

Application: Drunk Driving Laws and Traffic Deaths

Some facts

- Approx. 40,000 traffic fatalities annually in the U.S.
- 1/3 of traffic fatalities involve a drinking driver
- 25% of drivers on the road between 1am and 3am have been drinking (estimate)
- A drunk driver is 13 times as likely to cause a fatal crash as a non-drinking driver (estimate)

Drunk driving laws and traffic deaths, ctd.

Public policy issues

- Drunk driving causes massive externalities (sober drivers are killed, society bears medical costs, etc. etc.) – there is ample justification for governmental intervention
- Are there any effective ways to reduce drunk driving? If so, what?
- What are effects of specific laws:
 - mandatory punishment
 - minimum legal drinking age
 - economic interventions (alcohol taxes)



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ROMNEY CELEBRATES THE PASSAGE OF MELANIE'S BILL

Legislation puts Massachusetts in line with federal standards for drunk driving

Governor Mitt Romney today signed into law the toughest drunk driving legislation in the Commonwealth's history.

Named in honor of 13-year-old Melanie Powell, the new law will stiffen penalties for drunk driving offenses in Massachusetts and close loopholes in the legal system that allow repeat drunk drivers to get back behind the wheel.

“Today we honor those who have lost their lives in senseless drunk driving tragedies and act to save the lives we could otherwise lose next year,” said Romney. “We have Melanie’s Law today because the citizens of the Commonwealth cared enough to make it happen.”

The new measure gives prosecutors the power to introduce certified court documents to prove that a repeat offender has been previously convicted of drunk driving. In addition, the mandatory minimum jail sentence for any individual found guilty of manslaughter by motor vehicle will be increased from 2 ½ to five years.

Repeat offenders will be required to install an interlock device on any vehicle they own or operate. These devices measure the driver’s Blood Alcohol Content (BAC) and prevent the car from starting if the driver is intoxicated. Any individual who tampers with the interlock device could face a jail sentence.

For the first time, Massachusetts will be in compliance with federal standards for drunk driving laws.

Romney was joined by Tod and Nancy Powell, the parents of Melanie Powell, and her grandfather, Ron Bersani to celebrate the passage of the new drunk driving measure.

“Today we should give thanks to all of those who have worked so hard to make this day possible,” said Bersani. “Governor Romney and the Legislative leadership have advanced the fight against repeat drunk driving to heights that seemed unattainable just six months ago.

Under the law, stiff penalties will be established for individuals who drive while drunk with a child under the age of 14 in the vehicle and those who drive with a BAC of .20 or higher, more than twice the legal limit.

Romney thanked the Legislature for enacting a tough bill that cracks down on repeat drunk driving offenders in Massachusetts.

“Public safety is one of our top priorities and Melanie’s Law will go a long way towards making our citizens and roadways safer,” said Speaker Salvatore F. DiMasi. “I commend the my colleagues in the Legislature and the Governor for taking comprehensive and quick action on this very important issue.”

“Today we are sending a powerful message that Massachusetts is serious about keeping repeat drunken drivers off the road,” said House Minority Leader Bradley H. Jones Jr. “I am proud of the Governor, Lieutenant Governor, and my legislative colleagues for joining together to pass tough laws to make our roadways safer.”

“I am pleased and proud that the Legislature did the right thing in the end and supported a Bill worthy of Melanie’s name and the sacrifices made by the Powell family and all victims of drunk drivers,” said Senator Robert L. Hedlund. “Melanie's Law will save lives and it would not have been accomplished if not for the tireless efforts and advocacy of the families.”

Representative Frank Hynes added, “I’d like to commend Ron, Tod, and Nancy for their tireless work in support of Melanie’s bill. As a family, they were able to turn the horrific tragedy in their lives into a greater measure of safety for all families on Massachusetts roadways.”

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The drunk driving panel data set
 $n = 48$ U.S. states, $T = 7$ years (1982,...,1988) (balanced)

Variables

- Traffic fatality rate (deaths per 10,000 residents)
- Tax on a case of beer (*Beertax*)
- Minimum legal drinking age
- Minimum sentencing laws for first DWI violation:
 - *Mandatory Jail*
 - *Mandatory Community Service*
 - otherwise, sentence will just be a monetary fine
- Vehicle miles per driver (US DOT)
- State economic data (real per capita income, etc.)

Why might panel data help?

- Potential OV bias from variables that vary across states but are constant over time:
 - culture of drinking and driving
 - quality of roads
 - vintage of autos on the road
 - use state fixed effects
- Potential OV bias from variables that vary over time but are constant across states:
 - improvements in auto safety over time
 - changing national attitudes towards drunk driving
 - use time fixed effects

By the way... how much do beer taxes vary?

Beer Taxes in 2005

Source: Federation of Tax Administrators

<http://www.taxadmin.org/fta/rate/beer.html>

	EXCISE TAX RATES (\$ per gallon)	SALES TAXES APPLIED	OTHER TAXES
Alabama	\$0.53	Yes	\$0.52/gallon local tax
Alaska	1.07	n.a.	\$0.35/gallon small breweries
Arizona	0.16	Yes	
Arkansas	0.23	Yes	under 3.2% - \$0.16/gallon; \$0.008/gallon and 3% off-10% on-premise tax
California	0.20	Yes	
Colorado	0.08	Yes	
Connecticut	0.19	Yes	
Delaware	0.16	n.a.	
Florida	0.48	Yes	2.67¢/12 ounces on-premise retail tax

Georgia	0.48	Yes	\$0.53/gallon local tax
Hawaii	0.93	Yes	\$0.54/gallon draft beer
Idaho	0.15	Yes	over 4% - \$0.45/gallon
Illinois	0.185	Yes	\$0.16/gallon in Chicago and \$0.06/gallon in Cook County
Indiana	0.115	Yes	
Iowa	0.19	Yes	
Kansas	0.18	--	over 3.2% - {8% off- and 10% on-premise}, under 3.2% - 4.25% sales tax.
Kentucky	0.08	Yes*	9% wholesale tax
Louisiana	0.32	Yes	\$0.048/gallon local tax
Maine	0.35	Yes	additional 5% on-premise tax

Maryland	0.09	Yes	\$0.2333/gallon in Garrett County
Massachusetts	0.11	Yes*	0.57% on private club sales
Michigan	0.20	Yes	
Minnesota	0.15	--	under 3.2% - \$0.077/gallon. 9% sales tax
Mississippi	0.43	Yes	
Missouri	0.06	Yes	
Montana	0.14	n.a.	
Nebraska	0.31	Yes	
Nevada	0.16	Yes	
New Hampshire	0.30	n.a.	
New Jersey	0.12	Yes	
New Mexico	0.41	Yes	

New York	0.11	Yes	\$0.12/gallon in New York City
North Carolina	0.53	Yes	\$0.48/gallon bulk beer
North Dakota	0.16	--	7% state sales tax, bulk beer \$0.08/gal.
Ohio	0.18	Yes	
Oklahoma	0.40	Yes	under 3.2% - \$0.36/gallon; 13.5% on-premise
Oregon	0.08	n.a.	
Pennsylvania	0.08	Yes	
Rhode Island	0.10	Yes	\$0.04/case wholesale tax
South Carolina	0.77	Yes	
South Dakota	0.28	Yes	
Tennessee	0.14	Yes	17% wholesale tax
Texas	0.19	Yes	over 4% - \$0.198/gallon, 14% on-premise and \$0.05/drink on airline sales

Utah	0.41	Yes	over 3.2% - sold through state store
Vermont	0.265	no	6% to 8% alcohol - \$0.55; 10% on-premise sales tax
Virginia	0.26	Yes	
Washington	0.261	Yes	
West Virginia	0.18	Yes	
Wisconsin	0.06	Yes	
Wyoming	0.02	Yes	
Dist. of Columbia	0.09	Yes	8% off- and 10% on-premise sales tax
U.S. Median	\$0.188		

TABLE 10.1 Regression Analysis of the Effect of Drunk Driving Laws on Traffic Deaths**Dependent variable: traffic fatality rate (deaths per 10,000).**

Regressor	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Beer tax	0.36** (0.05)	-0.66* (0.29)	-0.64+ (0.36)	-0.45 (0.30)	-0.69* (0.35)	-0.46 (0.31)	-0.93** (0.34)
Drinking age 18				0.028 (0.070)	-0.010 (0.083)		0.037 (0.102)
Drinking age 19				-0.018 (0.050)	-0.076 (0.068)		-0.065 (0.099)
Drinking age 20				0.032 (0.051)	-0.100+ (0.056)		-0.113 (0.125)
Drinking age						-0.002 (0.021)	
Mandatory jail or community service?				0.038 (0.103)	0.085 (0.112)	0.039 (0.103)	0.089 (0.164)
Average vehicle miles per driver				0.008 (0.007)	0.017 (0.011)	0.009 (0.007)	0.124 (0.049)
Unemployment rate				-0.063** (0.013)		-0.063** (0.013)	-0.091** (0.021)
Real income per capita (logarithm)				1.82** (0.64)		1.79** (0.64)	1.00 (0.68)
Years	1982-88	1982-88	1982-88	1982-88	1982-88	1982-88	1982 & 1988 only
State effects?	no	yes	yes	yes	yes	yes	yes
Time effects?	no	no	yes	yes	yes	yes	yes
Clustered standard errors?	no	yes	yes	yes	yes	yes	yes

F-Statistics and p-Values Testing Exclusion of Groups of Variables

Time effects = 0	4.22 (0.002)	10.12 (< 0.001)	3.48 (0.006)	10.28 (< 0.001)	37.49 (< 0.001)		
Drinking age coefficients = 0		0.35 (0.786)	1.41 (0.253)		0.42 (0.738)		
Unemployment rate, income per capita = 0		29.62 (< 0.001)		31.96 (< 0.001)	25.20 (< 0.001)		
\bar{R}^2	0.091	0.889	0.891	0.926	0.893	0.926	0.899

These regressions were estimated using panel data for 48 U.S. states. Regressions (1) through (6) use data for all years 1982 to 1988, and regression (7) uses data from 1982 and 1988 only. The data set is described in Appendix 10.1. Standard errors are given in parentheses under the coefficients, and *p*-values are given in parentheses under the *F*-statistics. The individual coefficient is statistically significant at the ⁺10%, *5%, or **1% significance level.

Empirical Analysis: Main Results

- Sign of the beer tax coefficient changes when fixed state effects are included
- Time effects are statistically significant but including them doesn't have a big impact on the estimated coefficients
- Estimated effect of beer tax drops when other laws are included.
- The only policy variable that seems to have an impact is the tax on beer – not minimum drinking age, not mandatory sentencing, etc. – however the beer tax is not significant even at the 10% level using clustered SEs in the specifications which control for state economic conditions (unemployment rate, personal income)

Empirical results, ctd.

- In particular, the minimum legal drinking age has a small coefficient which is precisely estimated – reducing the MLDA doesn't seem to have much effect on overall driving fatalities.
- What are the threats to internal validity? How about:
 1. Omitted variable bias
 2. Wrong functional form
 3. Errors-in-variables bias
 4. Sample selection bias
 5. Simultaneous causality bias

What do you think?

Digression: extensions of the “ $n-1$ binary regressor” idea

The idea of using many binary indicators to eliminate omitted variable bias can be extended to non-panel data – the key is that the omitted variable is constant for a group of observations, so that in effect it means that each group has its own intercept.

Example: Class size effect.

Suppose funding and curricular issues are determined at the county level, and each county has several districts. If you are worried about OV bias resulting from unobserved county-level variables, you could include county effects (binary indicators, one for each county, omitting one county to avoid perfect multicollinearity).

Summary: Regression with Panel Data

Advantages and limitations of fixed effects regression

Advantages

- You can control for unobserved variables that:
 - vary across states but not over time, and/or
 - vary over time but not across states
- More observations give you more information
- Estimation involves relatively straightforward extensions of multiple regression

- Fixed effects regression can be done three ways:
 1. “Changes” method when $T = 2$
 2. “ $n-1$ binary regressors” method when n is small
 3. “Entity-demeaned” regression
- Similar methods apply to regression with time fixed effects and to both time and state fixed effects
- Statistical inference: like multiple regression.

Limitations/challenges

- Need variation in X over time within entities
- Time lag effects can be important – we didn’t model those in the beer tax application but they could matter
- You need to use clustered standard errors to guard against the often-plausible possibility u_{it} is autocorrelated