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Frank A. Sloan; Bridget A. Reilly; Christoph Schenzler

Journal of Law and Economics, Vol. 38, No. 1. (Apr., 1995), pp. 49-77.

Stable URL:
http://links.jstor.org/sici?sici=0022-2186%28199504%2938%3A1%3C49%3AEOTLAI%3E2.0.CO%3B2-H

Journal of Law and Economics is currently published by The University of Chicago Press.

EFFECTS OF TORT LIABILITY AND INSURANCE ON HEAVY DRINKING AND DRINKING AND DRIVING*

FRANK A. SLOAN
Duke University

BRIDGET A. REILLY
Clinitrials Research Inc.

and

CHRISTOPH SCHENZLER
Vanderbilt University

ABSTRACT

Using self-reported data on patterns of alcohol use among individuals from the 1989–90 Behavioral Risk Factor Surveys, this study investigates effects of tort liability and third- and first-party insurance, alcohol prices, and criminal sanctions on frequency of binge drinking and driving under the influence of alcohol (DUI). Requiring drivers to purchase third-party insurance discouraged binge drinking, especially in states combining compulsory insurance with a surcharge for a DUI. Implementation of no-fault laws and switching from contributory to comparative negligence increased binge drinking, while higher alcohol prices reduced it. With one exception, neither tort nor nontort deterrents affected the fraction of bingeing episodes after which the individual drove. Overall, it appears that deterrence of DUI is achieved by curbing behavior that leads to DUI, namely, binge drinking. Once individuals engage in binge drinking, it appears that many policies designed to be deterrents have little influence.

I. INTRODUCTION

A MAJOR objective of tort law is to deter an accident by making the potential injurer liable for the victim's costs. There is a large body of theoretical research on the incentives that various legal rules provide to avoid accidents. By contrast, there is little empirical evidence on tort law's deterrent effects on accidents of any type. Automobile tort cases

* This research was supported in part by grant 5-R01-AA-08354, "Heavy Drinking and Drunk Driving: Which Deterrents Work?" from the National Institute on Alcohol Abuse and Alcoholism. We thank former Vanderbilt University Health Policy Center research associate Penny B. Githens for her significant contribution in compiling data for this study and Frank Chaloupka, University of Illinois at Chicago, for providing a tape including data on some of the explanatory variables.

[*Journal of Law and Economics*, vol. XXXVIII (April 1995)]
 0022-2186/95/3801-0003$01.50

are the most common type of personal injury cases by far.[1] For this reason, and because data are available, when empirical evidence of tort laws' deterrent effects is cited, the references are usually to studies of automobile accidents.[2] Findings of these studies are largely inconclusive, perhaps because they have focused on outcomes of changes in liability rules rather than on the influence of such changes on care levels. Outcomes and care are plausibly related, but an outcome is a step removed from the care that potential injurers take.

One of the most egregious forms of reckless driving behavior is driving under the influence of alcoholic beverages (DUI). The probability of crash involvement rises dramatically with the percentage of blood-alcohol concentration.[3] Half or more of all motor vehicle fatalities have been attributed to alcohol use.[4] The emphasis of public policy against reckless driving in general and drunk driving in particular has been on criminal rather than on civil sanctions. The trend toward mandatory criminal sanctions reflects a belief that sanctions are more effective if punishment is certain.[5]

Using self-reported data on patterns of alcohol use among individuals, this study investigates the role that tort liability and third- and first-party insurance play in binge drinking and in driving under the influence of alcohol. Effects of alcohol prices and criminal sanctions on binge drinking and driving under the influence of alcohol are also analyzed. Several tort liability and insurance variables included in our empirical analysis have plausible effects on binge drinking. Requiring drivers to purchase third-party insurance discouraged binge drinking, especially in states that combined compulsory insurance with a surcharge for a drinking and driving violation. No-fault laws led to more binge drinking (albeit a small effect), as did a change from a contributory to a pure comparative or modified comparative negligence rule. Higher alcohol prices reduced the rate of binge drinking. Among the criminal sanction variables, only availability

[1] In Kakalik and Pace's large sample of jury verdict abstracts, automobile cases were 55 percent of state court and 16 percent of federal court filings. See James S. Kakalik & Nicholas M. Pace, Costs and Compensation Paid in Tort Litigation (1986).

[2] See, for example, Richard Posner, Economic Analysis of Law (1986).

[3] See, for example, *id.*

[4] U.S. Department of Transportation, A Digest of State Alcohol-Highway Safety Related Legislation (1987); R. T. Ravenholt, Addiction Mortality in the United States, 1980: Tobacco, Alcohol, and Other Substances, 10 Population & Dev. Rev. 697 (1984); Jessie C. Fortenberry *et al.*, Analysis of Drug Involvement in Traffic Fatalities in Alabama, 12 Am. J. Drug & Alcohol Abuse 257 (1986); and Willard G. Manning *et al.*, The Costs of Poor Health Habits (1991). There are methodological problems in estimating the role of alcohol in traffic accidents. See James B. Jacobs, Drunk Driving: An American Dilemma (1989).

[5] H. Laurence Ross, Deterring Drunken Driving: An Analysis of Current Efforts, Supplement 10 J. Stud. Alcohol 122 (1985).

of police had this effect. By contrast, with one exception, neither tort nor nontort deterrents affected the fraction of bingeing episodes after which the individual drove.

Section II describes our conceptual framework. Section III provides background information on tort liability and insurance in the context of motor vehicle safety and also discusses pertinent concepts and prior empirical evidence. Data and the empirical specification are described in Section IV. Section V contains empirical results, and Section VI concludes with an assessment of the implications of our findings.

II. Theory

We assume that the individual enjoys "binge" drinking but can take certain actions to prevent loss, such as ordering a taxi, or arranging for a designated driver if away from home, or having a neighbor check up on the individual if intoxicated at home.[6]

Let L, the net utility from binge drinking, be

$$L = u(s; y) - (x + p)s - sl(x; z), \tag{1}$$

where

u = utility,
s = number of binge episodes per time period,
y = exogenous variable affecting taste for binge drinking,
x = per episode cost of preventing loss,
p = money price per episode,
l = anticipated loss per episode, and
z = exogenous variable affecting the sensitivity of loss to variations in preventive activity.

Included in x are monetary and opportunity costs of preventing loss borne by the individual, such as repaying favors. Time and monetary outlays for securing alcohol are in p. The anticipated loss encompasses all out-of-pocket costs incurred by individuals associated with accidents and includes increased insurance premium surcharges following traffic accidents and violations and uninsured third-party and first-party losses incurred by self.[7]

[6] A precise definition of binge drinking is provided in Section IV.

[7] This model is based on Shavell's framework for assessing deterrent effects of tort liability (in Steven Shavell, Economic Analysis of Accident Law (1987)). In this model, individuals are risk neutral. Given that we analyze major deviations from due care, we assume that accidents are unilateral. A justification will be provided in the following section. The premium surcharge would logically occur later. In this single-period model, we assume that the present value of downstream surcharges enters as a one-time expenditure.

The individual maximizes utility from bingeing net of outlays for acquiring alcohol and loss prevention and losses caused by excessive drinking. Three variables are exogenous to the individual: taste for drinking—high values of y signify higher marginal utility from bingeing—the price per bingeing episode (p), and the degree to which changes in bingeing activity and preventive activity per episode affect loss (z). The exogenous variable z reflects, for example, the extent to which liability insurance premiums increase following a chargeable accident or violation and out-of-pocket amounts individuals pay for their own medical care following accidents. Higher values of z signify greater sensitivity of l to changes in x. That is, a given amount of care is more productive at the margin in reducing l. The effect of x on l is specified as a continuous variable l ($l_x < 0$).[8]

Maximizing L over the two endogenous variables, x and s, the first-order conditions are

$$L_x = -s - sl_x = 0 \tag{2}$$

and

$$L_s = u_s - (x + p) - l = 0. \tag{3}$$

According to (2), the individual purchases prevention up to the amount at which a dollar's worth of expenditure yields a dollar's averted loss. According to (3), bingeing activity (number of episodes per time period) is set where the marginal utility from an additional episode equals marginal cost, defined in terms of per-episode prevention and acquisition cost and the anticipated loss incurred per episode.

We performed comparative statics analysis to evaluate the effects of changes in z, y, and p on x and s (Table 1). Increasing the penalty for engaging in heavy drinking and failure to exercise care increases the person's care level (x) and decreases the number of binge episodes (s). Increased price has no effect on the care level but decreases the number of binge episodes. An increase in an exogenous variable positively associated with a fondness for alcohol does not affect the care level but increases the number of binge episodes.

[8] Generally, the relationship between l and x is treated as discontinuous, with levels of x above the due care standard having no effect on l. However, our definition of l is more comprehensive, including cost of injury to one's self. Also, almost all civil disputes involving automobile accidents are settled or dropped rather than resolved at verdict. See Frank A. Sloan & Christoph Schenzler, Negligence Rules, Compensation, and Incentives for Accident Avoidance (unpublished manuscript, Vanderbilt Univ. 1992), and the discussion in the following section.

TABLE 1

COMPARATIVE STATICS ANALYSIS

Change in Exogenous Variable	Effect	Sign
A: Effects on optimal levels of x:		
z	$(sl_{xz}u_{ss})/D$	+
p	$0/D$	0
y	$0/D$	0
B: Effects on optimal levels of s:		
z	$(sl_{xx}(-l_z - sl_{sz}))/D$	−
p	sl_{xx}/D	−
y	$(sl_{xx}u_{sy})/D$	+

NOTE.—The determinant $D = -sl_{xx}u_{ss} > 0$ at an interior maximum.

III. LIABILITY, INSURANCE, AND DRIVERS' ACTIVITY AND CARE LEVELS

As defined above, l includes accident victims' losses borne by the driver, premium surcharges, fines and other criminal penalties, and uninsured personal injury and property cost borne by the driver. Both out-of-pocket loss and the gradient of loss with respect to the care level is subject to influence by public policy.

A. Role of Insurance

Under the negligence rule, tortfeasors are liable for the cost of injuries to victims if they fail to adhere to a due care standard. To insure against losing all their wealth, drivers purchase automobile liability insurance.

With any type of insurance, liability or first party, there is likely to be moral hazard. With liability insurance, which is typically complete, the cost of an accident to a negligent injurer is no longer the victim's loss but rather the present value of the increase in premiums resulting from "chargeable accidents." Experience-rated premiums following accidents and violations should reduce moral hazard. Because of public policy decisions, assigned risk plans, and regulatory restraints on surcharging, automobile liability insurance premiums often do not reflect expected accident costs of individual drivers.[9] In states where premiums are relatively insen-

[9] Christopher J. Bruce, The Deterrent Effects of Automobile Insurance and Tort Law: A Survey of the Empirical Literature, 6 L. & Pol'y 67 (1984); and Frank A. Sloan & Penny B. Githens, Drinking, Driving, and the Price of Automobile Insurance, 61 J. Risk & Ins. 33 (1994).

sitive to chargeable accidents and traffic violations, drivers may be more prone to take risks than in other states where liability premiums are experience-rated.

Normally, if premiums do not reflect expected losses, relatively careful persons may be expected to drop coverage unless they can purchase coverage from insurers willing to offer it at lower rates. However, drivers are often compelled to purchase minimum amounts of liability coverage. The rationale for compelling drivers to buy liability insurance is that even risk-averse persons may not purchase much coverage or insure at all. If injurers' wealth is lower than the losses they may cause, part of the liability premium would go to buying coverage for losses they would not bear if they did not insure. Without insurance, injurers' inability to pay for losses reduces the incentive the injurer has to take due care.[10]

Traditionally, states have had financial responsibility statutes that require motorists to prove solvency only after the motorist has been involved in an actual accident causing significant harm. In recent years, many states have moved away from financial responsibility to compulsory insurance. In states with financial responsibility laws, the percentage of uninsured drivers may run as high as 20 percent. But in states with compulsory insurance, only 1 percent of drivers are uninsured.[11] Compelling drivers to purchase experience-rated liability insurance should give drivers greater incentive to be careful.

Individuals may have other first-party coverage, including automobile collision, life, health, and disability insurance. In some states, drivers are compelled to buy minimum amounts of first-party coverage against personal injury ("personal injury protection" or PIP). Available evidence suggests that surcharging is less frequent for first-party than for third-party automobile insurance. Compelling individuals to buy first-party coverage has two offsetting effects—moral hazard from the additional unwanted coverage itself versus any effect of chargeable accidents on premiums for such coverage. Judging from a survey of state insurance departments we conducted in 1993, most states with any form of compulsory first-party automobile insurance permitted a surcharge on such insurance *if* the driver was determined to have been at fault for the accident. However, we did not measure variations among states in the extent of surcharging.

[10] Steven Shavell, On Liability and Insurance, 13 Bell J. Econ. 120 (1982); Steven Shavell, The Judgment Proof Problem, 6 Int. Rev. Law & Econ. 45 (1986); Shavell, *supra* note 7; and Comment, The Case of the Disappearing Defendant: An Economic Analysis, 132 Univ. Penn. L. Rev. 145 (1983).

[11] Gary T. Schwartz, A Proposal for Tort Reform: Reformulating Uninsured Motorist Plans, 48 Ohio St. L. J. 419 (1987).

B. Civil Liability Rules

No-Fault Automobile Insurance. Starting with Massachusetts in 1971, a number of states enacted no-fault automobile insurance statutes to cover losses from personal injuries.[12] No state has enacted such statutes since 1979, although several states have dropped it.

One group of laws, generally termed "modified no-fault," eliminates tort action for relatively nonserious injuries, with thresholds for exclusion varying somewhat among the states. Thresholds are defined in terms of a dollar value of loss or by characteristics of the injury. Statutes define dollar thresholds in nominal terms, and they have eroded over time.[13] In cases in which a victim is barred from tort action, the victim must rely on compensation from his or her first-party insurance, the purchase of which is mandatory. The other major category of no-fault laws requires purchase of minimum levels of first-party insurance but does not place any limitations on a victim's right to sue for damages.

Barring victims from obtaining compensation from tort suits should, all things being equal, decrease the return from additional x. Evidence from past studies is mixed on the effect of no-fault laws that provide a partial bar to tort liability on motor vehicle fatality rates and accident frequency.[14] To date, no study has evaluated the influence of such laws on activities likely to lead to accidents, such as heavy drinking, or on precautions taken, such as avoidance of drinking and driving.

Contributory versus Comparative Negligence. The traditional common-law rule is the contributory negligence rule that makes an injurer liable for the full amount of the victim's loss, but only when the injurer is found to have been negligent and the victim is found to have been nonnegligent. As of late 1989, only six states continued to use the contributory negligence rule.[15] In most states, the rule has been replaced by variants of the comparative negligence rule specifying that the victim's loss be shared between the injurer and the victim when both are found to have behaved negligently. Under the "pure" comparative negligence rule, the victim's loss is allocated among all negligent actors (plaintiff and all defendants), according to the share of the blame assignable to

[12] Roger C. Henderson, No-Fault Insurance for Automobile Accidents: Status and Effect in the United States, 56 Or. L. Rev. 287 (1977).

[13] All-Industry Research Advisory Council (AIRAC), Compensation for Automobile Injuries in the United States (1989).

[14] See the discussion in Section VII *infra*.

[15] Joseph W. Little, Eliminating the Fallacies of Comparative Negligence and Proportional Liability, 41 Ala. L. Rev. 13 (1989); Carol A. Mutter, Moving to Comparative Negligence in an Era of Tort Reform: Decisions for Tennessee, 57 Tenn. L. Rev. 199 (1990).

each actor. A plaintiff fails to be compensated only if he or she is 100 percent to blame. The other variants of the comparative negligence rule bar the plaintiff from recovery of loss when it is determined that the plaintiff shares much of the blame for the accident. If recovery is not barred, loss is shared on the basis of the percentage at fault. Under the 50 percent rule, plaintiffs do not recover when their negligence is greater than that of the defendants; in 49-percent-rule states, plaintiffs do not recover when their negligence is equal to or greater than the defendants'. Under the "slight-gross" rule, the comparison between plaintiff's negligence and that of the defendant is more qualitative. The rule requires that, for the plaintiff to collect compensation, his or her negligence must be "slight" and the defendant's "gross."[16]

The usual theoretical result is that when the legal standard is set at the efficient level of precaution, all the negligence rules create an incentive for efficient precaution levels.[17] But this conclusion holds only under stringent assumptions, such as that the standard for fault is set at the efficient level and courts make no errors in applying the standard. When liability insurance is widespread, incentives are affected by the effects of such rules on payments that drivers make as injurers, largely in the form of surcharges on liability insurance policies and the compensation drivers receive as victims.

Changing from contributory negligence to comparative negligence may not materially affect payments injurers make to victims. Empirical evidence indicates that payment is often made even under contributory negligence when the victim is partly to blame. Of automobile liability claims that resulted in payment to victims, less than 1 percent are resolved at trial.[18] Even when payment is discounted in proportion to degree of victim negligence, the injurer is likely to be charged with the accident, with a resulting premium surcharge.

Comparative negligence appears to give drivers in their role as potential accident victims less incentive to take care. However, in accidents involving substantial deviations from due care, such as driving under the influence of alcohol or drugs, the driver is more likely to be the injurer than the victim.[19] Whether or not the shift toward comparative negligence has affected driver behavior is an issue that must be decided empirically.

[16] Little, *supra* note 15.

[17] See, for example, Robert Cooter & Thomas Ulen, Law and Economics, at 354–62 & 400–403 (1988).

[18] Sloan & Schenzler, *supra* note 8.

[19] Michelle J. White, An Empirical Test of the Comparative and Contributory Negligence Rules in Accident Law, 20 RAND J. Econ. 308 (1989); Sloan & Schenzler, *supra* note 8.

C. *Dramshop Laws*

Traditionally, according to common law, third-party dispensers of alcoholic beverages were not liable for losses caused by their customers' drinking. Over the years, several states have enacted dramshop laws, and in other states, courts have established dramshop liability to curb sales of alcoholic beverages to minors and/or obviously intoxicated adults.[20] The rationale for dramshop liability is that the threat of a suit will cause dispensers of alcoholic beverages to monitor their customers' drinking and to distribute the social costs arising from abuse of alcohol to the alcoholic beverage industry. Dramshop laws affect availability of sites for drinking (minors) or heavy drinking (adults). To the extent that such laws are effective, they affect the price of alcohol consumption.

IV. Data

We obtained data on individuals from Behavioral Risk Factor Surveys (BRFS), which were conducted by state health departments under the direction of the U.S. Centers for Disease Control during each year, 1984–90. Eighteen states participated in 1984; by 1990, the number of participating states had risen to 45. On average, there were 938 interviews per state in 1984, and by 1990 there were 1,780 interviews per state.

We took a random 15 percent sample of the observations, yielding a sample of 49,199 observations.[21] This household survey, conducted annually by telephone, obtains information from persons over age 18 on demographic characteristics, such as age, race, gender, schooling, marital status, family income, and lifestyle. The BRFS is the only annual survey of alcohol use and related behavior, such as patterns of drinking and driving.[22] Lifestyle and behavior characteristics include diet, smoking, exercise, and use of seat belts. On alcohol consumption, the surveys for 1984–90 asked whether or not the person had consumed any alcoholic beverages during the past month, the number of drinks consumed per week or per month on average, the number of drinks per day on average on days the person drank, the number of times during the past month that the person had five or more drinks on an occasion—"binge drink-

[20] Jacobs, *supra* note 4; and James F. Mosher, Dram Shop Liability and the Prevention of Alcohol-Related Problems, 40 J. Stud. Alcohol 773 (1979).

[21] Weights were provided for the years 1985–90 but not for 1984. So as not to lose 1984 observations, we did not use the weights. Parameter estimates on variables for individual characteristics and their associated standard errors from weighted and nonweighted analyses were quite similar.

[22] Some supplements of the Health Interview Survey have questions on alcohol use, but state identifiers are not provided on the public use file.

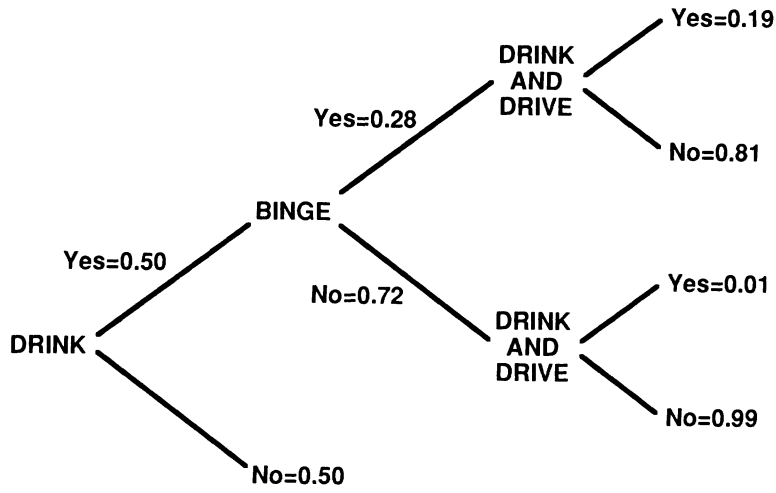

FIGURE 1.—Decision tree: drinking, binge drinking, and drinking and driving, 1990

ing"—and the number of times during the past month that the person drove when he or she had perhaps too much to drink.[23]

As shown in Figure 1, which is based on data from the 1990 BRFS, the probability of drinking and driving, conditional on *not* drinking five or more alcoholic beverages on one occasion during the past month, was only 0.01, in contrast to the probability of 0.19 if the respondent reported at least one binge episode. Of the half of the sample which drank at all

[23] As with any self-reported survey, there is an issue of the validity of the data. Bradstock *et al.* noted that the BRFS data on levels of alcohol consumption are consistent with other national alcohol survey data from the 1970s. See M. Kirsten Bradstock *et al.*, The Behavioral Risk Factor Surveys: III. Chronic Heavy Alcohol Use in the United States, 1 Am. J. Preventive Med. 15 (November/December 1985); and M. Kirsten Bradstock *et al.*, Drinking-Driving and Health Lifestyle in the United States: Behavioral Risk Factors Surveys, 48 J. Stud. Alcohol 147 (1987). However, they found the amount of drinking and driving to be lower than did other surveys of more narrowly defined populations, for example, Michigan residents.

There is research indicating that drinkers give reliable and accurate reports of their drinking practices when questioned under certain circumstances. See Julie Akiko Gladsjo *et al.*, Adequacy of Recall of Drinking Patterns and Event Occurrences Associated with Natural Recovery from Alcohol Problems, 17 Addictive Behav. 347 (1992). In Institute of Medicine, Broadening the Base of Treatment for Alcohol Problems (1990), a review of research indicates that self-reports are inherently neither valid nor invalid; their validity varies depending on the circumstances of questioning including, among other factors, vague questions and confidentiality issues. As a result, the questions in the BRFS that elicit precise consumption levels are likely to be the most accurate, while the questions on "driving when you had perhaps too much to drink" may be too ambiguous, or the topic too sensitive for the response to be completely reliable. However, we agree with Bradstock *et al.*'s (Drinking-Driving and Health Lifestyle in the United States, *supra*) inference, that is, the consistency of the data for key demographic subgroups suggests that the data are not seriously biased.

TABLE 2

FREQUENCY DISTRIBUTIONS OF BINGE DRINKING AND OCCASIONS OF DRINKING AND DRIVING TO BINGE EPISODES (Persons with at Least One Binge Episode)

A. NUMBER OF BINGE EPISODES DURING PREVIOUS MONTH

Number	Percentage
1	37.0
2	21.4
3	9.1
4	11.0
5	4.7
6–11	10.1
11–20	4.3
21–30	2.4
	100.0

B. RATIO OF DRINKING AND DRIVING EPISODES TO BINGE EPISODES

Ratio	Percentage
0.0	81.3
0.01–0.10	1.3
0.11–0.25	3.9
0.26–0.50	5.9
0.51–0.75	0.8
0.76–1.00	5.8
1.00+	1.0
	100.0

SOURCE.—Unpublished data from the 1984–90 Behavioral Risk Factor Surveys (15 percent sample).

during the previous month, slightly more than a quarter said they had had at least one binge episode. About two-fifths of those who binged did so more than once (Table 2, panel A). Only a few persons said they drove under the influence as often as they binged. One percent of binge drinkers reported more drinking and driving than binge-drinking episodes (Table 2, panel B). This latter result probably arose because a few respondents may have considered fewer than five drinks too much alcohol consumption for driving.

V. EMPIRICAL SPECIFICATION

A. Overview and Dependent Variables

Equations were estimated for the probability that the person consumed alcohol at all; the probability of binge drinking, conditional on drinking

at all; the number of times the person binge drank for those who binge drank at all; the probability of drinking and driving at all, conditional on some binge drinking; and the number of times the person said he or she drank and drove per binge episode reported. All variables were defined for the month before the survey.

We did not include nonbingers in our analysis of the decision to drink and drive for three reasons. First, the combination of not bingeing and drinking and driving almost never occurs (Figure 1). Second, the few individuals who do not consume five or more beverages on an occasion but who say they drink and drive plausibly have a much lower threshold for what they consider "drinking and driving." Third, since x is defined as prevention per unit of the activity, occasions of drinking and driving were defined relative to the number of binge episodes. Thus, we had to exclude cases in which there was no bingeing.

Undesirable behavior other than drinking and driving results from excessive alcohol use, ranging from fistfights to homicides and injury to self, such as from suicides, falls, and fires.[24] Unfortunately, the BRFS obtained no information on the other undesirable activities associated with heavy drinking.

Explanatory variables included (1) personal characteristics of the respondent, proxies for y; (2) price; (3) civil liability and insurance, and other deterrents to measure exogenous variations in l; and (4) a time trend. According to our model, personal characteristics and price should not enter the equation for the person's care level. However, it is quite possible that persons who binge drank in the current month, which was observed, also binged in the past, which was not observed in our data. To the extent that penalties for drinking and driving are stiffer for persons with a history of binge episodes, and a variable for previous s is not included as an explanatory variable, the care level may vary systematically with personal characteristics and price. If l depends on s (current s

[24] See, for example, Aaron T. Beck *et al.*, Alcoholism, Hopelessness, and Suicidal Behavior, 37 J. Stud. Alcohol 66 (1976); John C. Clark, Sudden Death in the Chronic Alcoholic, 36 Forensic Sci. Int'l 105 (1988); Terri Combs-Orme *et al.*, Violent Deaths among Alcoholics, 44 J. Stud. Alcohol 938 (1983); Tavia Gordon & Joseph T. Doyle, Drinking and Mortality: The Albany Study, 125 Am. J. Epidemiology 263 (1987); Richard A. Goodman *et al.*, Alcohol and Fatal Injuries in Oklahoma, 52 J. Stud. Alcohol 156 (1991); Arthur L. Kellermann *et al.*, The Epidemiologic Basis for the Prevention of Firearm Injuries, 12 Ann. Rev. Pub. Health 17 (1991); George E. Murphy & Richard D. Wetzel, The Lifetime Risk of Suicide in Alcoholism, 47 Archives Gen. Psychiatry 383 (1990); Linda G. Peterson *et al.*, Self-Inflicted Gunshot Wounds: Lethality of Method versus Intent, 142 Am. J. Psychiatry 228 (1985); Reginald G. Smart & Robert E. Mann, Changes in Suicide Rates after Reductions in Alcohol Consumption and Problems in Ontario, 1975–1983, 85 Brit. J. Addiction 463 (1990); and John W. Welte & Ernest L. Abel, Homicide: Drinking by the Victim, 50 J. Stud. Alcohol 197 (1989).

may be positively correlated with past s), the conclusion from the comparative statics analysis that changes in y and p do not affect x does not hold. Persons with a positive taste for alcohol and those facing a lower price would exercise higher levels of care. Intuitively, they would offset the higher anticipated loss from more frequent bingeing with a higher level of precaution at least in part. Changing the extent to which liability premiums change following a chargeable accident or violation has an ambiguous effect on x. To account for the possibility that l may depend on s, we included variables for y and p in one specification of the equation for x.

B. Personal and Family Characteristics

We included several personal characteristics as explanatory variables: binary variables for age, gender, and marital status (single); and education specified as three binary variables for 9–12 years of schooling, some college, and baccalaureate or more years of higher education, with those having fewer than 9 years of schooling, the omitted reference group, a variable for good health habits, and family income.

Our index of importance of good health to the respondent was based on self-reported exercise, wearing a seat belt, and smoking. Smoking was assigned a -1; the other activities received a $+1$ each. Index values ranged from -1 to 3, with 3 being the most health conscious. For example, a value of -1 was assigned if the person smoked, did not wear a seat belt, and did not exercise, while a value of 3 was assigned if the person engaged in two types of exercise, wore a seat belt, and did not smoke.[25]

The relationship between a person's income and the probability of being involved in an accident is a complex one. In Section II's model, income does not enter explicitly. Low-income persons may be less careful because courts do not hold persons liable for more than their assets and the limits of their liability coverage.[26] This relationship would be reflected in the effect of the care level on loss (l). It is also possible that income affects the degree of risk aversion, and wealthier persons purchase safer goods, such as safer automobiles at higher prices.[27]

[25] We assume here that health risk takers will also tend to drink a lot, but some research suggests that seat-belt laws may lead to more risky driving. When forced to take care, for example, wear a seat belt, some individuals achieve a desired level of risk by being less careful in other ways. See Singh & Thayer, *infra* note 27.

[26] Shavell, The Judgment Proof Problem, *supra* note 10. Beard has assessed circumstances under which this relationship may not hold. T. Randolph Beard, Bankruptcy and Care Choice, 21 RAND J. Econ. 626 (1990).

[27] There is little empirical evidence on the effect of income on driving behavior. Singh and Thayer found that for the sample as a whole, income had no effect on the number of

C. *Price*

We used data on alcohol prices from the American Chamber of Commerce Researchers Association's (ACCRA) *Inter-city Cost of Living Indicators*. This source provided data on beer, wine, and liquor for various cities and states. To construct the price measure, we computed mean values of the city data for individual states and years. The prices for each of the three types of alcoholic beverages were then weighted by their relative consumption shares to form a single price variable. The alcohol price in California in 1990 was set equal to 1.0, and prices in other states and years were computed relative to this numeraire price.

We included a binary variable to identify persons below the state's minimum drinking age. As noted above, the dramshop liability variable can also be interpreted as a price variable.

D. *Civil Liability and Insurance*

Except when noted, all variables were defined by state and year. Three variables represented compulsory automobile liability insurance: compulsory insurance in the five states in which policyholders paid the highest surcharges for a drunk driving conviction in 1991, compulsory insurance in the five states in which policyholders paid the lowest surcharges—the omitted reference group, and other states with compulsory insurance ("medium surcharge"). Because data on premium setting practices were available only for 1991, the classification of states on the basis of surcharging is time invariant. Bruce presented surcharges for a few states in the late 1970s. Comparing these data with data for 1991, it is apparent that relative surcharges among states were fairly similar in both years. We measured compulsory insurance by state and year.[28]

We included two variables for automobile no-fault: a binary variable for states with no-fault interacted with the fraction of claims in which a tort action was barred because the claim did not exceed the threshold, and a binary variable for states in which tort actions were not barred but which compelled drivers to purchase first-party insurance for losses due

traffic citations for moving violations during the past 3 years that respondents reported. However, for a subsample of respondents identified as risk lovers, income had a positive influence on citations. Harinder Singh & Mark Thayer, Impact of Seat Belt Use on Driving Behavior, 30 Econ. Inquiry 649 (1992).

[28] Information on premium surcharging practices was obtained from a national survey of 18 automobile insurers in 1991 (see Sloan & Githens, *supra* note 9). Comparing the fragmentary information for the late 1970s presented in Bruce, *supra* note 9, with evidence obtained by Sloan and Githens, there appears to be little change in the states in which automobile liability premiums increased the most or the least in response to a conviction for drunk driving since the late 1970s.

to bodily injury. The fraction of claims barred from tort action in 1977 and 1987 was computed from surveys of closed automobile claims.[29] It was necessary to interpolate to obtain values for other years. A binary variable identified states with dramshop liability for the years states imposed such liability.

Changes in civil liability occur as a result of statutory or judicial decisions. Since there is no reason to expect that the source of the change affects outcome, no distinction was made according to whether a rule was based on a statute or court decision. We defined variables for pure comparative negligence, modified comparative negligence (49 and 50 percent rules), contributory and slight-gross negligence, the omitted reference group, modification of the collateral source rule, and ceilings on payment for noneconomic loss.

E. Other Deterrents

Several criminal sanctions potentially affect drinking and driving behavior. Variables for the mandatory minimum fine (1990 $), mandatory minimum jail term (days), and minimum mandatory length of driver's license revocation (days), all defined to be applicable to the driver's first DUI conviction, were included as explanatory variables. Enforcement was measured by the number of full-time-equivalent police per 1,000 population in the state and year.

A time trend was included for time-varying aggregate factors common to all areas. In preliminary analysis, state binary variables were included. These variables were very collinear with the policy variables. Many of the policies were constant for several years, making it difficult to disentangle state policies from time-invariant state effects. In the regressions presented below, binaries for location have been excluded. Means and standard deviations of explanatory variables are shown in Table 3.

VI. Results

A. Probability of Drinking

Various potential deterrents designed to discourage behavior leading to personal injury and property damage are plausibly not likely to affect a person's decision whether to consume alcoholic beverages at all. Therefore, the equation for the probability that any alcoholic beverages were consumed during the month prior to the survey, estimated with probit,

[29] The surveys are described in AIRAC, 1 & 2 Automobile Injuries and Their Compensation in the United States (1979); and AIRAC, *supra* note 13.

TABLE 3

MEANS (and Standard Deviations) OF EXPLANATORY VARIABLES

Variable	Entire Sample	Drinkers	Binge Drinkers	Drinker-Drivers (Binge Drinkers Only)
Age	45.3	40.3	34.3	31.5
	(18.1)	(15.4)	(12.1)	(10.0)
Male	.42	.51	.70	.76
	(.49)	(.50)	(.46)	(.42)
Single	.42	.40	.47	.58
	(.49)	(.49)	(.50)	(.49)
High school	.34	.31	.35	.34
	(.47)	(.46)	(.48)	(.47)
Some college	.25	.29	.31	.35
	(.44)	(.46)	(.46)	(.48)
College +	.23	.30	.24	.24
	(.42)	(.46)	(.43)	(.43)
Good health habits	1.20	1.33	1.14	1.05
	(1.10)	(1.13)	(1.14)	(1.13)
Family income ($10,000s)	2.95	3.44	3.31	3.25
	(2.00)	(2.04)	(1.99)	(1.96)
Alcohol price	1.04	1.03	1.03	1.03
	(.08)	(.08)	(.08)	(.09)
Minimum drinking age	.05	.04	.06	.07
	(.22)	(.19)	(.24)	(.25)
Compulsory liability insurance	...	.78	.78	.75
		(.41)	(.42)	(.43)
High surcharge and compulsory liability insurance	...	.10	.10	.09
		(.30)	(.29)	(.28)
Medium surcharge and compulsory liability insurance	...	.84	.85	.86
		(.36)	(.36)	(.35)
Compulsory first party	...	.06	.05	.04
		(.24)	(.22)	(.20)
No-fault	...	.08	.08	.08
		(.13)	(.13)	(.13)
Pure comparative negligence	...	.29	.28	.24
		(.45)	(.45)	(.43)
Modified comparative negligence	...	.53	.56	.59
		(.50)	(.44)	(.49)
Dramshop	...	.61	.61	.58
		(.49)	(.49)	(.49)
Fine ($)	...	101.3	96.3	96.3
		(156.5)	(153.1)	(152.8)
Jail (days)	...	.43	.42	.41
		(.87)	(.85)	(.83)
License revocation (days)	...	27.7	27.0	27.5
		(63.9)	(61.4)	(66.9)
Police per 1,000 state population	...	2.52	2.52	2.52
		(.43)	(.43)	(.43)

is primarily of interest for describing characteristics of drinkers versus nondrinkers and to contrast these results with those on bingeing and on care conditional on bingeing (Table 4).

Coefficients on all variables included in the equation are statistically significant at the 1 percent level. Marginal effects are shown in brackets. The probability of being a drinker declined with age and rose with being male and single, being more educated, having good health habits, and having a higher family income. The only possibly surprising result is that persons with more good health habits were more likely rather than less likely to have consumed some alcohol during the previous month.

Higher alcohol price reduced the probability of alcohol use, as did laws specifying the minimum age at which a person can legally purchase alcoholic beverages. The estimated effect on the probability of drinking of raising price and curbing availability to youths is substantial. A 10 percent increase in price is predicted to reduce the probability of use by 0.06 on average. Imposing the minimum drinking age on a 19-year-old is estimated to reduce the probability of drinking at all by 0.15 (for the group affected by such statutes).

B. Binge Drinking

For the analysis of binge drinking, we used Tobit, with the dependent variable being the number of binge-drinking episodes during the prior month. Alternatively, we used probit to analyze the decision of drinkers to do any binge drinking and, for persons who said they binge drank at least once during the prior month, ordinary least squares (OLS) for the number of binge-drinking episodes. In general, explanatory variables had the same direction of effect in the probit and OLS regressions. Reflecting the fact that the majority of drinkers did not engage in binge drinking (Figure 1) and many bingers only did so once or twice during the last month (Table 2), the probit and Tobit results tend to be more similar in terms of signs on coefficients and levels of statistical significance than are the OLS and Tobit results. To assess magnitudes of response to specific changes in explanatory variables, we used the Tobit results.[30]

[30] We computed marginal effects from the Tobit coefficients. See John F. McDonald & Robert A. Moffitt, The Uses of Tobit Analysis, 62 Rev. Econ. & Stat. 318 (1980), for a discussion of the method. We based our calculations on the fraction of nonzero values of the dependent variable generated from the Tobit coefficients and values of the explanatory variables rather than on the actual fraction of cases in the sample that were nonzero. The predicted fraction, based on the coefficients and the values of explanatory variables at their observational means, was 0.22, rather than the actual sample fraction of 0.28. This discrepancy arose because the predicted probability is a nonlinear function of the Tobit index.

TABLE 4

REGRESSION RESULTS

EXPLANATORY VARIABLES	PROBABILITY OF DRINK PROBIT	PROBABILITY OF BINGE PROBIT	NUMBER OF BINGE EPISODES		FRACTION OF BINGE EPISODES, DRINK AND DRIVE	
			OLS	Tobit	Tobit	Tobit
Intercept	1.47*	1.01*	5.37*	5.92*	−.66	.18
	(.10)	(.20)	(1.39)	(1.37)	(.18)	(.36)
Age	−.014*	−.027*	.030*	−.15*	· · ·	−.012*
	(.001)	(.001)	(.006)	(.01)		(.002)
	[−.006]	[−.009]	[· · ·]	[−.03]		[−.00]
Male	.39*	.76*	1.72*	5.24*	· · ·	.19*
	(.01)	(.02)	(.15)	(.15)		(.04)
	[.15]	[.24]	[· · ·]	[1.20]		[.03]
Single	.26*	.23*	.81*	1.60*	· · ·	.26*
	(.02)	(.02)*	(.15)	(.15)		(.04)
	[.10]	[.07]	[· · ·]	[.37]		[.05]
High school	.25*	−.09**	−.73*	−.90*	· · ·	.18*
	(.02)	(.04)	(.25)	(.25)		(.07)
	[.10]	[−.03]	[· · ·]	[−.21]		[.03]
Some college	.37*	−.16*	−.79*	−1.35*	· · ·	.26*
	(.02)	(.04)	(.26)	(.26)		(.07)
	[.15]	[−.05]	[· · ·]	[−.31]		[.05]
College +	.45*	−.33*	−1.08*	−2.41*	· · ·	.21*
	(.03)	(.04)	(.28)	(.28)		(.08)
	[.18]	[−.10]	[· · ·]	[−.55]		[.04]
Good health habits	.022*	−.12*	−.47*	−.94*	· · ·	−.067*
	(.006)	(.010)	(.07)	(.07)		(.017)
	[.009]	[−.04]	[· · ·]	[−.22]		[−.01]
Family income ($10,000s)	1.09*	.12**	−.71***	.50	· · ·	.15
	(.00)	(.06)	(.40)	(.40)		(.10)
	[.43]	[.04]	[· · ·]	[.10]		[.03]

Time	−.045*	−.000	−.19*	−.093*	−.037	−.039*
	(.004)	(.006)	(.04)	(.039)	(.103)	(.010)
	[−.019]	[−.00]	[· · ·]	[−.02]	[−.01]	[−.01]
Alcohol price	1.42*	−.68	−.31	−3.97*	· · ·	−.76*
	(.08)	(.16)	(1.03)	(1.02)		(.27)
	[−.57]	[−.22]	[· · ·]	[.91]		[−.14]
Minimum drinking age	−.38*	−.10***	−.70**	−.44	· · ·	−.25*
	(.04)	(.05)	(.31)	(.34)		(.08)
	[−.15]	[−.03]	[· · ·]	[−.10]		[−.04]
Compulsory liability insurance	· · ·	−.068**	−.037	−.40**	−.042	−.044
		(.027)	(.18)	(.18)	(.047)	(.047)
		[−.02]	[· · ·]	[−.09]	[−.01]	[−.01]
High surcharge and compulsory liability insurance	· · ·	−.076	−.94**	−.92**	.031	−.039
		(.063)	(.42)	(.41)	(.11)	(.11)
		[−.02]	[· · ·]	[−.21]	[.01]	[−.01]
Medium surcharge and compulsory liability insurance	· · ·	−.062	−.92*	−.80**	.10	−.054
		(.049)	(.32)	(.32)	(.08)	(.063)
		[−.02]	[· · ·]	[−.18]	[.02]	[−.01]
Compulsory first party	· · ·	−.076*	.84**	−.080	−.094	−.004
		(.005)	(.34)	(.32)	(.093)	(.095)
		[−.02]	[· · ·]	[−.02]	[−.02]	[−.001]
No-fault	· · ·	.0024	−.004	.012***	.000	.001
		(.0009)	(.006)	(.006)	(.002)	(.002)
		[.00]	[· · ·]	[.00]	[.00]	[.00]
Pure comparative negligence	· · ·	.16*	.72*	1.20*	−.20*	−.21*
		(.04)	(.28)	(.27)	(.07)	(.07)
		[.05]	[· · ·]	[.28]	[−.04]	[−.04]
Modified comparative negligence	· · ·	.19*	.37	1.22*	−.031	−.055
		(.04)	(.25)	(.24)	(.060)	(.063)
		[.06]	[· · ·]	[.28]	[−.01]	[−.01]
Dramshop	· · ·	−.024	−.084	−.12	−.035	−.006
		(.024)	(.16)	(.16)	(.041)	(.042)
		[−.01]	[· · ·]	[−.03]	[−.01]	[−.00]

TABLE 4 (*Continued*)

Explanatory Variables	Probability of Drink Probit	Probability of Binge Probit	Number of Binge Episodes		Fraction of Binge Episodes, Drink and Drive	
			OLS	Tobit	Tobit	Tobit
Fine ($1,000s)	· · ·	−.081	−.48	−.79	.12	.20
		(.09)	(.53)	(.52)	(.14)	(.14)
		[−.00]	[· · ·]	[−.18]	[.02]	[.03]
Jail	· · ·	−.001	−.24*	−.086	−.036	−.017
		(.013)	(.09)	(.089)	(.024)	(.025)
		[−.00]	[· · ·]	[−.02]	[−.01]	[−.00]
License revocation (1,000 days)	· · ·	.091	1.35	.81	.12	.25
		(.184)	(1.25)	(1.22)	(.32)	(.33)
		[.03]	[· · ·]	[.19]	[.03]	[.04]
Police per 1,000 population	· · ·	−.045**	−.34***	−.46**	.013	−.002
		(.022)	(.19)	(.18)	(.052)	(.051)
		[−.01]	[· · ·]	[−.11]	[.002]	[−.00]
σ	· · ·	· · ·	· · ·	7.07*	.93*	.90*
				(.08)	(.03)	(.03)
Number of observations	37,858	18,534	5,217	18,534	5,217	5,217
R^2			.07			
$R^2(C)$			.06			
$F(23; 5,193)$			16.2			

NOTE.—Numbers in parentheses are standard errors; numbers in brackets are estimated marginal effects evaluated at the observational means. In ordinary least squares (OLS), the coefficient shows the marginal effect.

* Statistically significant at the 1 percent level (two-tail test).

** Statistically significant at the 5 percent level (two-tail test).

*** Statistically significant at the 10 percent level (two-tail test).

Our theoretical analysis predicted that variables associated with a "taste for drinking" should lead to more binge drinking, and raising price and curbing availability of alcoholic beverages should reduce binge drinking. Insurance, tort, and criminal penalties that make careless drivers pay more for careless behavior should decrease the number of binge-drinking episodes.

As in the analysis of the decision to drink at all during the past month, being male and single raised the number of binge episodes. The marginal effect of being male is substantial (1.20 episodes). Older persons had a slightly lower probability of bingeing at all (-0.01 per year), but if they binged, they tended to binge slightly more. However, family income, which had a positive and statistically significant impact on the probability of drinking at all, has a negative and significant effect on the number of binge episodes conditional on some bingeing. The Tobit parameter estimate for the influence of family income, which reflects both the probability of bingeing and the number of episodes conditional on some bingeing, is positive but statistically insignificant. A $10,000 increase in family income from the mean is estimated to raise the expected number of episodes per month by 0.10. Although more educated persons were more likely to drink at all, they did less binge drinking. Holding other factors constant, a high school dropout had 0.55 more binge-drinking episodes during the previous month than did a college graduate based on the Tobit coefficient on the binary college variable for graduates.

As predicted by the model, higher alcohol prices and curbing availability by imposing minimum-drinking-age laws reduced the amount of binge drinking, but only the result for price is statistically significant. The Tobit coefficient implies that a 10 percent increase in the price of alcoholic beverages would decrease the expected number of binge episodes per month by 0.09 on average. The minimum drinking age tended to keep more youths from bingeing at all; for youths who had at least one episode, those covered by such a statute also tended to binge less.

Judging from the coefficients and levels of statistical significance, it is apparent that efforts to penalize careless behavior deter binge drinking. Requiring that drivers purchase minimum amounts of automobile liability insurance lowered the frequency of binge drinking, mainly through the effect of such statutes on decreasing the probability of binge drinking at all during the month before the survey. Requiring liability insurance reduced the number of binge episodes per month by 0.09 on average, the same as increasing price by 10 percent. This effect is for the omitted reference group, states in which the surcharge for a DUI was among the five lowest in the United States. In the five states with the highest surcharges for a DUI, mandating automobile insurance coverage reduced

the number of bingeing episodes in the past month by 0.21 on average. In the remaining states, the Tobit results predict a decrease of 0.18 episodes.

The Tobit coefficient on the explanatory variable for compelling drivers to purchase first-party automobile insurance for personal injuries is negative but statistically insignificant. Although requiring such purchases reduced the probability of binge drinking, the OLS coefficient implies that binge drinkers engaged in more such behavior when they were made to buy first-party coverage. The implied marginal effect is substantial (0.84 additional episodes per month). As explained above, first-party insurance premiums may be surcharged, but generally this is only done if liability insurance premiums are surcharged.

Where no-fault laws barred victims from suing, the number of binge episodes increased. However, the effect implied by the Tobit coefficient on the no-fault variable, which is statistically significant at the 10 percent level, is virtually zero. Imposing dramshop liability did not influence binge drinking in any of the regressions.

The results imply that switching from contributory to pure comparative or modified comparative negligence increased binge drinking. The Tobit coefficients, both statistically significant at the 1 percent level, imply very similar marginal effects. Compared to states with contributory negligence, the number of binge-drinking episodes per month was 0.28 higher in states with pure and with modified comparative negligence. To the extent that the negligence rule makes a difference, one would expect switching to pure comparative negligence to have had a greater effect.

Of the criminal deterrents, only the variable for the number of police per 1,000 population had a statistically significant and negative effect on binge drinking. Increasing the number of police by 10 percent is predicted to reduce the number of episodes by 0.03. Both probit and OLS results imply that increasing police availability reduced binge drinking. However, the Tobit analysis shows no effect of police availability. The OLS coefficient on mandatory jail terms is negative and statistically significant at the 1 percent level (marginal effect is -0.24 episodes per month). Overall, the results imply that tort law and insurance practices as well as alcohol pricing policies have greater impacts on binge drinking than do criminal sanctions.

C. Care Level

Results from probit analysis of the probability of drinking and driving, conditional on a binge episode, not shown, are very close to the Tobit analysis of the fraction of binge episodes in which the individual drove, which is shown in Table 4. Ordinary least squares analysis of the fraction,

which was limited to those respondents who reported at least one drinking and driving episode, not shown, was not fruitful, in terms of either the number of statistically significant coefficients or the equation's explanatory power ($R^2 = 0.02$). We also conducted analysis of the number of drinking and driving episodes, which was not limited to binge drinkers but rather included all respondents who consumed some alcohol during the prior month. Adding the nonbingers, 99 percent of who reported no drinking and driving, had essentially no effect on the results.

Our conceptual analysis yielded the predictions that neither taste for high alcohol use nor price should affect x. Thus, one regression with the fraction of binge episodes in which the individual said she or he drank and drove excludes measures of y and p.

Overall, neither tort nor nontort variables affect the fraction of bingeing episodes in which the individual drank and drove. Adding the personal characteristics and price variables has a very minor effect on the parameter estimates on the tort and nontort variables.

Only one of the tort and nontort sanction variables has a statistically significant effect on care. Persons in states with pure comparative negligence drove after bingeing in a lower proportion of cases. The fraction of binge episodes in which the person reported driving was 0.04 lower under pure comparative negligence than under contributory negligence. Viewed in terms of the overall effect of negligence rules on highway safety, the beneficial effect of pure comparative negligence on the care level only partially offsets the higher rate of binge drinking in states with pure comparative negligence.

Since we had information only on surcharging practices as of 1991, it is possible that the weak results for surcharges reflect errors in variables (although statistically significant results were nevertheless obtained in the binge-drinking analysis). To explore this possibility, we reestimated the equation for care levels with data for 1990, the most recent BRFS data available (results are not shown). The coefficient on the high surcharge variable was negative and statistically significant at the 10 percent level, implying that requiring automobile liability insurance with high surcharging for DUI reduces the fraction of binge episodes followed by driving by 0.09 on average. Although the sign on the parameter estimate for medium surcharge was also negative, the estimate was much smaller in absolute value and not statistically significant at conventional levels.

We explained above that the return to the individual from taking precautions, measured in terms of reduced loss, may increase, if prior to the month before the survey the individual had been convicted of DUI, or another traffic violation, or had been at fault for an accident. Since no measure of the individual's prior driving record was available from the

survey, we could not be sure that personal characteristics and price would not show an effect on the propensity to drive after bingeing. If so, we would expect that the variables leading to heavy drinking/bingeing would have a negative effect on driving after bingeing.

Although several coefficients are statistically significant at conventional levels—those on male, single, high school, some college, college +, alcohol price, and minimum drinking age—with the exception of schooling, the explanatory variables associated with higher rates of bingeing also lead to more driving following episodes of bingeing. That is, if single males, for example, had more to lose from being cited for a DUI at the time, either from a surcharge on premiums or a criminal penalty, this was not reflected in a lower propensity to binge and drive, as our comparative studies analysis predicted for the case in which l depended on s. Taking each characteristic separately, the associated marginal effects are not large. However, combining characteristics, such as being both male, single, and some college, marginal effects become substantial. The coefficient on alcohol price implies that a 10 percent increase in price would decrease the fraction of binge episodes in which the person drove by 1.4 percent.

VII. Discussion

There is a paucity of empirical evidence on deterrent effects of tort law. Available evidence comes from studies of the effect of no-fault automobile insurance laws and on workers' compensation. Results from the empirical studies of no-fault are mixed. Landes found that implementation of no-fault increased motor vehicle fatalities, while Kochanowski and Young as well as Zador and Lund found no effect with the same dependent variable. Gaudry analyzed the influence of no-fault in Quebec.[31] The total number of accidents and accident victims increased appreciably after no-fault was introduced. The number of drivers increased in Quebec after no-fault was implemented: first, premiums decreased overall, thus increasing the affordability of insurance, and second, premiums decreased relatively for individuals belonging to the highest-risk

[31] Elisabeth M. Landes, Insurance, Liability, and Accidents: A Theoretical and Empirical Investigation of the Effect of No-Fault Accidents, 25 J. Law & Econ. 49 (1982); Paul S. Kochanowski & Madelyn V. Young, Deterrent Aspects of No-Fault Automobile Insurance: Some Empirical Findings, 52 J. Risk & Ins. 269 (1985); and Paul Zador & Adrian Lund, Re-analyses of the Effects of No-Fault Auto Insurance on Fatal Crashes, 53 J. Risk & Ins. 226 (1986); Marc Gaudry, The Effects on Road Safety of the Compulsory Insurance, Flat Premium Rating and No-Fault Features of the 1978 Quebec Automobile Act (unpublished manuscript, University of Montreal 1987).

classes. All drivers were forced to purchase not very experience rated insurance at the same time victims' option of filing a tort claim was eliminated. A highly experienced rated (compulsory) no-fault plan may have had the opposite effect. More generally, effects of tort law and criminal sanctions critically depend on how they are implemented. In our analysis, we found a small increase in binge drinking attributable to no-fault laws, but no effect on the proportion of times the individual drove after bingeing.

Outcome studies of traffic fatalities measure the failure to take care indirectly. By contrast, in this study, the dependent variables for binge drinking and driving conditional on binge drinking are direct measures of behavior. Although the measures used in this analysis could be subject to underreporting, given the many plausible relationships, many respondents must have reported their behavior fairly accurately. In fact, if there is underreporting, it is noteworthy that a rather high percentage of adults (14 percent) reported that they consumed five or more alcoholic beverages on one occasion, and of these individuals, 19 percent reported driving after having, in their opinion, too much to drink.

Two major findings emerge from the empirical analysis. First, deterrence of drinking and driving is achieved by curbing behavior that leads to DUIs, namely, binge drinking. Once individuals engage in binge drinking, it appears that many policies designed to be deterrents have little influence. This finding is supported by Kenkel's empirical analysis of binge drinking and driving using data from a supplement to the 1985 Health Interview Survey.[32] Second, in our research, tort liability rules—contributory rather than comparative negligence, the traditional negligence rule rather than no-fault, and compulsory liability insurance coupled with experience-rating of premiums—are more effective in reducing binge drinking than are criminal sanctions. Our empirical evidence on the effect of experience rating on binge drinking is consistent with empirical evidence from other lines of insurance that shows that basing premiums on experience influences insureds' behavior in socially desirable ways.[33]

Dramshop laws show no effects on the measures used in this analysis.

[32] Donald S. Kenkel, Drinking, Driving, and Deterrence: The Effectiveness and Social Costs of Alternative Policies, 36 J. Law & Econ. 877 (1993). Kenkel used a different specification from ours. He included more criminal sanctions but did not assess effects of tort law and insurance on binge drinking and driving.

[33] See, for example, Michael J. Moore & W. Kip Viscusi, Promoting Safety through Workers' Compensation: The Efficacy and Net Wage Costs of Injury Insurance, 20 RAND J. Econ. 499 (1989); and Robert H. Topel, Experience Rating of Unemployment Insurance and the Incidence of Unemployment, 27 J. Law & Econ. 61 (1984).

In other work, Chaloupka and coauthors and we found that such laws reduced both motor vehicle and other types of alcohol-related deaths.[34] One possibility is that dramshop laws simply displace binge drinkers from commercial establishments to other locations. But if this were so, one would expect reductions in driving per binge episode, which was not observed.

Of the deterrents considered, other than tort liability and insurance, increasing alcohol prices and implementing minimum-drinking-age laws appear to be most effective. While some of the regressions imply that mandatory minimum fines deter DUIs and the number of binge-drinking episodes, responses to the length of mandatory jail terms are the strongest. But, taken as a group, the results on criminal sanctions, especially on jail terms, are too inconsistent to merit much confidence.

Finally, the model's implications are partly supported. Most important, we found evidence that penalizing harmful behavior did reduce the rate of binge drinking, which the model predicts. But we found the penalties overall have no effect on driving following binge episodes, while the model predicted that higher penalties should increase the care level per binge episode. Raising the price of bingeing, either the money price or availability through the minimum drinking age, decreased the amount of bingeing, as expected, but it also reduced the frequency of driving after bingeing, which was not predicted by the model. Possibly a low price leads to drinking habits that in turn change risk preferences, a complication beyond the scope of our static model and available data.

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