

Landes, Elisabeth M.

Working Paper

Compensation for Automobile Accident Injuries: Is the Tort System Fair? – And: Insurance, Liability, and Accidents: A Theoretical and Empirical Investigation of the Effect of No-Fault on Accidents

Working Paper, No. 17

Provided in Cooperation with:

George J. Stigler Center for the Study of the Economy and the State, The University of Chicago
Booth School of Business

Suggested Citation: Landes, Elisabeth M. (1980) : Compensation for Automobile Accident Injuries: Is the Tort System Fair? – And: Insurance, Liability, and Accidents: A Theoretical and Empirical Investigation of the Effect of No-Fault on Accidents, Working Paper, No. 17, The University of Chicago, Center for the Study of the Economy and the State, Chicago, IL

This Version is available at:

<https://hdl.handle.net/10419/262419>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

COMPENSATION FOR AUTOMOBILE ACCIDENT INJURIES:
IS THE TORT SYSTEM FAIR?

And

INSURANCE, LIABILITY AND ACCIDENTS:
A THEORETICAL AND EMPIRICAL INVESTIGATION
OF THE EFFECT OF NO-FAULT ON ACCIDENTS

Elisabeth M. Landes

Working Paper No. 017

October 1980

CENTER FOR THE STUDY OF THE ECONOMY AND THE STATE

The University of Chicago
1101 East 58th Street, Chicago, Illinois 60637

COMPENSATION FOR AUTOMOBILE ACCIDENT INJURIES:
IS THE TORT SYSTEM FAIR?

by

Elisabeth M. Landes

Center for the Study of the Economy and the State
University of Chicago

First Draft, September 1980

COMPENSATION FOR AUTOMOBILE ACCIDENT INJURIES:
IS THE TORT SYSTEM FAIR?

by

Elisabeth M. Landes

Center for the Study of the Economy and the State
University of Chicago

I. Introduction

Sixteen states enacted "no-fault" automobile insurance laws between 1971 and 1976, electing to remove or restrict liability for motor vehicle accident injuries and substitute in its place compulsory first-party insurance. Eight others introduced compulsory or voluntary "add-on" no-fault benefits in the form of personal injury protection insurance without choosing to restrict tort-liability.

The adoption of no-fault by these states was a legislative response to dissatisfaction with the alternative "fault" system, which combines tort-liability with voluntary first-party protection and voluntary (or compulsory) third-party (liability) insurance. In the debate surrounding these laws, the most commonly expressed objection to the fault system was that it is inequitable, because it compensates only some "victims" of automobile accidents for their losses while other "victims"--those found to be negligent in the tort process and those injured by uninsured drivers--may remain uncompensated. Implicit in this objection is concern for consumer competence in the purchase of automobile-related (and non-automobile-related) accident insurance. If consumers of insurance were fully aware

of the risks they faced and their possible consequences and were able to purchase insurance in perfect markets, clearly legislators would have no cause for concern. Any differences among individuals in the amount of insurance they purchased (and hence the subsequent compensation in the event of a loss) would simply reflect differences in individually optimal decisions, as exist in other markets such as the market for apples.

However serious automobile accidents are low probability events (fatal and non-fatal accident injury rates were only about 12 per thousand population in the United States in 1975) and because of this people may be unaware of or underestimate their risk. Alternatively, information in the insurance market may be so costly that the insurance decisions individuals make fall unacceptably wide of the decisions they would make in the absence of such costly information.

Stated otherwise, the frequently alleged overcompensation of small losses and undercompensation of large losses attributed to the fault system may reflect private insurance decisions made in the face of costly information by individuals who systematically underestimate the risk of serious accidents. Implicit in the objection to the fault system, then, is a perception of "market failure" in the markets for first-party medical, life, accident, and disability insurance as well as automobile insurance.¹ Certainly, the quality of other products is regulated in the alleged belief that consumers haven't the proper incentives or available information to make appropriate choices.

Economists as well as legislators have expressed concern for consumer ignorance in the purchase of automobile insurance. In attempting to explain why the low-cost producers in the insurance industry, direct writers, have not swept the market, Joskow maintains that information is particularly costly in the market for automobile insurance:

. . . Undoubtedly there is no other product for which consumer ignorance is so prevalent. . . . Comparative price shopping is very difficult since price differences for comparable coverages are not readily available in printed form and because it is difficult to obtain information from friends and neighbors. I can get good information on price differences and price levels for all kinds of products from the fellow in the next office if he has purchased these products and/or shopped around for them. Asking him about his insurance is of little value since he is in a different risk class, lives in a different community, and drives a different kind of car. . . . In the presence of such large information problems it is not surprising that it has taken so long for the direct writers charging lower rates to capture a sizable portion of the property insurance market. . . . (Joskow, pp. 404-5, my emphasis added.)

In this paper I investigate the extent to which there seems to be systematic ignorance or misinformation in the market for insurance against automobile accident injury losses. I find no evidence to support the hypothesis of pervasive consumer ignorance in the purchase of insurance.

II. An Empirical Analysis of Individual Insurance Decisions

Given perfect information, risk-neutral insurers, and proportional loading in insurance prices, all risk-averse individuals would fully insure above some nontrivial deductible amount.² Observed differences in insurance among individuals then would reflect differences in the full price of insurance among these individuals. One can imagine many differences in full price that would lead individuals to purchase different quantities of market insurance. Here I focus on one subset: differences in the cost of acquiring and processing information instrumental to making appropriate insurance decisions. I subsume into this set of costs those characteristics which may render one less able to use the legal system to advantage. Because I have no direct measure of information costs, I rely on personal characteristics such as race, family income, sex, education, and labor force status as proxy variables for cost of information, or, alternatively, for differences in "full price" of market insurance.

I analyze a sample of 399 non-fatally injured victims of serious automobile accidents. They are chosen from the larger Department of Transportation Serious Injury Survey (1970) according to the following two criteria: 1) all dollar values of economic loss are reported by the individuals themselves and not imputed to them by the original survey analysts; 2) the race, sex, age, education, and family income of each individual is either reported or can be inferred from the data. The original Department of Transportation sample includes individuals who lost at least three weeks from work or, if not working, six or more weeks from normal activities, or incurred \$500 in medical expenses, or two weeks of hospitalization.

In Table 1 I regress total non-tort compensation on five exhaustive categories of loss-to-date and expected future loss as a consequence of the accident. Sixty percent of the variation in non-tort compensation received by these individuals is explained by the variation of these measures of economic loss. This is in itself, I think, an interesting statistic. It suggests that on average dollar compensation bears a strong relationship to dollar loss. In unreported regressions I also included a measure of the victim's negligence in the equation. Negligence reduces dollar compensation on average and for certain categories of loss, but increases it for other categories. I haven't sufficient confidence in the measure of negligence to try to trace out its overall effect on compensation.

In Table 1 I also report results for a regression of tort recovery on accident losses. Comparing coefficients in the two regressions reveals that the losses most heavily compensated in tort suits are medical expenses to date and expected future losses. These are presumably both highly correlated with non-economic loss--"pain and suffering"--a real but unreported loss category.

TABLE 1

RELATIONSHIP BETWEEN COMPENSATION AND LOSS--RESPONDING SAMPLE

N = 399

| Dependent Variable | Nontort Compensation (1) | Tort Compensation (2) | Total Compensation (3) |
|---------------------------|-----------------------------|--------------------------|---------------------------|
| <u>Loss to Date:</u> | | | |
| Medical | 1.16 (7.39) | .64 (3.03) | 1.80 (5.84) |
| Wage | .57 (4.74) | -.01 (-.05) | .56 (2.39) |
| Other | -.58 (-.52) | -.53 (-.36) | -1.11 (-.51) |
| <u>Future Loss:</u> | | | |
| Medical & Other | .06 (.10) | 2.10 (2.65) | 2.17 (1.86) |
| Wage | -.06 (-2.74) | .08 (2.63) | .02 (.39) |
| <u>(Loss to Date)**2:</u> | | | |
| Medical | -1.1 E-05 (-1.42) | -5.35E-01 (-.50) | -1.70E-05 (-1.07) |
| Wage | -2.44E-05 (-3.37) | 7.04 E-06 (.73) | -1.74E-05 (-1.23) |
| Other | -3.58E-04 (-.59) | 1.42E-03 (1.76) | 1.06E-03 (.90) |
| <u>(Future Loss)**2:</u> | | | |
| Medical & Other | -6.80E-06 (-.09) | -1.97E-04 (-1.93) | -2.54E-03 (-1.36) |
| Wage | 1.32E-06 (7.25) | -3.46E-07 (-1.42) | 9.77E-07 (2.73) |
| Constant | -377 (-1.25) | -40 (-.10) | -416 (-.71) |
| R ² | .60 | .25 | .48 |

Note: t-values in parentheses.

The proportion of variance of tort compensation explained by economic losses is lower than for non-tort compensation, as one would expect. This is true in part because the non-economic losses compensated in tort suits are unmeasured and in part because tort compensation has some aspects of a lottery.

Entering the personal characteristics of the injured individuals into the regressions does not contribute significantly to the explanation of compensation. Table 2 presents the results for regressions of compensation on loss when the individual's personal characteristics are entered in addition to the loss variables. The results suggest that married men and more educated individuals receive somewhat greater compensation from first-party sources; however, none of the personal characteristics--age, race, sex, income, education, marital status, or employment status--has an individually statistically significant effect on tort recovery or on total compensation. The joint F-statistics for the inclusion of the set of variables is insignificant in all regressions.

These results contravene the contention that individuals systematically misestimate the risks they face from automobile accident injuries: those who would be expected to be better forecasters, such as the more educated and higher income, do not make significantly different insurance decisions. Further these results contravene the contention that the fault system discriminates against "high-risk" individuals--the young, poor, nonwhite, unemployed, or low income--arbitrarily throwing them into the nonstandard market where they face higher prices for comparable coverage. Were this true, these high-risk individuals would purchase lower coverage (the law of demand) and receive lower compensation for a given loss. The empirical results reveal no difference among groups in the relationship of compensation to loss.

TABLE 2

RELATIONSHIP BETWEEN COMPENSATION, LOSS, AND PERSONAL CHARACTERISTICS--
RESPONDING SAMPLE

N = 399

| Dependent Variable | Nontort Compensation (1) | Tort Compensation (2) | Total Compensation (3) |
|---------------------------------------|-----------------------------|--------------------------|---------------------------|
| <u>Loss to Date:</u> | | | |
| Medical | 1.13 (7.06) | .61 (2.81) | 1.74 (5.51) |
| Wage | .58 (4.13) | .01 (.07) | .59 (2.14) |
| Other | -1.15 (-1.00) | -1.23 (-.78) | -2.38 (-1.04) |
| <u>Future Loss:</u> | | | |
| Medical & Other | .10 (.16) | 2.20 (2.71) | 2.30 (1.95) |
| Wage | -.06 (2.47) | .09 (2.77) | .03 (.65) |
| <u>(Loss to Date)**2:</u> | | | |
| Medical | -9.45E-06 (-1.17) | -4.94E-06 (-.45) | -1.44E-05 (-.90) |
| Wage | -2.51E-05 (-3.22) | 6.22E-06 (.59) | -1.89E-05 (-1.23) |
| Other | -1.68E-04 (-.28) | 1.63E-03 (1.97) | 1.47E-03 (1.22) |
| <u>(Future Loss)**2:</u> | | | |
| Wage | 1.28E-06 (6.97) | -3.87E-07 (-1.56) | 8.84E-07 (2.46) |
| Other | -1.51E-05 (-.20) | -2.11E-04 (-2.02) | -2.27E-04 (-1.49) |
| <u>Personal Characteristics:</u> | | | |
| Age (years) | -5.10 (-.09) | -21.3 (-.28) | -26.4 (-.24) |
| Age**2 | .07 (.11) | .19 (.23) | .26 (.21) |
| Race (1=white) | -447 (-.66) | -333 (-.37) | -781 (-.59) |
| Sex (1=female) | 38.42 (.07) | 25.2 (.03) | 63.6 (.06) |
| Education (yrs. Completed) | 108 (1.88) | 71.6 (.92) | 180 (1.58) |
| Family Income (\$000) | 8.04 (.25) | 56.8 (1.30) | 64.9 (1.02) |
| Marital Status (1=M.S.P.) | 888 (1.79) | 414 (.61) | 1302 (1.32) |
| Employment Status (1=in labor force†) | 655 (1.35) | 366 (.56) | 1022 (1.07) |
| Sex x Race | -1333 (-1.17) | 490 (.32) | -844 (-.38) |
| Marital Status x Sex | -728 (-.99) | -51.0 (-.05) | -779 (-.54) |
| Constant | -1254 (-1.30) | -718 (-.55) | -1973 (-1.04) |
| R ² | .61 | .26 | .49 |

†At time of accident.

However, while the regressions indicate that on average personal characteristics do not affect the relationship between compensation and loss, it may be that the variability or "closeness" of that relationship is affected by personal characteristics. The fault system may hold more aspects of a lottery for those to whom information is more costly than for those to whom it is less costly.

To investigate this, I regress the absolute value of the predicted error from each of the regressions in Table 2 on the set of individual personal characteristics and the measures of realized loss. These results are reported in Table 3. The only clear pattern to emerge in any of the regressions is that the relationship of compensation to loss is more variable for individuals who incur large medical expenses and wage loss to date and/or who expect greater future income loss.³ This may reflect measurement error in part: large reported losses may be partly the result of exaggerated reporting. It may also reflect that extreme values of both medical and current and future earnings loss are associated with high values for general damages, an unreported but real category of loss for which victims are compensated. And it may reflect that those with greater losses experience greater true variability in the relationship between compensation and loss.

However, in none of the regressions is the variability significantly related to the personal characteristics of the injured. The variability is unrelated, then, to characteristics that economists associate with costs of information and others may associate with ability to "use the system" to advantage. If the tort system is "inequitable," and I find no evidence of that here, its inequities are unrelated to age, race, sex, education, income, employment, or marital status.

TABLE 3

VARIABILITY OF RELATIONSHIP BETWEEN COMPENSATION, LOSS AND
PERSONAL CHARACTERISTICS--RESPONDING SAMPLE

N = 399

| Dependent Variable | Absolute Value of Predicted Error from Table 2 | | |
|----------------------------------|--|--------------------------|---------------------------|
| | Nontort Compensation (1) | Tort Compensation (2) | Total Compensation (3) |
| <u>Loss to Date:</u> | | | |
| Medical | .38 (9.07) | .66 (12.44) | .72 (8.31) |
| Wage | .16 (3.76) | .05 (.96) | .17 (1.92) |
| Other | -.03 (-.08) | -.82 (-1.59) | -.65 (-.77) |
| <u>Future Loss:</u> | | | |
| Medical & Other | -.16 (1.00) | .17 (.85) | .10 (.30) |
| Wage | .04 (4.75) | .05 (4.83) | .09 (5.39) |
| <u>Personal Characteristics:</u> | | | |
| Age | -4.60 (-.12) | -13.73 (-.28) | 19.12 (.24) |
| Age**2 | .11 (.26) | .10 (.18) | -.24 (-.27) |
| Race | -115.4 (-.25) | -343.5 (-.59) | -332.1 (-.35) |
| Sex | -120.1 (-.32) | -347.0 (-.73) | -450.5 (-.58) |
| Education | -18.20 (-.47) | 87.18 (1.76) | 93.6 (1.16) |
| Family Income | 25.26 (1.17) | .36 (.01) | -20.92 (-.47) |
| Marital Status | 92.13 (.28) | 424.2 (.99) | 496.3 (.72) |
| Employment Status | 151.57 (.49) | 269.2 (.67) | 603.5 (.93) |
| Sex x Race | 645.0 (.84) | -163.6 (-.17) | 667.3 (.42) |
| Marital Status x Sex | -110.2 (-.22) | 249.5 (.40) | -264.2 (-.26) |
| Constant | 266.4 (.42) | -23.15 (-.03) | -217.6 (-.16) |
| R ² | .41 | .44 | .36 |

Footnotes

¹Compensation for losses suffered in automobile accidents does not derive exclusively from automobile insurance. Individuals purchase first-party accident and disability insurance in other forms. In a 1970 insurance industry study of serious accidents 32.5% of reimbursement came from insurance and government sources other than automobile insurance.

²Arrow, Kenneth J., Essays in the Theory of Risk Bearing (Chicago, 1971).

³I attempted to correct the estimates in Tables 1 and 2 for heteroscedasticity using the technique suggested by Glesjer (see Johnston, 1972), but I was unable to eliminate heteroscedasticity in the errors using simple functional forms.

References

Arrow, Kenneth J. Essays in the Theory of Risk Bearing (Chicago, 1971).

Johnston, J. Econometric Methods (New York, 1972).

U. S. Department of Transportation, Economic Consequences of Accidents (1970).

INSURANCE, LIABILITY AND ACCIDENTS: A THEORETICAL
AND EMPIRICAL INVESTIGATION OF THE EFFECT
OF NO-FAULT ON ACCIDENTS

by

Elisabeth M. Landes

Center for the Study of the Economy and the State
University of Chicago

Revised
September 1980

INSURANCE, LIABILITY AND ACCIDENTS: A THEORETICAL
AND EMPIRICAL INVESTIGATION OF THE EFFECT
OF NO-FAULT ON ACCIDENTS

Sixteen states enacted "no-fault" automobile insurance laws between 1971 and 1976, electing to remove or restrict liability for motor vehicle accident injuries and substitute in its place compulsory first-party insurance.¹ Economists and economic analysts of the law have shown that removing or restricting liability for damages to others permits potential injurers to shift some of the costs of their activity onto potential victims and may result in higher losses from accidents. The principal argument advanced by advocates of "no-fault" is that savings in administrative costs will outweigh increased losses, if any, from accidents.

This paper investigates the effect on accidents of removing liability for motor vehicle accident injuries. In the first part of the paper I show that compulsory insurance can serve as a substitute for a liability rule, so that no increase in accident losses will occur from restricting liability. This conclusion rests on the assumption that the insurance industry acts as a single competitive firm, either through extensive reinsurance or other cooperative behavior, and thereby induces individuals to internalize all costs of their driving behavior even though they are not legally liable for damage to others. However, if some losses are recoverable only if tort suits are permitted--e.g., intangible losses such as "pain and suffering"--then this result no longer holds. Even with compulsory insurance provided by a single competitive firm, restricting liability will result in increased accident losses.

The second part of the paper investigates accident losses by state, comparing states that have and have not restricted liability for motor vehicle accident injuries. Here I find that states with tort restrictions have experienced significantly increased fatal accident rates relative to other states. I estimate that states which place relatively moderate restrictions on tort suits have had between two and five percent more fatal accidents as a result of adopting "no-fault" while states with more restrictive laws have had as many as ten to fifteen percent more fatal accidents.

I find further that the accident effects of no-fault are larger in states in which the insurance industry is less "concentrated" as measured alternatively by the four-firm concentration ratio and the share of direct writers in the voluntary market. Consistent with this result is the finding that states in which the market was initially more "concentrated" were more likely to adopt no-fault between 1971 and 1976--i.e., the smaller the (presumably) anticipated effect of no-fault on accident losses, the cheaper a no-fault law is to adopt.

I. Insurance and Liability

To see how compulsory insurance can serve as a substitute for a liability rule, consider the problem of individual choice in the absence of insurance as modeled by Diamond and others:²

Accident technology is such that an individual's accident probability is a function of his own level of care, x_i , and the level of care y_j chosen by all other drivers.

$$P_{A_i} = \sum_{j \neq i} P_{A_{ij}}(x_i, y_j)$$

where x and y can be perfectly and costlessly monitored by all participants in the activity--drivers, the courts, and in this analysis, insurance companies. Assuming that all individuals are identical and that the number of drivers is fixed permits expressing this probability as a function of own care and the average level of care taken by all other drivers.

$$P_{A_i} = P_A(x_i, y)$$

where $P_A < 1$,
 $P_{A_x}, P_{A_y} < 0$, and
 $P_{A_{xx}}, P_{A_{yy}}, P_{A_{xy}} > 0$.

In the absence of a liability rule the individual will choose a level of care to maximize his expected utility:

$$V = (1 - P_{A_i})U(c - p_x x) + P_{A_i}U(c - p_x x - L)$$

where c is income,
 L is his own potential loss from an accident, and
 p_x is the per-unit cost of care.

Assuming a linear utility function, an individual will choose a level of care x that satisfies the following relation:

$$-P_{A_x} \cdot L = p_x \quad (1)$$

Since all individuals are assumed to be identical, a no-liability equilibrium will occur for all drivers at x^0 where

$$-P_{A_x}(x^0, x^0) \cdot L = p_x \quad (2)$$

Individual investments in care and the resulting accident losses in the absence of liability present a problem exactly analogous to that of trucks traveling along an unowned road. The marginal cost of an individual's driving, like that of adding another truck to the road, is the sum of his own expected costs plus the additional costs he imposes on all other identical drivers. In the no-liability equilibrium, drivers take into account only their own expected accident losses, and ignore the expected losses of others.

The socially optimal individual equilibrium level of care, x^* , minimizes the sum of accident losses and avoidance costs for all drivers, or

$$-P_{A_x}(x^*, x^*) \cdot 2L = p_x, \quad x^* \gg x^0, \quad (3)$$

where $2L$ is the full cost of an accident.

Diamond shows that introducing a liability rule that holds a driver liable for both his own costs and those of the other driver, if his own level of care falls short of some specified due care standard and the other driver's does not, results in the following possible equilibria:

$$x = x^0 \quad \text{whenever} \quad d \leq x^0 \quad \text{or} \quad d \geq \hat{d};$$

$$x = d \quad \text{whenever} \quad x^0 < d < \hat{d},$$

where d is the standard of due care, and

\hat{d} is a level of care so stringent that all drivers will prefer to be negligent than to adopt it.

Thus while x^* is a possible equilibrium, it is achieved only by a liability rule which sets the standard of due care precisely equal to x^* . For $d < x^*$, or $d > \hat{d}$ there will be more accidents than socially optimal. For $x^* < d < \hat{d}$ the number of accidents will be smaller than the social optimum.

A. Voluntary Insurance in the Absence of Liability

For insurance to have a role in this analysis, one must abandon the assumption of risk neutrality. In the absence of a liability rule, the individual will maximize expected utility with respect to both the level of care, x , and the amount of insurance to buy, I :

$$\begin{aligned} V &= (1-P_{A_1})U(c-p_x x - p_I I) + P_{A_1}U(c-p_x x - p_I I - L + I) \\ &= (1-P_{A_1})U(Y_{NA}) + P_{A_1}U(Y_A) \end{aligned}$$

The first-order conditions for a maximum are

$$\frac{\partial V}{\partial I} = P_{A_1}U'(Y_A) - [(1-P_{A_1})U'(Y_{NA}) + P_{A_1}U'(Y_A)]p_I = 0 \quad (4)$$

$$\frac{\partial V}{\partial x} = \frac{-\partial P_{A_1}}{\partial x} [U(Y_{NA}) - U(Y_A)] - [(1-P_{A_1})U'(Y_{NA}) - P_{A_1}U'(Y_A)] \left[p_x + \frac{\partial (p_I \cdot I)}{\partial x} \right] = 0 \quad (5)$$

It is clear from inspection of these first-order conditions that if insurance is "fair," e.g., if $p_I = P_A$ then $I = L$ and $x = x^0$, so that the no-liability equilibrium is identical, as one would expect, to that derived in (1) above.

But is $P_I = P_A$ an equilibrium price for the insurance industry to charge? The answer depends both on whether insurance is compulsory or voluntary--i.e., whether it can serve the dual role of insurance and license to drive or only that of insurance--and on whether insurance firms act cooperatively or non-cooperatively.

To see this, assume an insurance industry comprised of m independent identical firms each with a share of the market $\gamma = \frac{1}{m}$. To any firm, F , the marginal cost of an additional driver, i , is $\gamma P_{A_1} \cdot \bar{I}$ if they do not insure him, $P_{A_1}(I + \gamma \bar{I})$ if they do, where γ is the insurer's share of

the market of drivers and represents the probability that any accident in which individual i is involved will involve another driver insured by F , I is the amount of insurance demanded by the individual, and \bar{I} is the mean value of purchased insurance for all drivers.

The firm's private marginal cost of providing insurance when it acts independently of all other firms in the industry, then, is only $P_{A_i} \cdot I$, since it will bear $\gamma P_{A_i} \bar{I}$ as long as the individual drives, whether or not he is insured. Therefore the competitive price of voluntary insurance cannot exceed P_{A_i} per dollar purchased, ignoring any operating costs. All drivers will purchase full insurance, $I = L$, and will choose the no-liability level of care, x^0 . The insurance industry will earn zero profits, since losses paid out per driver will just equal the premium per driver ($= P_{A_i} \cdot L$).

Is this conclusion changed if firms act cooperatively? I.e., is there a cooperative zero profit solution that would lead to fewer accidents and lower insurance premiums than the non-cooperative solution? With voluntary insurance the answer is no.

To see this, assume that the m firms agree to charge a two-part price for insurance equal to P_{A_i} per dollar of own coverage desired plus $P_{A_i} \cdot \gamma \bar{I}$, the additional expected fixed cost that individual i 's driving imposes on the firm. Assuming that insurance companies can perfectly and costlessly monitor the level of care chosen by each driver or the resulting accident probability, the first-order condition (4) still implies that if they insure at all, all drivers will insure fully ($I = L$) because the marginal price per dollar of insurance remains P_A . Condition (5) is modified to become

$$p_x + \frac{\partial (p_I \cdot I)}{\partial x} = p_x + \frac{\partial P_{A_i}}{\partial x} (1+\gamma)L = 0 \quad (6)$$

All insured drivers are induced to choose level of care $x_I(\gamma) \gg x^0$, even in the absence of legal liability.

To assure zero profits, insured drivers must receive a rebate or subsidy equal to $\gamma \bar{P}_A L$, where \bar{P}_A is the mean accident probability for the whole class and is not sensitive to any individual driver's choice of care (although it is clearly the result of the level of care chosen by all drivers).

The final full expenditure on insurance for each driver then, is

$$\begin{aligned} P_I \cdot L &= P_{A_i}(x_I(\gamma), x_I(\gamma))(1+\gamma)L - \gamma \bar{P}_A(x_I(\gamma), x_I(\gamma))L \\ &= P_{A_i}(x_I(\gamma), x_I(\gamma))L, \end{aligned}$$

which is less than in the non-cooperative solution, since

$$P_{A_i}(x_I(\gamma), x_I(\gamma)) << P_{A_i}(x^0, x^0).$$

At first glance then it seems that cooperative pricing by the firms in the insurance industry can reduce both the frequency of accidents and the final price of insurance.

Recall, however, that x^0 is the level of care that minimizes $P_{A_i} \cdot L + p_x x^0$. In a regime of voluntary insurance every driver will individually wish to remain uninsured and to face expected costs of $P_A(x^0, x_I(\gamma))L + p_x x^0 << P_{A_i}(x_I(\gamma), x_I(\gamma)) \cdot L + p_x x_I(\gamma)$. Hence the only possible equilibrium solution even when insurance firms act cooperatively is the no-liability equilibrium.

B. Compulsory Insurance in the Absence of Liability

Compulsory insurance in the absence of a liability rule transforms the road from an unowned resource to a resource held in common by the firms in the insurance industry. Common ownership of a resource will have no allocative effect if the m firms continue to act independently

of each other. Since each firm will face the cost $\gamma P_{A_i} L$ of an additional driver whether he is insured by that firm or any of the other identical firms in the industry, the private marginal cost to any firm F of offering insurance to any individual i remains $P_{A_i} \cdot L$. The non-cooperative solution in the case of compulsory insurance then is identical to that in the case of voluntary insurance.

However, with compulsory insurance, cooperative behavior by the m firms in the industry can force all drivers to take into account the cost they impose on other drivers as well as on themselves, and to drive with greater care.

Consider again the analysis of cooperative behavior in the case of voluntary insurance. The solution was constrained to be the same as the no-liability solution only because all drivers could and would choose to remain uninsured when faced with any other pricing scheme.

However, by definition, drivers cannot choose to remain uninsured in a regime of compulsory insurance. (Recall that I assume that the number of drivers is fixed.) Compulsory insurance is equivalent to compulsory licensing of drivers where the license fee $(= P_A(x_i, \gamma)(1+\gamma) \cdot L)$ forces drivers to choose level of care $x_I(\gamma)$. $1 - \gamma$ is the proportion of total driving costs that individuals do not incorporate in their care decision. The firms in the insurance industry can collectively gain through lower expected accident losses by cooperating until γ effectively equals one, where expected accident losses are minimized. ($\gamma = 1$ produces $x_I(1) = x^*$ in (3) above, or the social optimum.) Stated otherwise, if insurance firms act together so that γ effectively equals one, a no-liability rule coupled with compulsory insurance is equivalent in its effect on accident losses to an efficient liability rule, where the due care standard, d , is set to x^* .

In order to assure zero profits, firms must rebate the excess premiums to their insured. In the real world some of the excess of premiums over loss is absorbed by adjustment and administrative costs. In 1975, for example, about 38.2 percent of the direct premiums written for private passenger automobile liability insurance were absorbed by costs. (Best's Aggregates and Averages, Property-Liability, 1975) If expense loading is proportional to expected loss, individual drivers face a premium

$P_I = 1.62 P_{A_i}$ even without cooperation among firms in the industry. However, most state regulation of insurance permits (and even requires) some cooperative behavior among insurance firms, such as information pooling and cooperative rate setting. This behavior is exempt from federal antitrust sanctions under the terms of the McCarran Act.

Reinsurance is an external force which further acts to discipline and coordinate the actions of the primary insurers. Premiums charged by reinsurers are not subject to state regulation but are part of the cost base of the primary insurers, while commissions paid to the primary insurers by the reinsurers are commonly inversely related to the previously experienced loss ratio.

C. Qualifications

Section B shows that a no-liability/mandatory insurance system may be equivalent in its effects on accident losses to a liability rule. A crucial assumption for this result to hold is that all losses are insurable, so that income can be equalized in all states of the world. This assumption is not, however, an accurate description of the insurance market. Partly because of moral hazard, which was assumed away in section B, first-party insurance generally carries a coinsurance rate. Even without an explicit coinsurance rate, certain kinds of losses from accidents cannot be recovered except in a

tort suit; these are generally termed "general" or "noneconomic" damages, such as "pain and suffering."

Let the ratio of economic to total losses (= general + economic) equal k , where k is strictly less than one. Then the marginal cost to an insurance firm of offering insurance becomes

$$MC = P_A \cdot L[(1+\gamma)k + (1-\delta)P_N(1-P_N)(1+\gamma)(1-k)]$$

where $\delta = 0$ when a liability rule is in effect, so that individuals injured may file a tort suit for total damages, $\delta = 1$ under a no-liability rule, $P_N \cdot (1-P_N)$ equals the probability that the individual would be found liable in a tort suit, and γ again equals the firm's share of the market, or the probability that the accident will involve another individual insured by that firm.

$$MC = P_A \cdot L(1+\gamma)[k + P_N(1-P_N)(1-\delta)(1-k)] \quad (7)$$

As before $(1-\gamma)$ is the amount of total loss that individuals do not take into account when making their care decisions. But even for $\gamma = 1$, where insurance firms act in concert, the marginal cost of insurance, individual choice of care, and hence accident losses under a liability rule ($\delta=0$) will differ from those under a system of no-liability and mandatory insurance ($\delta=1$).

$$\frac{dMC}{d\delta} = -P_A L(1+\gamma)P_N(1-P_N)(1-k) + \left[\frac{\partial P_A}{\partial x} \frac{dx}{d\delta} + \frac{\partial P_A}{\partial y} \frac{dy}{d\delta} \right] \frac{MC}{P_A} \quad (8)$$

Limiting compensable damages to economic damages, implicit in a no-liability rule, affects the marginal cost of insurance in two ways: it increases the frequency of accidents as individuals reduce their care, thus increasing marginal cost, and reduces the amount of damages for which insurance firms would be liable, thus reducing marginal cost.

Assuming as before that $P_A = \exp(-(x+y))$ and that all individuals are identical, the second term in the RHS of (8) can be trivially derived from individual expected utility maximization. Further assuming almost neutral attitudes toward risk, evaluating (8) at $\delta = 1$ yields the following:

$$\begin{aligned} \frac{dMC}{MCd\delta} &= \frac{-P_N(1-P_N)(1-k)}{k} + \frac{\gamma P_N(1-P_N)(1-k) - \frac{\partial P_N}{\partial y}(P_N(1-\gamma) + (1-P_N)(1-\gamma k))}{(1+\gamma k)} \quad (9) \\ &= \frac{1}{k} \cdot \frac{P_N(1-P_N)(1-k) + k \frac{\partial P_N}{\partial y}(P_N(1-\gamma) + (1-P_N)(1-\gamma k))}{1 + \gamma k} \end{aligned}$$

Even at $\gamma = 1$ it is clear that $\frac{dMC}{d\delta}$ is not necessarily equal to zero when $k \ll 1$.

$$\left. \frac{dMC}{MCd\delta} \right|_{\gamma=1} = \frac{-(1-P_N)(1-k)}{k(1+k)} \left[\frac{k \partial P_N}{\partial y} + P_N \right] \quad (10)$$

At $\gamma = 1$ $\frac{dMC}{d\delta} < 0$ as $\frac{-k \partial P_N}{\partial y} < P_N$.

Let $P_N = (1-y)$ so that $\frac{\partial P_N}{\partial y} = -1$. Then

$$\frac{dMC}{MCd\delta} = \frac{-[P_N(1-P_N)(1-k) - k(P_N(1-\gamma) + (1-P_N)(1-\gamma k))]}{k(1+\gamma k)} \quad (11)$$

$$\left. \frac{dMC}{MCd\delta} \right|_{\gamma=1} = \frac{(1-P_N)(1-k)}{1+k} (k - P_N) \quad (12)$$

and $\frac{d}{d\gamma} \left[\frac{dMC}{MCd\delta} \right] = \frac{-2k - P_N^2(1-k)}{(1+\gamma k)^2} < 0 \quad (13)$

Although the proportional change in marginal cost cannot be signed, it is less positive or more negative, at higher levels of γ . This result yields two interesting implications for the adoption of no-fault automobile insurance across states. First that states in which the insurance industry

is effectively more concentrated will experience smaller increased losses from accidents; and second that those same states should be more likely to adopt no-fault automobile insurance, because of the smaller expected effect on accident costs.

I attempt to test these hypotheses in the next section with state data on fatal automobile accidents.

II. The Effect of No-Fault on Accident Losses:

An Empirical Investigation

Sixteen states enacted no-fault automobile insurance laws between 1971 and 1976. The no-fault plans adopted by these states exhibit two key features: restriction of tort-liability for personal injury damages arising from automobile accidents and compulsory first-party personal injury protection (PIP) insurance.⁴ Both the degree of restriction placed on tort liability and the level of PIP benefits individuals are compelled to purchase vary among states.⁵ For example, in Massachusetts the right to bring a tort suit for damages suffered in an automobile accident is abolished except where the medical expenses involved exceed \$500 or where the accident results in "serious injury"; at the same time Massachusetts PIP benefits have a modest \$2,000 maximum. At a different point in the spectrum, the law in Michigan prohibits tort suits except where an accident causes the victim death, serious impairment of bodily function, or serious disfigurement, or where the accident was the result of intentional harm or where damages exceed the prescribed limits for economic loss. These limits are 85% of lost earnings up to \$1,250 per month for up to three years, or, in the case of death, 100% of this loss. No limit exists on medical-hospital benefits or rehabilitation expenses under the Michigan plan.

These states provide a natural data base for examining the effect of restricting liability on accident losses, and for examining the interaction between that effect and industry structure.

In this section I investigate the effect of restricting tort liability on a single measure of accident losses: fatal accidents. Fatal accidents are chosen as a direct measure of accidents rather than the alternative statistic, injury accidents, because reporting of the latter is likely to be sensitive to differences across states and over time in insurance requirements, which makes them unsuitable for this investigation.⁶

The set of variables used to describe state automobile insurance systems is listed and defined in Table 1. The variables THRESH and RTHRESH are measures of state medical expense tort thresholds. If an accident results in an injury to an individual requiring medical expenses which exceed the value of THRESH, then the injured may bring a tort suit to recover noneconomic damages. The dollar value of THRESH varies from \$200 in New Jersey to \$2,000 in Minnesota. Because the price of medical and hospital services varies across states, the same dollar value may reflect different real levels of stringency. To construct RTHRESH, I deflate THRESH for each state by an index of medical care prices in that state, taken from Feldman (1976). A third measure of the stringency of state tort thresholds, PCL, is the proportion of insurance claims in a 1979 industry-wide survey in which the injured was barred from tort recovery by the state's tort threshold. Table 2 presents the value of these variables for each of the sixteen no-fault states.

Tables 3.1-3.3 present results of regressions of fatal accident rates across states for the years 1967-1975. The independent variables include those listed in Table 1, state population and population density. In the equation employing THRESH or RTHRESH as the measure of stringency, a dummy

TABLE 1

VARIABLES DESCRIBING STATE AUTOMOBILE INSURANCE SYSTEMS

| Variable | Description |
|----------|--|
| D2 | Dummy variable equal to 1 in any year in which a state has a true no-fault plan in effect, zero otherwise. |
| D1 | Dummy variable equal to 1 in the first full year in which a no-fault plan is in effect, zero otherwise. |
| THRESH | Dollar medical expense threshold. (See text.) |
| RTHRESH | Real value of medical expense threshold = THRESH deflated by a medical price index. [Source for price index: Feldman, 1976.] |
| PCL | The proportion of insurance claims barred from tort recovery by a state's tort threshold. [Source: AIRAC, 1979.] |
| V | Dummy variable equal to 1 if Michigan and no-fault law in effect, zero otherwise. |

TABLE 2

MEASURES OF RESTRICTIVENESS OF NO-FAULT LAW, BY STATE

| STATE | THRESH (\$) | RTHRESH ^a | PCL ^b |
|---------------|----------------|----------------------|------------------|
| New Jersey | 200 | 4.08 | .2620 |
| Connecticut | 400 | 7.63 | .3347 |
| Kansas | 500 | 7.79 | .3289 |
| Massachusetts | 500 | 8.14 | .2499 |
| Colorado | 500 | 11.54 | .3003 |
| Utah | 500 | 14.71 | .1795 |
| Georgia | 500 | 15.57 | .2335 |
| Nevada | 750 | 11.33 | .2430 |
| Pennsylvania | 750 | 15.54 | .3749 |
| New York | 1,000 | 15.16 | .3238 |
| Florida | 1,000 | 24.40 | .2512 |
| Kentucky | 1,000 | 28.94 | .3549 |
| North Dakota | 1,000 | 46.35 | .4293 |
| Hawaii | 1,500 | 82.37 | .5252 |
| Minnesota | 2,000 | 46.60 | .4826 |
| Michigan | - | - | .4053 |

^aNOTE: See Appendix for details of construction. Source for expenditure shares is AIRAC, Vol. I, Table 5-2. Source for prices is Feldman (1976), Table 14, p. 81, Table 15, p. 83, Table 19, p. 95.

^bSOURCE: AIRAC, Vol. I, Table 8-3, p. 82 and Table 8-12, p. 96.

variable V is included to represent Michigan, since Michigan's law does not provide a dollar medical expense threshold.

In addition to these variables, state and time dummy variables were included to hold constant state and time-specific effects. The state dummy variables capture the effect of other important determinants of accident rates which may vary considerably across states, such as the population age, race and sex composition. Similarly, the time dummy variables will capture the effect on driving, and therefore on accidents, of the dramatic changes in the price of gasoline between 1967 and 1977.

The regressions are estimated both for the full sample of 51 "states" (including the District of Columbia as a "state") and for the sample of 15 states which had enacted no-fault laws by 1975. (North Dakota's no-fault law was enacted in 1976.) Fatal accidents, population, THRESH and RTHRESH are all expressed in natural logs in the regressions. Joint F statistics for the legal variables are reported at the bottom of the table.

The effect of restricting tort liability for motor vehicle accident injuries on fatal accidents is measured by the coefficient on D2 plus the interaction effect with the tort-threshold stringency measure. The effect is non-negative in all ranges of the data for all regressions and is increasingly positive with increasing stringency levels. Table 4 presents the estimated effect of no-fault on fatal accidents as a function of tort threshold stringency measure. Except for states with very low tort thresholds, no-fault has produced both an economically and statistically significant increase in fatal accidents: a medical expense threshold of \$500 implies about a 4 percent increase in fatal accident rates; a medical expense threshold of \$1,500 implies an increase in fatal accidents of more than 10 percent!

TABLE 3.1

EFFECT OF NO-FAULT ON FATAL ACCIDENTS
 MEASURE OF STRINGENCY OF TORT THRESHOLD: THRESH

| | All States 1967-1975 | States Which Passed Laws Between 1967 & 1975, 1967-1975 |
|---------------------------------------|-------------------------|---|
| Sample: Number of States/Years | 51/9 (1) | 15/9 (2) |
| Ln (Population) | -.013 (-.29) | .443 (2.82) |
| Population Density | .295 (5.18) | .940 (1.12) |
| D1 | -.048 (-1.53) | -.053 (-2.07) |
| D2 | -.334 (-1.52) | -.325 (-1.81) |
| Ln (THRESH) | .059 (1.69) | .060 (2.15) |
| V | .299 (1.29) | .337 (1.84) |
| S.E.E. | .00674 | .00330 |
| Turning Point | \$287 | \$220 |
| Joint F Statistic, Legal Variables | 1.42 | 1.97 |

TABLE 3.2

EFFECT OF NO-FAULT ON FATAL ACCIDENTS
 MEASURE OF STRINGENCY OF TORT THRESHOLD: RTHRESH

| | All States 1967-1975 | States Which Passed Laws Between 1967 & 1975, 1967-1975 |
|---------------------------------------|-------------------------|---|
| Sample: Number of States/Years | 51/9 (1) | 15/9 (2) |
| Ln (Population) | -.014 (-.30) | .411 (2.59) |
| Population Density | .296 (5.19) | .821 (1.00) |
| D1 | -.052 (-1.64) | -.063 (-2.27) |
| D2 | -.079 (-1.18) | -.064 (-1.17) |
| Ln (RTHRESH) | .049 (1.83) | .053 (2.46) |
| V | .046 (.48) | .085 (1.18) |
| S.E.E. | .00673 | .00327 |
| Turning Point | 5.02 | 3.33 |
| Joint F Statistic, Legal Variables | 1.54 | 2.28* |

*Significant at a .10 level.

TABLE 3.3

EFFECT OF NO-FAULT ON FATAL ACCIDENTS
 MEASURE OF STRINGENCY OF TORT THRESHOLD: PCL

| | All States 1967-1975 | States Which Passed Laws Between 1967 & 1975, 1967-1975 |
|---------------------------------------|-------------------------|---|
| Sample: Number of States/Years | 51/9 (1) | 15/9 (2) |
| Ln (Population) | -.008 (-.18) | .656 (4.40) |
| Population Density | .292 (5.10) | .617 (.76) |
| D1 | -.035 (-1.09) | -.055 (-2.10) |
| D2 | .039 (.52) | .056 (-1.04) |
| PCL | .021 (.09) | (.374) (2.18) |
| S.E.E. | .00068 | .00330 |
| Turning Point | - | .15 |
| Joint F Statistic, Legal Variables | .50 | 2.36* |

*Significant at a .10 level.

TABLE 4

ESTIMATED EFFECT ON FATAL ACCIDENTS OF LIMITING TORT LIABILITY FOR MOTOR
VEHICLE ACCIDENT INJURIES BY LEVEL OF TORT THRESHOLD STRINGENCY

MEASURE OF TORT THRESHOLD:

| THRESH | | | | | RTHRESH | | | | | PCL | | | | |
|--------|------------------------|------------------|-----------------|-------|------------------------|------------------|-----------------|---------|------------------------|------------------|-----------------|-------|------------------------|------------------|
| Level | Number of States | Estimated Effect | | Level | Number of States | Estimated Effect | | Level | Number of States | Estimated Effect | | Level | Number of States | Estimated Effect |
| | | N = 51/9 % | N = 15/9 % | | | N = 51/9 % | N = 15/9 % | | | N = 51/9 % | N = 15/9 % | | | |
| 200 | 1 | -2.11 (-.50) | -.59 (-.15) | < 5 | 1 | -.02 (0.00) | 2.18 (.64) | .15-.25 | 4 | 2.71 (.84) | 1.82 (.53) | | | |
| 400 | 1 | 1.98 (.71) | 3.66 (1.09) | 5-10 | 3 | 1.99 (.72) | 4.42 (1.32) | .25-.35 | 5 | 2.93 (1.11) | 5.67 (1.65) | | | |
| 500 | 5 | 3.33 (1.25) | 5.06 (1.50) | 10-15 | 3 | 4.56 (1.67) | 7.29 (2.03) | .35-.45 | 3 | 3.16 (.85) | 9.67 (2.24) | | | |
| 750 | 2 | 5.83 (1.93) | 7.66 (2.05) | 15-20 | 3 | 6.30 (2.03) | 9.23 (2.34) | .45-.55 | 3 | 3.39 (.60) | 13.82 (2.42) | | | |
| 1000 | 3 | 7.65 (2.09) | 9.55 (2.28) | 20-25 | 2 | 2.03 (2.16) | 11.33 (2.54) | | | | | | | |
| 1500 | 1 | 10.26 (2.13) | 12.26 (2.44) | 47 | 1 | 11.56 (2.24) | 15.12 (2.70) | | | | | | | |
| 2000 | 1 | 12.15 (2.10) | 14.21 (2.49) | 82 | 1 | 14.63 (2.20) | 18.59 (2.74) | | | | | | | |

NOTE: Numbers in parentheses are t-values.

The stringency of a tax threshold and its consequent effect on accident losses depends on the proportion of accidents for which tort recovery is barred by the threshold. Clearly, if automobile accidents resulting in medical expenses of less than \$500 never gave rise to a tort suit in the absence of a threshold, then a \$500 tort threshold does not effectively change liability. The stringency of a tort threshold, then, depends upon the underlying litigiousness of the population.

A 1970 study undertaken by the Federal Judicial Center for the U.S. Department of Transportation concludes that litigiousness--the propensity to file a lawsuit in the event of an accident--is strongly correlated with population density. Table 5 reports results for regressions in which the tort threshold variables are interacted with population density. The results indicate that indeed the effect on accidents of a tort threshold is significantly higher at higher levels of population density. Further, with the exception of one specification, the inclusion of the interaction term increases the statistical significance of the other legal variables, and the expanded set of legal variables becomes jointly significant at the .10 level in the 51-state sample and at the .01 level in the 15-state sample.

III. The Interaction between Market Structure, No-Fault, and Fatal Accident Rates

The discussion in section I concludes that the effect on accidents of restricting tort liability for motor vehicle accident injuries should be smaller in states in which the insurance industry is more concentrated. In this section I employ two different measures of market concentration. The first is the four-firm concentration ratio, which I have for the years 1967-1977, and the second is the share of direct writers in direct premiums written in the voluntary market, which I have for 1967-1978.⁷ My conjecture

TABLE 5
INTERACTIVE EFFECT OF TORT THRESHOLD AND POPULATION "LITIGIOUSNESS" (POPULATION DENSITY)

| Measure of Stringency (STRING): | Ln (THRESH) | | Ln (PTHRESH) | | PCL | |
|---------------------------------------|------------------|------------------|------------------|------------------|-----------------|------------------|
| | 51/9 (1) | 15/9 (2) | 51/9 (3) | 15/9 (4) | 51/9 (5) | 15/9 (6) |
| Sample: Number of States/Years: | | | | | | |
| <u>Variables</u> | | | | | | |
| D1 | -.041 (-1.29) | -.045 (-1.81) | -.045 (-1.42) | -.056 (-2.17) | -.032 (-.98) | -.048 (-1.80) |
| D2 | -.041 (-1.29) | -.045 (-1.81) | -.045 (-1.42) | -.056 (-2.17) | -.032 (-.98) | -.048 (-1.80) |
| STRING | -.689 (-2.38) | -.660 (-3.19) | -.201 (-2.26) | -.187 (-2.92) | .014 (.19) | -.078 (-1.37) |
| STRING * POPDEN | .107 (2.47) | .102 (3.30) | .076 (2.56) | .072 (3.31) | .017 (.07) | .351 (2.04) |
| V | .024 (1.87) | .035 (2.81) | .080 (2.08) | .122 (3.33) | .096 (.45) | .275 (1.27) |
| | .649 (2.18) | .660 (3.11) | .163 (1.47) | .197 (2.57) | ... | ... |
| Joint F-Statistic, Legal Variables | 1.85* | 3.34** | 2.12* | 4.35** | .43 | 2.22* |

*Significant at a .10 level.

**Significant at a .01 level.

here is that direct writers are more concentrated within states than national compnaies, which sell through independent brokers. (This conjecture is confirmed by the simple correlation between the share of direct writers and the four-firm concentration ratio for the 11 years in which I have data for both: .79.) In Table 6 I regress fatal accidents (in logs) for the sample of states which enacted no-fault between 1971 and 1975 on population (in logs), population density, D1, D2, the measure of concentration, and the interaction between D2 and concentration.

In both equations the positive effect of no-fault on fatal accidents is attenuated at higher levels of "concentration." The coefficient on the interaction terms are negative both for the four-firm concentration ratio in column (1) and for the share of direct writers in column (2).

The discussion in section I also concludes that because the anticipated effect on accidents will be smaller for states in which the insurance industry is more concentrated, those states will be more likely to adopt no-fault. In Table 7 I regress D2, the dummy variable for restricted tort liability, on the concentration measures employed in Table 6. The dependent variables are all three-year averages of their two-, three-, and four-year lagged values.

The four-firm concentration ratio has no apparent effect on the probability of adopting no-fault in column (1), although from column (3) it appears that among the 16 states that adopted no-fault between 1971 and 1976, those in which the four-firm concentration ratio was higher adopted it earlier. The effect of the share of direct writers is significantly positive in both columns (2) and (4). A one-percent increase in the share of direct writers increased the likelihood of adopting no-fault by 2.4 percent between 1971 and 1976.

TABLE 6

THE EFFECT OF MARKET STRUCTURE ON FATAL ACCIDENTS
DEPENDENT VARIABLE: \ln (FATAL ACCIDENTS)

| Sample: Number of States/Years | 15/9 (1) | 15/9 (2) |
|-----------------------------------|------------------|------------------|
| \ln (Population | .640 (3.72) | .811 (4.88) |
| Population Density | .306 (.34) | -.679 (-.74) |
| D1 | -.038 (-1.52) | -.026 (-1.00) |
| D2 | .130 (1.45) | .175 (2.45) |
| 4-Firm CR | .002 (.59) | |
| D2 * 4-Firm CR | -.002 (-1.07) | |
| Share Direct Writers | | -.127 (-.37) |
| D2 * Share Direct Writers | | -.302 (-2.54) |
| S.E.E. | .0034 | .0032 |

TABLE 7

THE EFFECT OF CONCENTRATION ON THE ADOPTION OF NO-FAULT

DEPENDENT VARIABLE: D2 = 1 IF NO-FAULT LAW IN EFFECT
FOR STATE IN THAT YEAR,

= 0 OTHERWISE

| Sample: Number of States/Years | 51/5 (1) | 51/5 (2) | 15/5 (3) | 15/5 (4) |
|-----------------------------------|---------------|----------------|------------------|-----------------|
| Ln (Population) | .99 (1.25) | .34 (.72) | -.55 (-.40) | -.84 (-.60) |
| Population Density | .19 (.60) | .44 (1.21) | 10.63 (-1.76) | -6.32 (-.94) |
| 4-Firm CR | .17 (.19) | | 5.53 (2.15) | |
| Share Direct Writers | | 3.15 (2.91) | | 5.58 (2.36) |
| S.E.E. | .063 | .061 | .075 | .075 |

Finally, the adoption of no-fault should encourage increased concentration and cooperative action among firms in the insurance industry as a means of internalizing the externalities created by restricting tort liability for motor vehicle accident injuries. This implication seems at first glance to be rejected by the data.

In Tables 8.1-8.2 I regress the four-firm concentration ratio and the shares of national companies, state leaders, direct writers, and the non-standard market, respectively, on population (in logs), population density, D1 and D2. No-fault seems to reduce both the four-firm concentration ratio (Table 8.1) and the share of direct writers (Table 8.2), at least up until 1977, while it increases the share of national companies and perhaps state leaders. The economic magnitude of the coefficients is not large in percentage terms; however the 1.8 percent reduction in the share of direct writers (Table 8.2, column 3) represents a redistribution of about \$66 million dollars per year in direct premiums earned from direct writers to national companies and state leaders.

By the time a no-fault law is at least three years old (panel B), the effect on both the four-firm concentration ratio and the share of direct writers disappears. However, none of the regressions in Tables 8.1 and 8.2 reveals the increase in concentration predicted to accompany the adoption of no-fault.

IV. Summary and Conclusions

The hypotheses developed in section I of this paper receive substantial support from the data in sections II and III. Restricting tort liability for motor vehicle accident injuries substantially increases accident losses, at least as evidenced by comparing the fatal accidents of states which have and have not adopted no-fault, and the pre- and post-no-fault accident rates of

TABLE 8.1

THE EFFECT OF NO-FAULT ON THE FOUR-FIRM CONCENTRATION RATIO

A: Law Currently in Effect

| Sample: Number of States/Years | 51/11 (1) | 15/11 (2) |
|--------------------------------|------------------|------------------|
| D1 | .008 (1.07) | .009 (1.33) |
| D2 | -.011 (-1.85) | -.017 (-1.65) |

B: Law in Effect at Least:1) 2 Years

| Sample: Number of States/Years | 51/9 (1) | 15/9 (2) |
|--------------------------------|-----------------|-----------------|
| D2 | -.003 (-.52) | -.008 (-.91) |

2) 3 Years

| Sample: Number of States/Years | 51/8 (1) | 15/8 (2) |
|--------------------------------|-----------------|-----------------|
| D2 | -.002 (-.40) | -.007 (-.91) |

TABLE 8.2
THE EFFECT OF NO-FAULT ON MARKET STRUCTURE

| | Share | | | | Share | | | |
|---------------------------|-----------------------|------------------|-------------------|------------------|-----------------------|------------------|-------------------|------------------|
| | National Companies | State Leaders | Direct Writers | Non- Standard | National Companies | State Leaders | Direct Writers | Non- Standard |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| A. Current Law | | | | | | | | |
| D1 | -.022 (-4.05) | .007 (1.19) | .015 (2.14) | .011 (2.35) | -.020 (-3.36) | .006 (.88) | .015 (2.45) | .003 (.60) |
| D2 | .021 (4.73) | -.003 (-.66) | -.018 (-3.15) | .003 (.66) | .023 (2.51) | .011 (1.09) | -.034 (-3.67) | .018 (2.44) |
| Number of States/Years | | | 51/12 | | | | 15/12 | |
| B. Law in Effect | | | | | | | | |
| 1) At Least 2 Years | | | | | | | | |
| D2 | .013 (3.32) | .000 (.05) | -.013 (-2.54) | -.002 (-.56) | .015 (2.15) | .002 (.29) | -.018 (-2.39) | -.005 (-.88) |
| Number of States/Years | | | 51/10 | | | | 15/10 | |
| 2) At Least 3 Years | | | | | | | | |
| D2 | .015 (3.30) | -.007 (-1.23) | -.008 (-1.23) | -.008 (-1.90) | .019 (2.68) | -.017 (-2.08) | -.002 (-.32) | -.013 (-2.10) |
| Number of States/Years | | | 51/9 | | | | 15/9 | |

those states which did adopt it between 1971 and 1975. Further the less cooperative or concentrated the insurance industry in a state, the greater the effect of no-fault on fatal accidents and, consistent with this result, the less likely a state was to adopt no-fault.

However a puzzle emerges in the empirical results as well. The theory developed in section I predicts an increase in cooperative action among insurance firms and concentration of the insurance industry to follow no-fault, yet the data do not reveal this pattern. Concentration, as measured alternatively by the four-firm concentration ratio and the share of direct writers, seems to fall, at least temporarily, subsequent to the adoption of no-fault.

I have not addressed the question of what effect, if any, the adoption of no-fault has had on the distribution of income within the insurance industry. This omission arises not from lack of interest, but because I have tried to focus here on the effect of alternative liability rules on accident losses. Certainly if one wants to explain why no-fault was adopted in some states and not others, this question must be addressed and I hope to do so in a later paper.

FOOTNOTES

¹Massachusetts was the first in 1971. Then came Florida (1972), Connecticut (1973), New Jersey (1973), Hawaii (1973), Michigan (1973), Utah (1974), Kansas (1974), New York (1974), Colorado (1974), Nevada (1974), Pennsylvania (1974), Minnesota (1975), Kentucky (1975), Georgia (1975), North Dakota (1976).

²See for example Peter Diamond (1974) and John Brown (1973).

³Like Diamond, I ignore the question of the activity level. It is intuitively clear, however, that the level of activity in a no-liability equilibrium will be greater than socially optimal.

⁴Details of each state's no-fault law are briefly described in an appendix.

⁵Eight other states have introduced compulsory or voluntary "add-on" no-fault benefits in the form of personal injury protection insurance. The laws in these states are not true no-fault laws, however, because they do not restrict tort-liability.

⁶I follow Sam Peltzman's advice in this choice. The variability in reported injury accident rates within states is very large. For example, reported injury accidents in Connecticut increased about 75% between 1971 and 1972, while at the same time fatal accident rates increased less than 1%. For the same period, the number of reported injury accidents almost doubled in Louisiana, while fatal accidents fell in number. In Massachusetts, reported injury accidents fell about 30% between 1971 and 1972, while fatal accident rates rose 1%.

⁷These data were provided by A. M. Best's Executive Data Service.

APPENDIX

TABLE 1

| State | Effective Date of Law | Medical Threshold Limitation | Maximum, All Benefits Combined | Maximum Benefits Specified for | | | |
|---------------|-----------------------|------------------------------|--------------------------------|--------------------------------|-----------|--------------------|---------------------|
| | | | | Medical Expense | Wage Loss | Essential Services | Survivors' Benefits |
| New Jersey | 1/1/73 | \$200 | - | unlimited | \$5,200 | \$4,380 | variable |
| Connecticut | 1/1/73 | 400 | \$5,000* | \$5,000 | 200/week | 5,000 | 200/week |
| Colorado | 4/1/74 | 500 | 62,975 | 25,000 ¹ | 6,500 | 5,410 | 1,000 |
| Georgia | 10/1/74 | 500 | 5,000 | 2,500 | 200/week | 20/day | 200/week |
| Kansas | 1/1/74 | 500 | 21,560 | 2,000 ² | 7,800 | 4,380 | 12,180 |
| Massachusetts | 1/1/71 | 500 | 2,000* | 2,000 | 2,000 | 2,000 | - |
| New York | 2/1/74** | 500 | 50,000* | 50,000 | 1,000/mo. | 25/day | 2,000 ³ |
| Utah | 1/1/74 | 500 | 14,180 | 2,000 | 7,800 | 4,380 | 3,000 |
| Nevada | 2/1/74 | 750 | 10,000* | 10,000 | 10,000 | 10,000 | 10,000 |
| Pennsylvania | 7/19/75 | 750 | - | unlimited | 15,000 | 8,125 | 5,000 |
| Florida | 1/1/72** | 1,000 | 10,000* | 10,000 | 10,000 | 10,000 | - |
| Kentucky | 7/1/75 | 1,000 | 10,000* | 10,000 | 200/week | 200/week | 200/week |
| North Dakota | 1/1/76 | 1,000 | 15,000* | 15,000 | 7,800 | 5,475 | 13,275 |
| Hawaii | 9/1/74 | 1,500 | 15,000* | 15,000 | 800/mo. | 800/mo. | 800/mo. |
| Minnesota | 1/1/75 | 2,000 | 30,000 | 20,000 | 200/week | 15/day | 200/week |
| Michigan | 10/1/73 | - | - | unlimited | 49,428 | 21,900 | 1,000/mo. |

*Aggregate limit for all benefits where the amount may be used for any combination of expenses or losses.

**On 7/5/77 Florida changed to a days-of-disability threshold and on 6/20/78 changed to a verbal threshold. New York changed to a days-of-disability threshold on 8/11/78.

¹Plus \$25,000 for rehabilitation expenses.

²Plus \$2,000 for rehabilitation expenses.

³In addition to the \$50,000 aggregate limit.

References

Automobile Injuries and Their Compensation in the United States. All-Industry Research Advisory Committee (AIRAC), 1979.

A. M. Best's Aggregates and Averages 1975 (New Jersey: Best's Executive Data Service, 1975).

Brown, John Prather. "Toward an Economic Theory of Liability," Journal of Legal Studies, Vol. II, No. 2 (1973), pp. 323-350.

Diamond, Peter A. "Single Activity Accidents," Journal of Legal Studies, Vol. III, No. 1 (1974), pp. 107-164.

Feldman, Roger. The Supply and Demand for Physicians' Hospital and Office Visits. Unpublished Ph.D. dissertation, University of Rochester, 1976.