segerson (1989). This may be what the Federal Interagency Task Force (1977) had in mind when it concluded that "subjective" rate-making by the insurance industry had contributed to the product-liability crisis. Insurance premia may have been based on perceived liability risks — e.g., a relatively small number of very large awards — rather than on statistical information. Of course, "subjective" premia may be the best that insurers can come up with when confronted with new or changing conditions.

45. See also Shavell (1987); Landes and Posner (1987); and Cooter and Ulen (1988).

46. See Landes and Posner (1987: Chapter 10) for a formal analysis.


48. In a different context, automobiles sold in California differ from those sold in other states because of California's more stringent air-quality laws.

49. If this is the case, firms are responding to the upper tail of the distribution of awards (see section II.E), which (according to Priest, 1988) accounts for a large proportion of average product liability awards.

50. Alternatively, s may be defined as the probability that the defendant will be held liable for the full amount of damages.

51. The producer's liability costs may depend on x not only through its effect on the probability or magnitude of damages but also through its effect on determination of "fault." For example, under a negligence standard, a producer will be held liable for damages only if found to have been "negligent," which may be defined in terms of the level of precaution, x.

52. Strictly speaking, s should be a function of x and y, because (as noted) negligence-based rules assign liability based on the precaution taken by injurers and victims. However, the exposition here is simpler if we treat s as a separate variable.

53. We have already discussed these three issues, in a different context, in section II.A.

54. Using data on the frequency and size of punitive damage awards in product liability cases, Landes and Posner find the frequency to be quite low. Thus, the perception that punitive damages are a major component of product liability costs seems to be based on a
few large judgments.

55. See Cooter and Ulen (1988: p. 394-5) for a similar specification. They call $m$ the "punitive multiplier."

56. At one time, joint and several liability required that the injurers have acted in concert. Recently, though, this requirement has been significantly relaxed.

As an example of this doctrine in product liability law, suppose that a small manufacturer, with a small amount of product liability insurance coverage, produces a product that it knows to be defective. A large discount chain (with a lot of coverage) notifies the manufacturer of the defect but sells the product anyway, without any warning. If a plaintiff sued both firms, under joint and several liability the discount chain would be exposed to the full amount of damages, regardless of its lesser share of overall responsibility.


Suppose, for example, that a consumer bought a drug that years later caused damages of $100,000. The seller is known to have been one of two companies who (at the time of the sale) sold 100 and 150 units respectively. If the offending firm cannot be identified exactly, under market share liability the first company would bear 40 percent of the damages, or $40,000 (because $100/250 = 0.4), and the second 60 percent, or $60,000 (because $150/250 = 0.6).

Note that if all sellers charged the same price, apportioning damages according to shares of market revenues would yield the same result.

58. A controversial issue in the tort reform debate is the widespread use of contingent fees by plaintiffs' lawyers. See Danzon (1983); Miceli and Segerson (1991a); and Tort Policy Working Group (1986) (which proposed mandating a sliding scale). With contingent fees, if a suit is unsuccessful the victim owes nothing for the attorney’s time. Thus, the practice largely removes the barriers to sue faced by plaintiffs (especially those with marginal claims or liquidity constraints), by allowing them to pay attorneys' fees with a share of the award. Many people claim that contingent fees lead to excessive litigation and attorneys' fees; others argue that the institution affords low-income victims access to the legal system and potential injurers an incentive to invest in precaution (Miceli and Segerson, 1991a). Whether desirable or not, contingent fees clearly increase the expected costs of dealing in dangerous products by raising the probability that a victim will sue, and perhaps the probability that the suit will go to trial rather than settle (Thompson, 1991).

59. For example, Viscusi (1986) found that, in a sample of 10,784 product liability claims, 95% of those not dropped were settled rather than tried. This is consistent with the settlement rate in
other areas of tort law (Priest and Klein, 1984).

60. The discovery process is designed to minimize divergences in expectations. Casual empirical evidence suggests that the states’ discovery rules vary widely, from the "trial by ambush" system used in New York to the full disclosure followed in Connecticut. To the extent that Federal discovery rules require full disclosure, the greater-than-average tendency to try products cases in Federal courts may promote settlement and thus reduce litigation costs.

61. Note that we are assuming that, if the case goes to trial, the defendant is potentially liable only for the victim’s damages and not for punitive damages or the plaintiff’s legal fees.

62. For example, we may interpret a as the fraction of claims for which the value of the claim exceeds the plaintiff’s litigation costs; see Miceli and Segerson (1991a).

63. Marino (1988) provides a theoretical discussion of scale effects.

64. An example illustrates the point. Suppose (for the same two firms in the example in footnote 57) that the probability of an accident per unit of output r is 0.01 for the small firm (q = 100) and 0.008 for the large firm (q = 150). Expected damages actually caused by the small firm are therefore

\[(.01)(100)(\$100,000) = \$100,000,\]

and expected damages actually caused by the large firm are

\[(.008)(150)(\$100,000) = \$120,000,\]

making total damages $220,000. Under market share liability, the small firm would bear liability of only

\[(.4)(\$220,000) = \$88,000 < \$100,000,\]

and the large firm would bear liability of

\[(.6)(\$220,000) = \$132,000 > \$120,000.\]

Note that we are assuming here that buyers of the product do not perceive the difference in safety.

65. This will be true, of course, under any apportionment rule. Note that, if a firm merges with another firm in the same industry, the successor firm may face the full exposure.
66. Any scale economies would, of course, be reduced if larger firms produce safer products, and hence have lower accident rates, than smaller firms. Further, it is not clear to us that maintaining an in-house legal staff is necessarily cheaper, per unit of litigation of given quality, than hiring outside counsel from an independent law firm of comparable size -- especially if the outside law firm is on a retainer and thus familiar with the company's operation.

67. An offsetting factor here may be that, under certain legal rules, plaintiffs would hold out for higher settlements against larger firms, with their deeper pockets.

68. This effect could depend on the type of product the firm sells. For example, a seller of "impulse" items displayed at supermarket checkout counters would be more susceptible to this effect than a seller of custom industrial equipment.

69. Such disputes received considerable attention during the height of the asbestos litigation. Insurers argued that the claims traced back to goods produced before the companies bought the insurance coverage.

70. Typically, insurers are required by (state) law to maintain financial reserves, including their own capital, in specified amounts and forms tied to the risks they are covering.

71. For example, suppose a pool is composed half of members with an accident rate of .01, and half of members with a rate of .005. The premium for the group will thus be based on the average accident rate of .0075=(.5)(.01)+(.5)(.005), which will be higher than the premium if all members had the low rate, and lower than if they all had the high rate.

72. This result holds more generally for products that reach the consumer indirectly, after passing through wholesalers and retailers. It also applies to workers injured on the job in product-related accidents, because they have contractual relationships with their employers, who in turn have contractual relationships with the suppliers of the injuring products. It does not apply, however, to injured bystanders who do not have a contractual relationship with any party to the accident.

73. These arguments illustrate the Coase Theorem (Coase, 1960), which says that (when transaction costs are low) resources will be allocated efficiently regardless of the legal rule.

74. It also ignores the administrative costs of the legal system, which may differ among legal rules. See Landes and Posner (1987) for a discussion of this point.
75. This supposes that the due standard of care under a negligence rule is set at the efficient level -- the usual assumption in economic models of negligence. See, e.g., Shavell (1987).

76. They found similar evidence in appellate decisions published since the mid-1980s.

77. While this might at first appear surprising, it is in fact consistent with the view that, in practice, there is little difference among the theories, especially when breach of warranty is broadly interpreted. See our discussion of state differentials in section II above, as well as the further evidence (below) in support of this conclusion.

78. The 66% of cases based on negligence were decided on negligence alone, or on negligence along with strict liability or breach of warranty (or both); the 27% based on strict liability were decided on strict liability alone, or strict liability with breach of warranty; and the 7% based on breach of warranty were decided on breach of warranty alone.

79. This is consistent with the view that in practice the distinctions among the theories is not great (see Section II, on state differentials). See also the results of Higgins (1978), discussed below.

80. Higgins (1978) obtained similar results when he used industrial accidents as his dependent variable. However, the same caveat applies to this measure of the accident rate.

81. Note that, if this perception is correct, then the tort system is failing to perform the dual functions identified above of providing manufacturers an incentive to produce safer products and compensating victims for their losses.

82. These reforms include (1) allowing state-of-the-art defenses in strict liability cases; (2) raising the standard of proof for punitive damages; (3) allowing comparative negligence in all actions; (4) limiting or abolishing joint and several liability; (5) placing a $500,000 cap on noneconomic awards; (6) placing a cap on punitive damage awards; (7) modifying the collateral source rule by allowing workers' compensation reductions; and (8) limiting the liability of product sellers. See GAO (1989), Table 5.3.

83. It is possible, for example, to achieve uniformity across states by having all states adopt the laws the most stringent state. This would reduce the variance of the distribution across states but at the same time increase the expected value. See II.E. above.
84. In fact, GAO (1989, p. 57) concludes that, instead of increasing uniformity, the many state legislative reforms to limit producer liability have actually increased the variation across states.


86. Much of the unpredictability in awards is due to juries rather than differences in the law. This source of uncertainty would not necessarily be reduced by uniform Federal legislation, although features of the law that limit jury discretion could increase predictability.

87. It is also possible to "pool" cross-sectional and time-series data to form a data set consisting of observations for a given subset of the population over several time periods.

88. In fact, this is one reason for using liability to induce efficient care rather than relying on regulations. See Segerson (1986) for a related discussion.

89. See Wittman (1986) for an empirical study of factors influencing the magnitudes of awards, and Dewees (1986) for an example of how the discrepancy between amounts that would be awarded by a court and true damages could influence a polluter's decisions.

90. The latter situation is mostly a problem of the cost of compiling data sets. The "right" industry designation would probably be that of the producer in most instances. Then the question is whether a rule of thumb, such as using the SIC code of the lead named defendant (e.g., Dungworth, 1988), results in the correct product designation.

91. In this sense, product liability differs from torts where it is clear at the time that decisions are made which state's law will apply in the event of an accident. In such cases, differences across states in the applicable law will create variability in an across-state sample.

92. There may be sufficient variability over time to allow for time-series analysis of the impacts of changes in state laws. However, with time series analysis it would be very difficult to compare the relative impacts on small versus large firms, as discussed below.

93. See, for example, U.S. Consumer Product Safety Commission.

94. See, for example, U.S. Department of Labor.

95. See, for example, U.S. Administrative Office of the Courts.

96. See, for example, U.S. Small Business Administration.
97. Obviously, one could also go directly to the individual states' general statutes, but the CCH reporter is much more convenient both to access and to use.

98. Industry-level data on sales (value of shipments) and GNP are readily available from the U.S. Department of Commerce, while employment data are available from the Bureau of Labor Statistics (for non-agricultural employment) and the Department of Agriculture (for agricultural employment).

99. The definition of "small firm" could be varied to suit the particular objective.

100. For example, exposure rather than size or inherent hazard may explain the large incidence of accidents in "Sports and Recreational Equipment" relative to (say) "General Household Appliances."

101. For workplace accidents resulting in workers' compensation claims or tort actions, it may be possible to recover the identity of the manufacturer or distributor of a specific product involved in an accident from the workers' compensation claim records or court records. To do so, however, would be very time-consuming for a sufficiently large sample.

102. Note, however, that a sample of this size is unlikely to contain enough observations on firms within any given industry to allow one to discern the relative contributions of size per se and type of product.

103. In technical terms, a sample of litigants may exhibit "selection bias" in terms of product liability risks.

104. The Small Business Data Base covers firms of all sizes. Note that it is derived from a broader data base supplied by Dun & Bradstreet.

105. This is approach (3) outlined in Section VI.

106. This is approach (2) outlined in Section VI.

107. Interagency Task Force Report (1977) used sales to convert liability insurance premiums to average premiums.

108. Most firms would not be able to estimate the likely effects of changes in the law on their costs of product liability insurance. Such information would have to be obtained from a separate survey of insurance companies.

In questions concerning changes in the amount of insurance purchased, some hypothesis about the likely effects on product prices (e.g., no change, or a 10 percent increase) would have to be provided.
110. This might not seem a very efficient way to collect information on the costs and outcomes of litigation, because only a small number of the firms surveyed would likely have been involved recently in litigation. A more efficient way to obtain this type of information would be to survey only firms with actual litigation experience. However, as long as a general survey is being administered for other purposes, the added cost of obtaining information on actual litigation should be relatively small. Care should be taken, of course, to get as large enough number of firms with litigation experience in the total sample.

111. In fact, Viscusi used the ICC codes to classify industries. For the most part, these coincide with the SIC codes. One exception is "Firearms and Ammunition," which Viscusi lists as industry 19 but which we included in SIC 34 (Fabricated Metal Products), because the SIC code for "Firearms and Ammunition" is 348.

112. If instead we were dealing with a sample, it would be necessary to determine whether the sample was random before we could make comparisons across industries. For example, observing that premiums paid by firms in Industry X were twice as large as those paid by firms in Industry Y would say nothing about the relative burden of product liability in Industries X and Y if the difference arose simply because the sample included twice as many firms from Industry X as from Industry Y, even though X and Y were of equal size.

113. Note that the size of an industry is determined in part by the level of aggregation at which the data are reported: The higher the level of aggregation, the greater the size. Viscusi's data are primarily at the 2-digit SIC level.

114. We took the GNP data, published by the U.S. Department of Commerce, from The Statistical Abstract of the United States. Alternative measures of industry size include total employment and total sales or value of shipments. We saw no compelling reason to choose either of these measures over GNP. Eventually -- once a proper study has been mounted, perhaps using primary data -- it would be a good idea to check the sensitivity of the results to using different measures of industry size.

115. All dollar figures are premiums per billion dollars of GNP originating.

116. Recall, however, that this does not necessarily imply that firm size per se is the cause of the higher premiums. Since we have not corrected for product type, we cannot rule out the possibility that the higher premiums are attributable to the nature of the products produced by industries that tend to be small-firm dominated.
116. Omitting the agricultural, mining, and construction sectors from the second subsample strengthens the relationship between premiums and firm size for the bodily injury premiums but weakens it for the property damage premiums. The difference is driven primarily by the construction industry, which is dominated by small firms and pays high premiums. As noted above, in the construction industry, property damage premiums exceed those for personal injury, while the reverse is generally true for the manufacturing industry. Thus, removing the construction industry from the sample weakens the relationship between premiums and firm size for property damages but strengthens it for personal injuries.

117. Dungworth's total sample is 85,694 cases, but in 1,562 of those governments were the lead defendants. We had no way to make use of these observations.

118. For example, Dungworth isolated "Pharmaceuticals" (SIC 283) from the rest of the "Chemicals" industry (SIC 28); split up "Transportation equipment" (SIC 37) into three sub-groups of 3-digit industries; and moved "Office and Computing Machines" (SIC 357) from "Machinery (Except Electrical)" (SIC 35) into a subgroup with "Electric and Electronic Equipment" (SIC 36).

119. As the period 1980-1984, used for insurance premiums, lies in the middle of the time period of Dungworth's sample (1973-1986), use of the same GNP data seemed appropriate.

120. Over the sample period, Federal asbestos cases accounted for 94.6 percent of the total cases filed against firms in SIC 32. According to Dungworth's estimates, however, SIC 32 accounted for only 63.9 percent of all asbestos-related cases (20,888 in all); the rest were in "Textile Mill Products" (SIC 22); "Paper and Allied Products" (SIC 26); various service, utility, and shipping industries (SIC 15-17, 41, and 75); and a miscellaneous group.

121. Recall that, because of the way the data on firm size by numbers of employees are reported, we were constrained to work with at the level of 2-digit SIC codes.