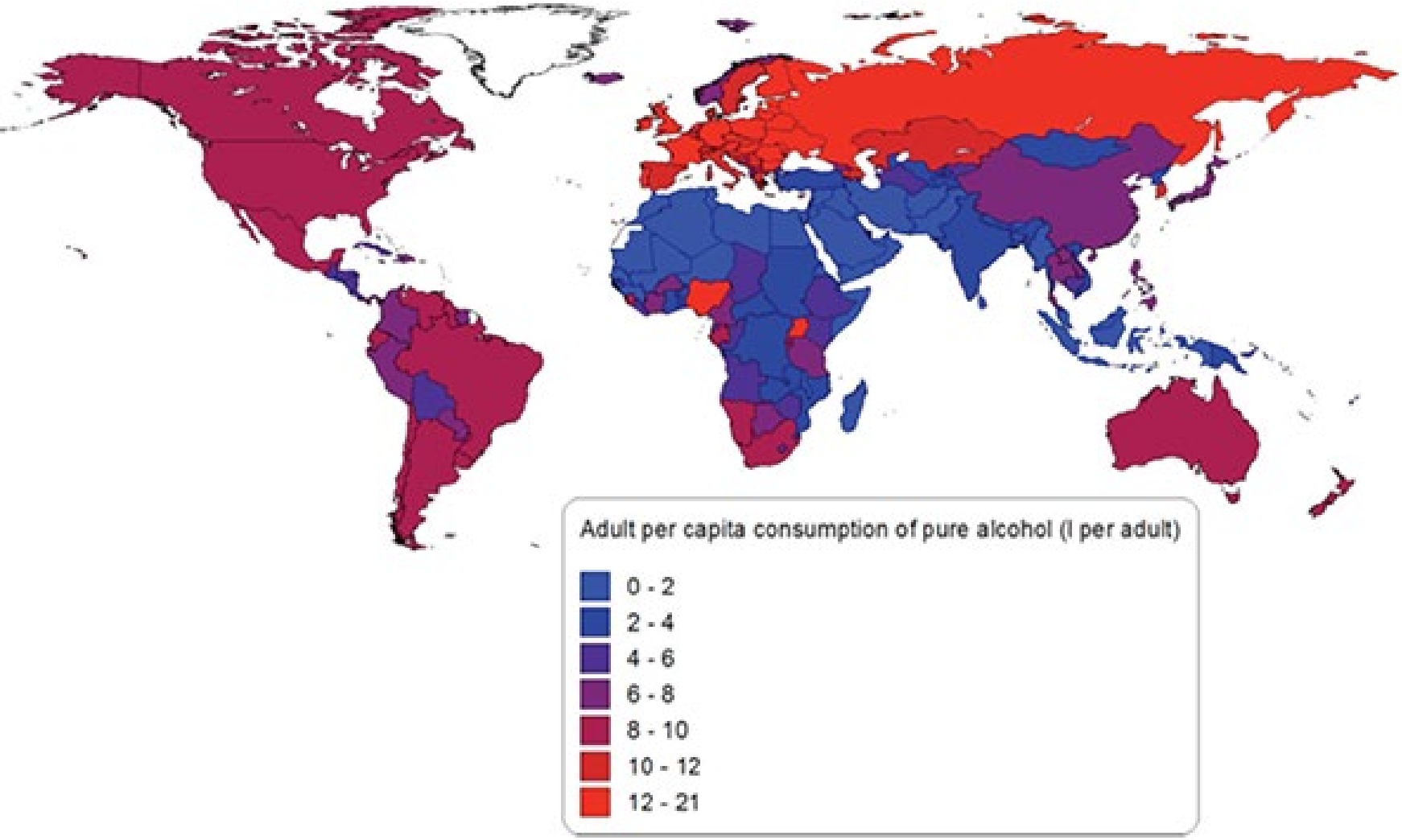
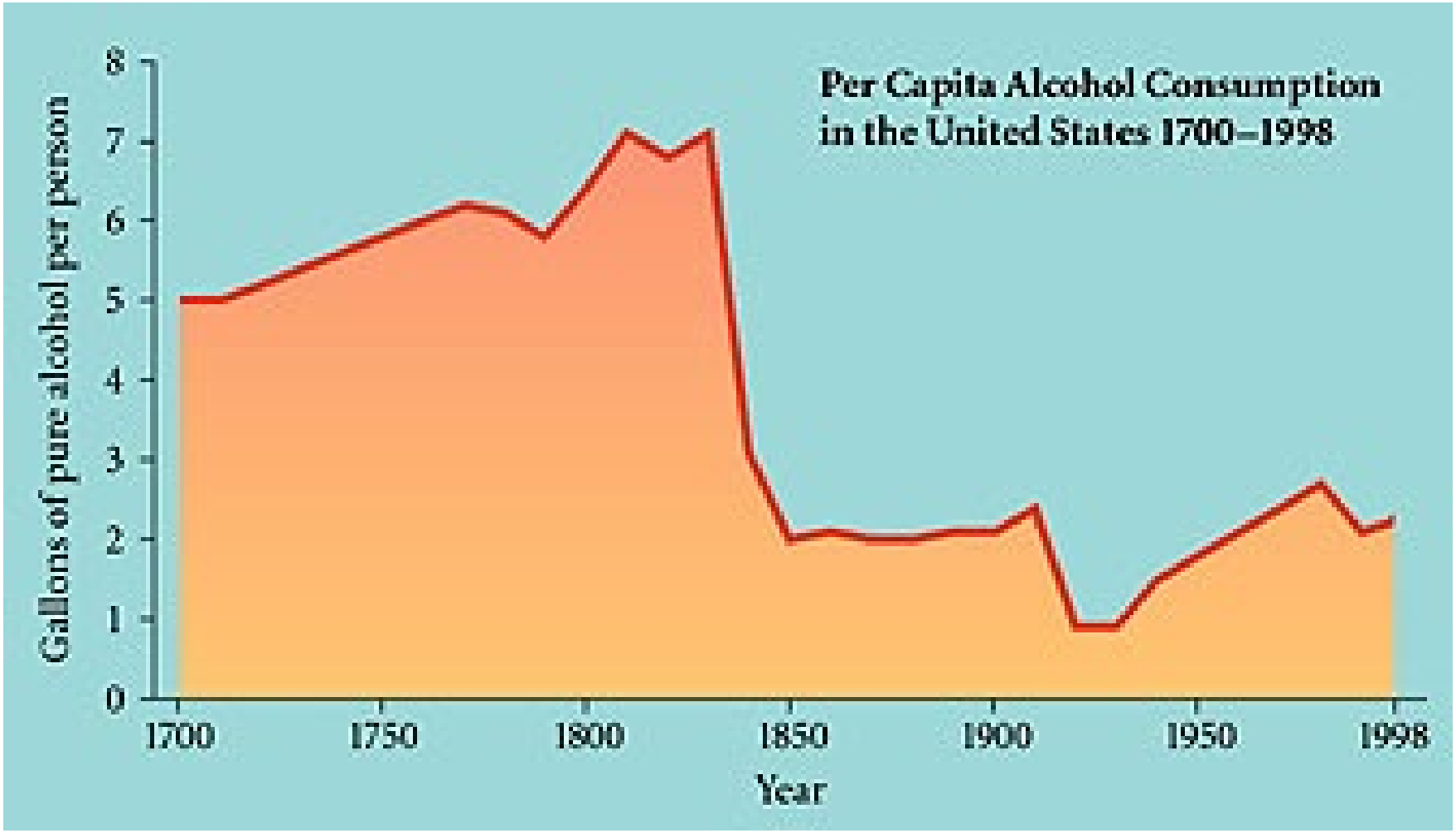
ECNS 316

Lecture 11

The Effect of Alcohol on Health, Risky Behaviors, and Crime



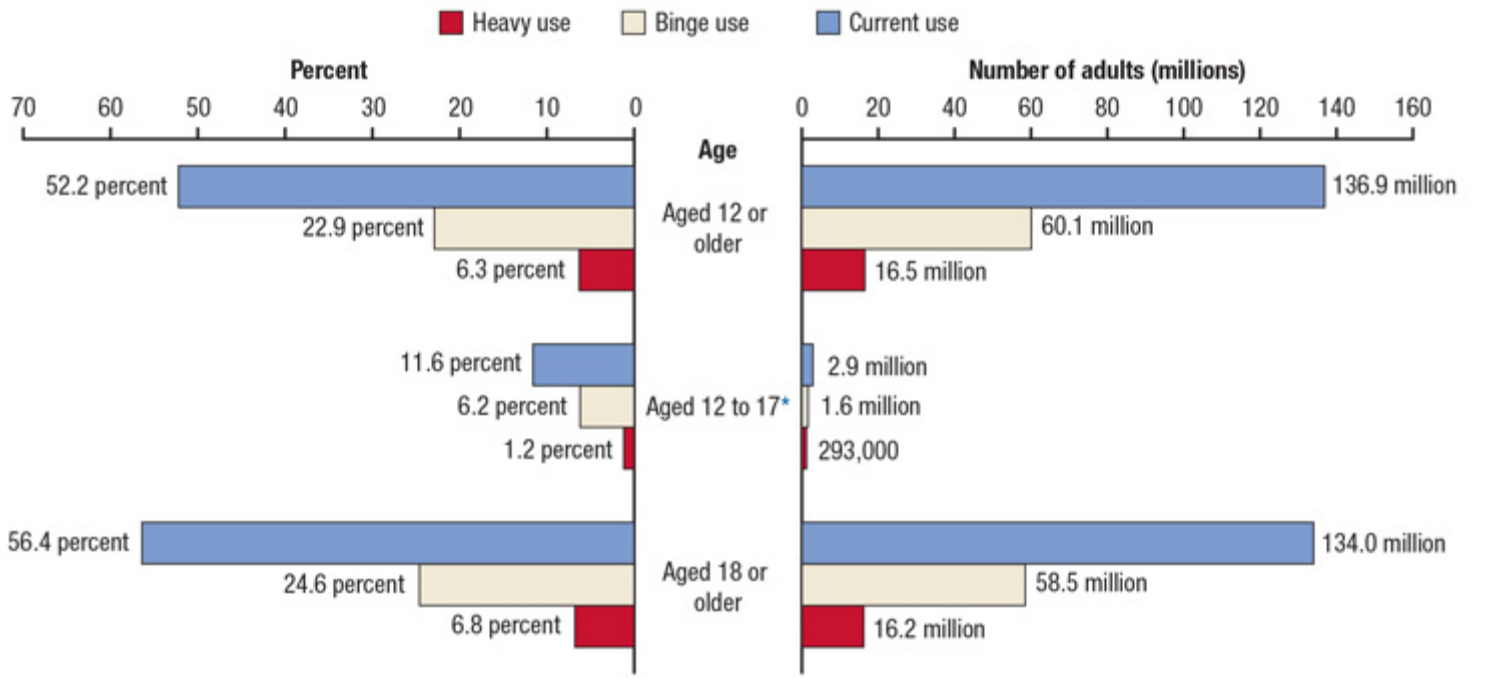
Source: Rehm, Jürgen and Kevin D. Shield. 2013. “Alcohol and Mortality: Global Alcohol-Attributable Deaths From Cancer, Liver Cirrhosis, and Injury in 2010.” *Alcohol Research: Current Reviews*, 35 (2): 174-183.



Adapted from David F. Musto's Alcohol in American History, Scientific American, April 1996

"If I take a settler after my coffee, a cooler at nine, a bracer at ten, a whetter at eleven and two or three stiffners during the forenoon, who has any right to complain?" –A Georgia gentleman from the Colonial era

Figure 1. Alcohol use in the past month among individuals aged 12 or older: 2013



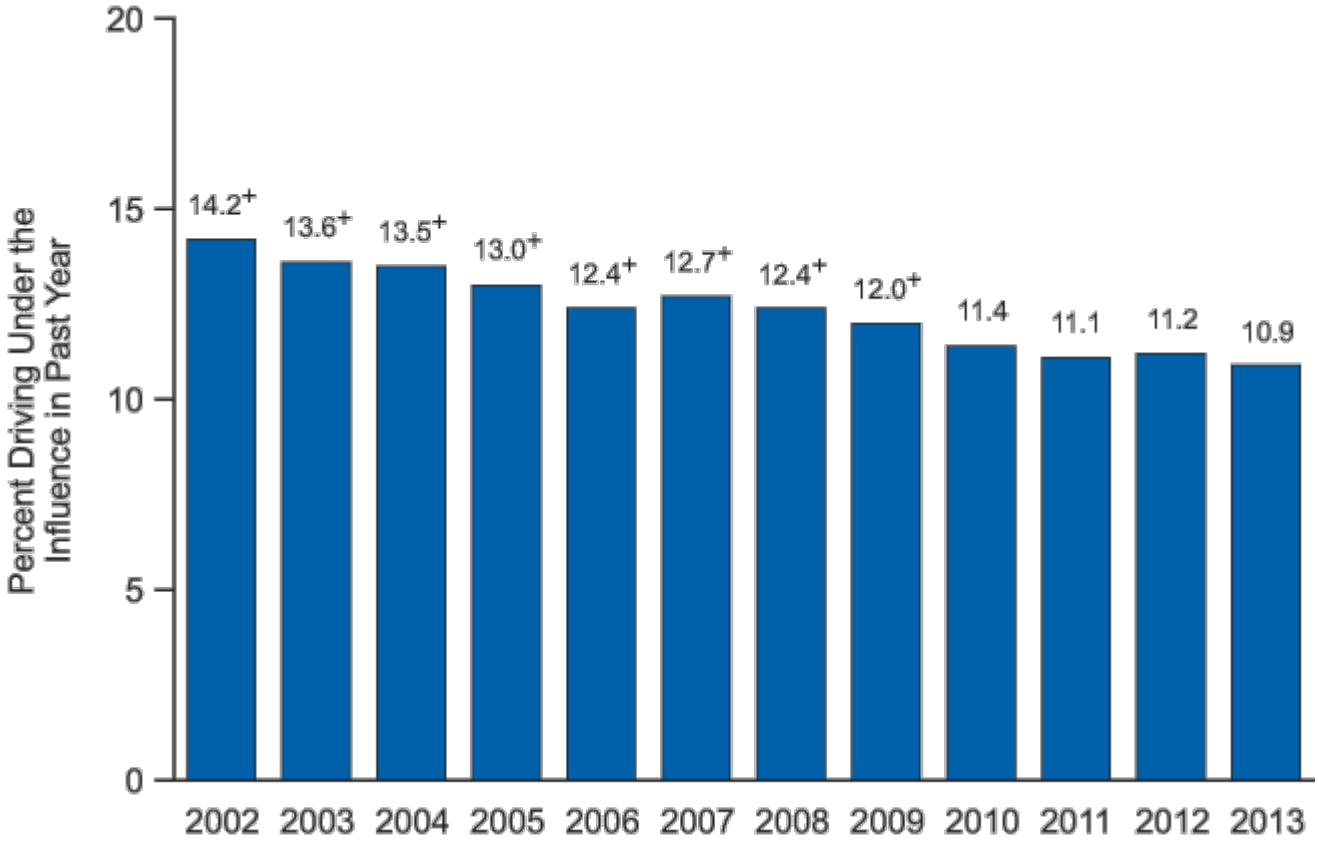
* The percentage and estimated number of adolescents aged 12 to 17 who were heavy alcohol users were 1.2 percent and 293,000 adolescents.

Source: SAMHSA, Center for Behavioral Health Statistics and Quality, National Survey on Drug Use and Health (NSDUH), 2013.

Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings

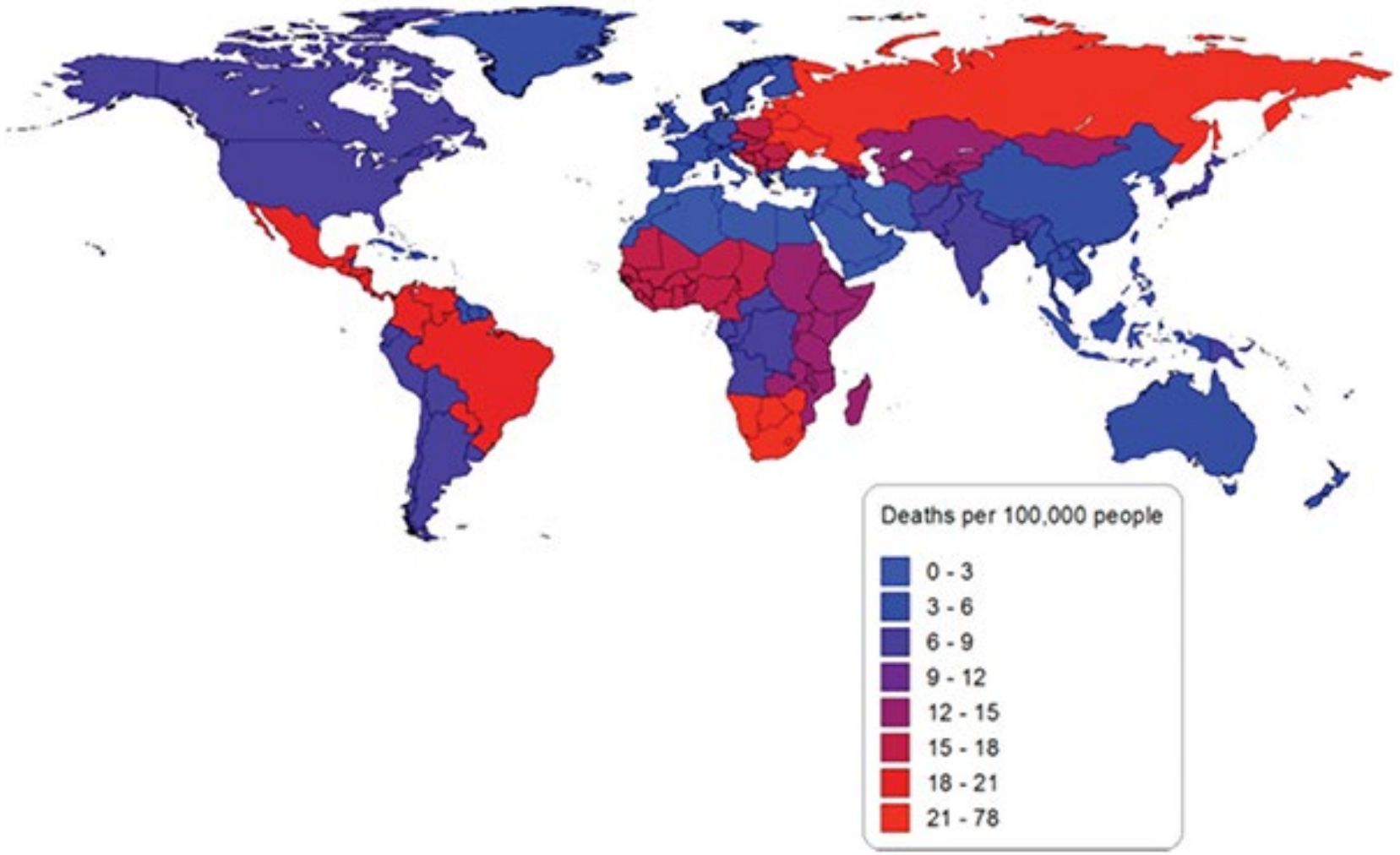
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Substance Abuse and Mental Health Services Administration

Figure 3.5 Driving Under the Influence of Alcohol in the Past Year among Persons Aged 12 or Older: 2002-2013



Results from the 2013 National Survey on Drug Use and Health: Summary of National Findings

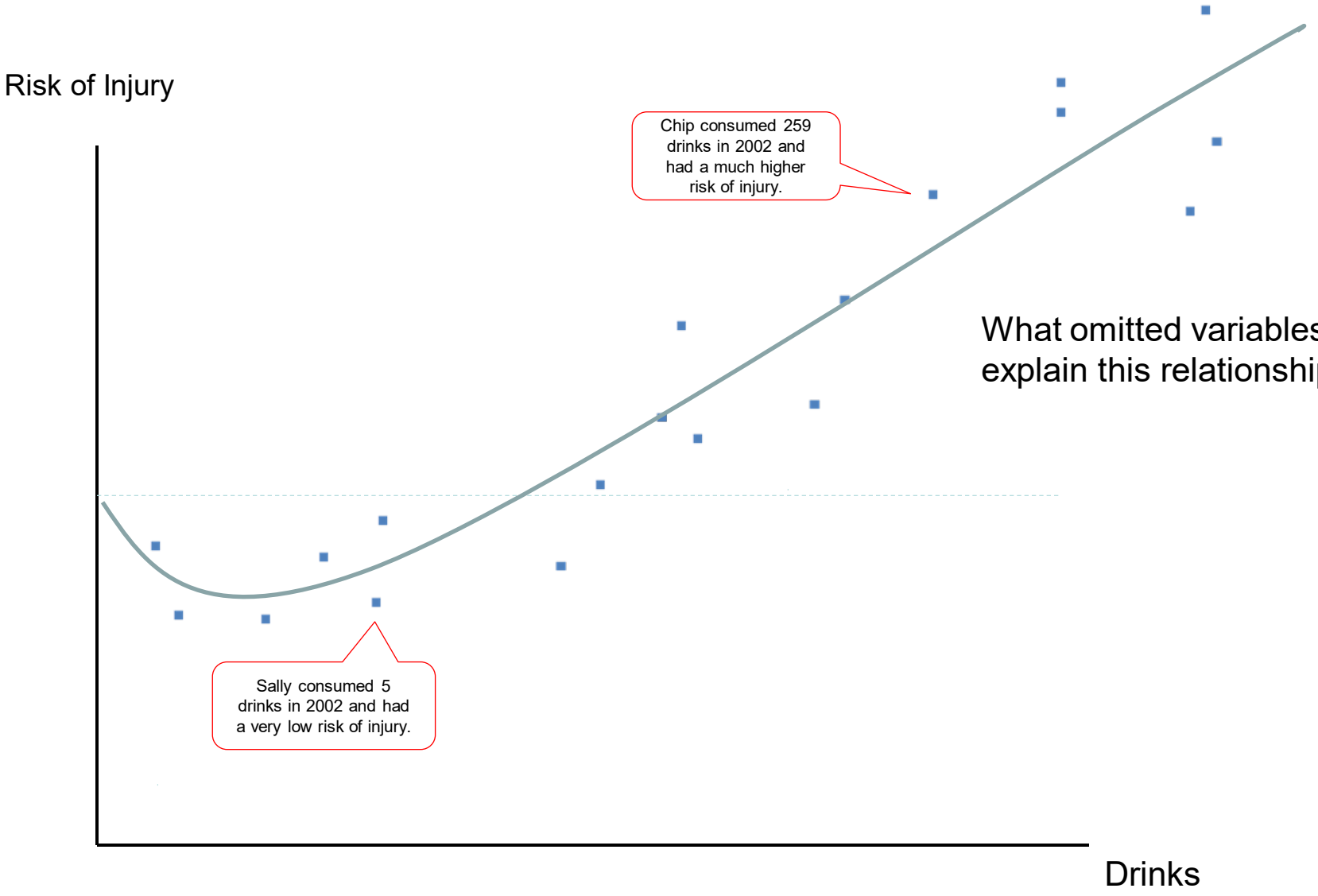
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Substance Abuse and Mental Health Services Administration



Source: Rehm, Jürgen and Kevin D. Shield. 2013. “Alcohol and Mortality: Global Alcohol-Attributable Deaths From Cancer, Liver Cirrhosis, and Injury in 2010.” *Alcohol Research: Current Reviews*, 35 (2): 174-183.

Alcohol consumption has long been recognized as a risk factor for mortality. By combining data on alcohol per capita consumption, alcohol-drinking status and alcohol-drinking patterns, risk relationships, and mortality, the Comparative Risk Assessment Study estimated alcohol-attributable mortality for 1990 and 2010. Alcohol-attributable cancer, liver cirrhosis, and injury were responsible for the majority of the burden of alcohol-attributable mortality in 1990 and 2010. In 2010, alcohol-attributable cancer, liver cirrhosis, and injury caused 1,500,000 deaths (319,500 deaths among women and 1,180,500 deaths among men) and 51,898,400 potential years of life lost (PYLL) (9,214,300 PYLL among women and 42,684,100 PYLL among men). This represents 2.8 percent (1.3 percent for women and 4.1 percent for men) of all deaths and 3.0 percent (1.3 percent for women and 4.3 percent for men) of all PYLL in 2010. The absolute mortality burden of alcohol-attributable cancer, liver cirrhosis, and injury increased from 1990 to 2010 for both genders. In addition, the rates of deaths and PYLL per 100,000 people from alcohol-attributable cancer, liver cirrhosis, and injury increased from 1990 to 2010 (with the exception of liver cirrhosis rates for women). Results of this paper indicate that alcohol is a significant and increasing risk factor for the global burden of mortality.

--Rehm and Shield (2013, p. 174).



What omitted variables could explain this relationship?

$$Risk\ of\ Injury_i = \alpha_0 + \alpha_1 Drinks_i + \alpha_2 DrinksSquared_i + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots \beta_k X_{ki\ t} + \varepsilon_i$$

Much of the econometric research of survey data has focused on estimating the ("first-stage") effect of taxes on drinking by teenagers and young adults. Teenagers and young adults are of special concern for several reasons:

- First, they exhibit relatively high rates of binge drinking and involvement in motor vehicle accidents and violent crime.

- Second, to the extent that drinking is habit forming, drinking before the age of 21 determines later consumption.

- Third, drinking behavior during the transition from adolescence to adulthood may have consequences for human capital accumulation. We'll talk about this issue towards the end of the semester.

Proportion of respondents who drank: states that increased their beer tax vs. states that did not.

	Tax Increase (u_s = 1)	No Tax Increase (u_s = 0)
1989 (v_t = 0)	.4620	.6620
1992 (v_t = 1)	.3564	.5848
Difference (1992-1989)	-.1056	-.0772

The difference-in-differences (DD) estimate = -.0284 (the difference between -.1056 and -.0772).

Dee (1999) used this approach to examine the effect of beer taxes on teen drinking.

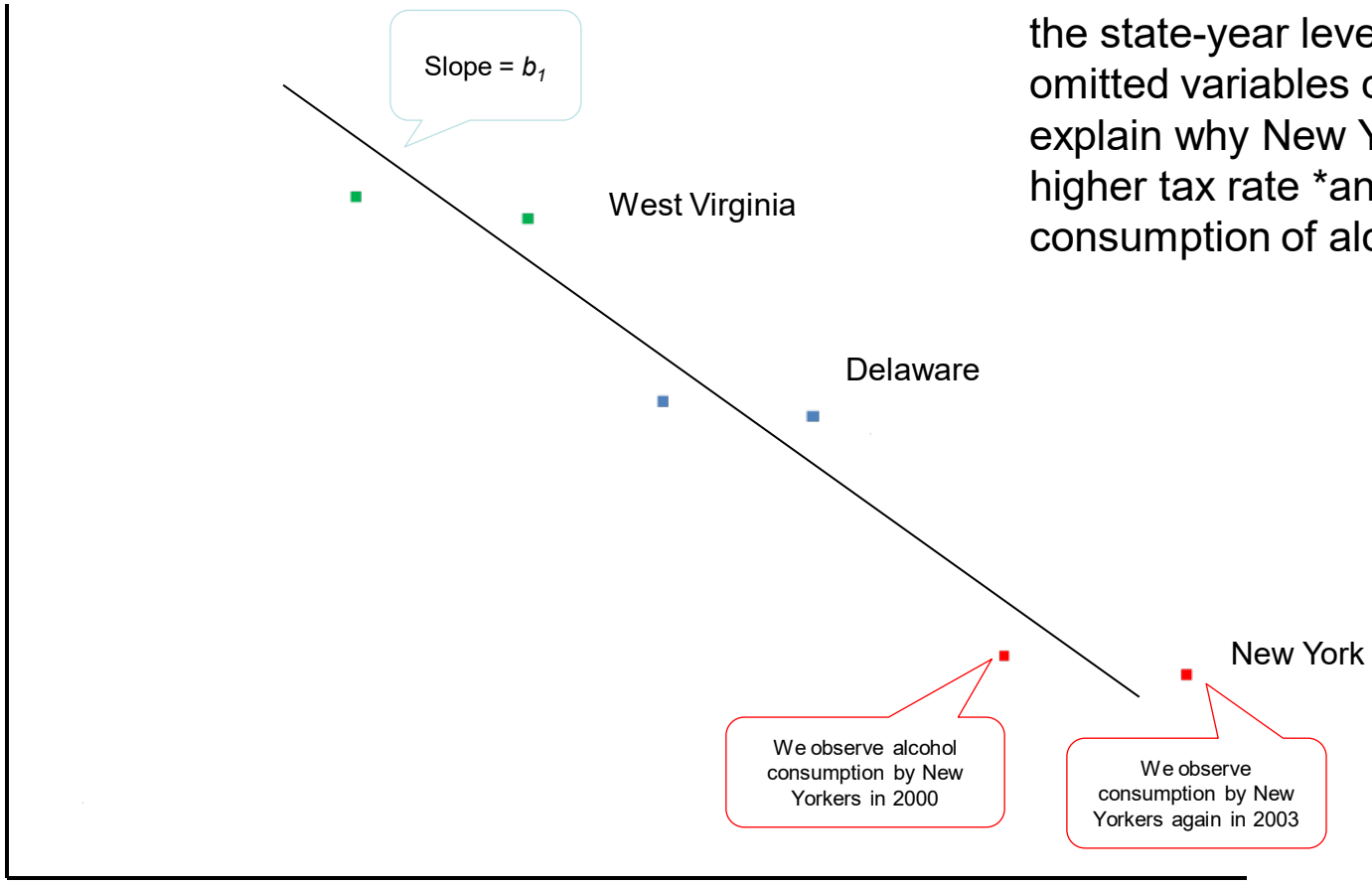
$$Drinker_{ist} = \alpha_0 + \alpha_1 Tax_{st} + \beta_1 X_{1ist} + \delta_s + \pi_t + \varepsilon_{ist}$$

He found little evidence of a relationship between beer taxes and teen alcohol consumption and little evidence of an effect on teen traffic fatalities.

Reference

Dee, Thomas. 1999. “State Alcohol Policies, Teen Drinking and Traffic Fatalities.” *Journal of Public Economics*, 72(2): 289-315.

Av. Drinks Consumed

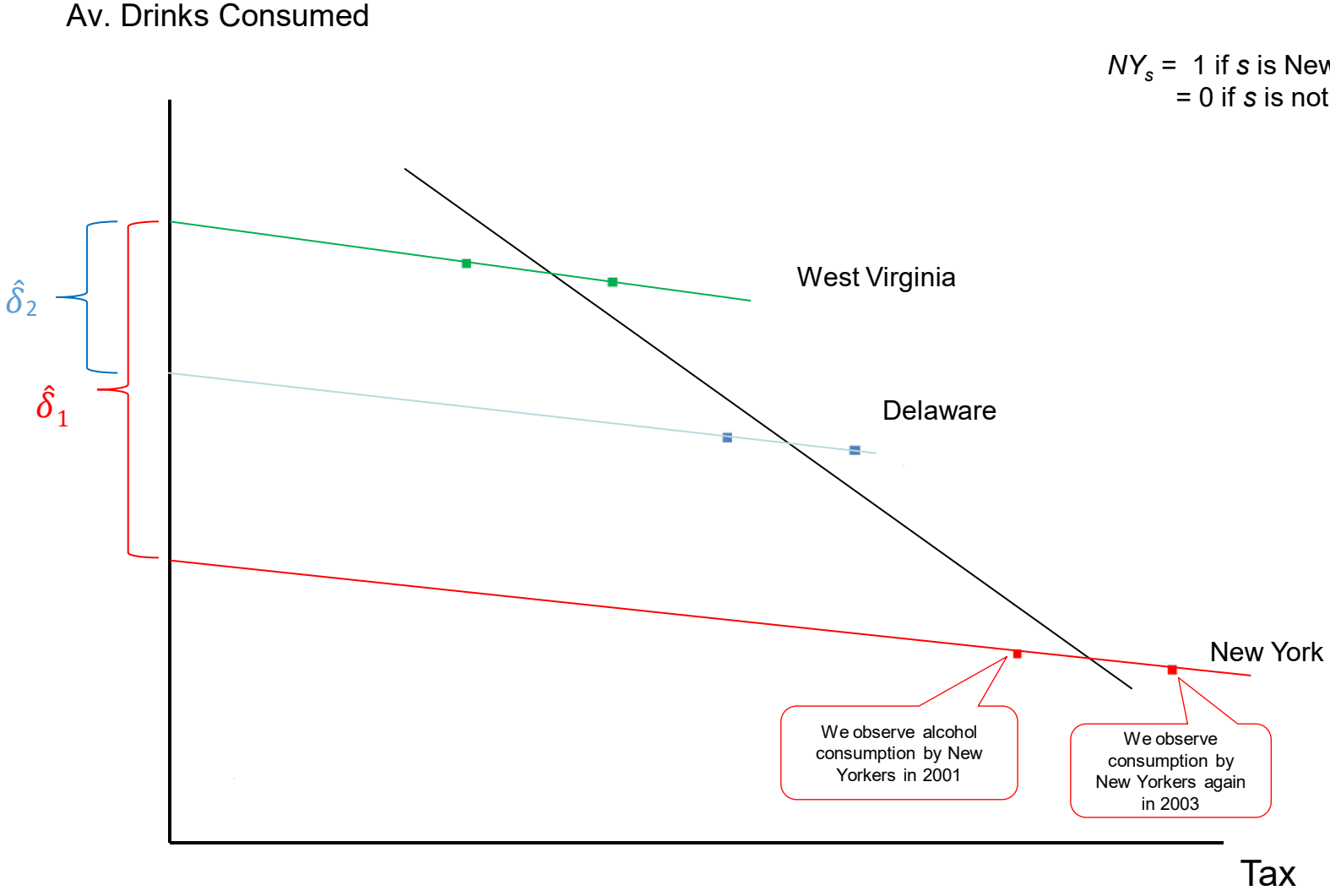


Taxes are a plausible instrument. Start with data at the state-year level. What omitted variables could explain why New York has a higher tax rate *and* lower consumption of alcohol?

$$Drinks_{st} = \beta_0 + \beta_1 Tax_{st} + \varepsilon_{st}$$

Step 1: Establish a relationship between drinking and plausibly exogenous policy.

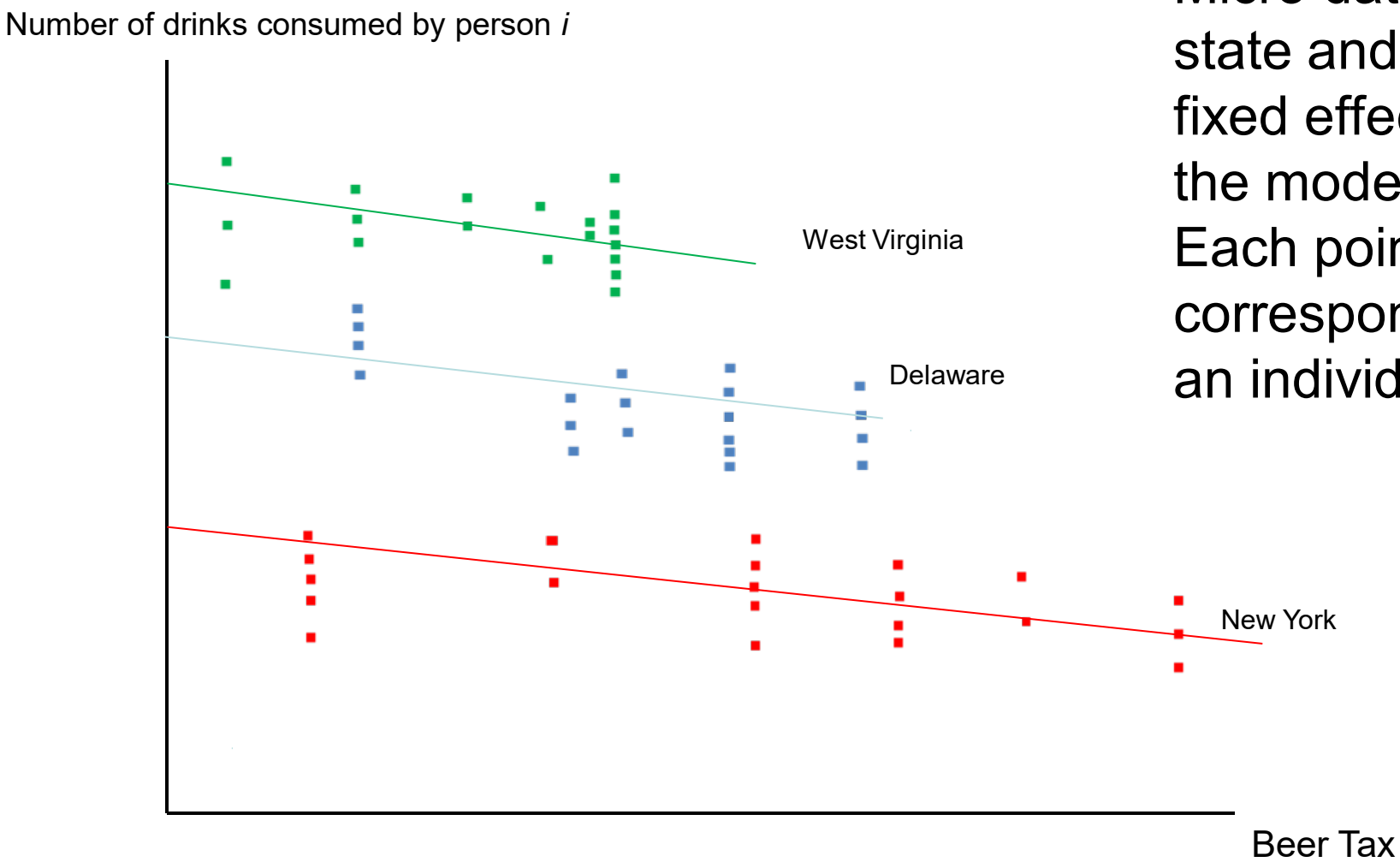
Step 2: Examine the relationship between the exogenous policy and health outcome (risk of injury).



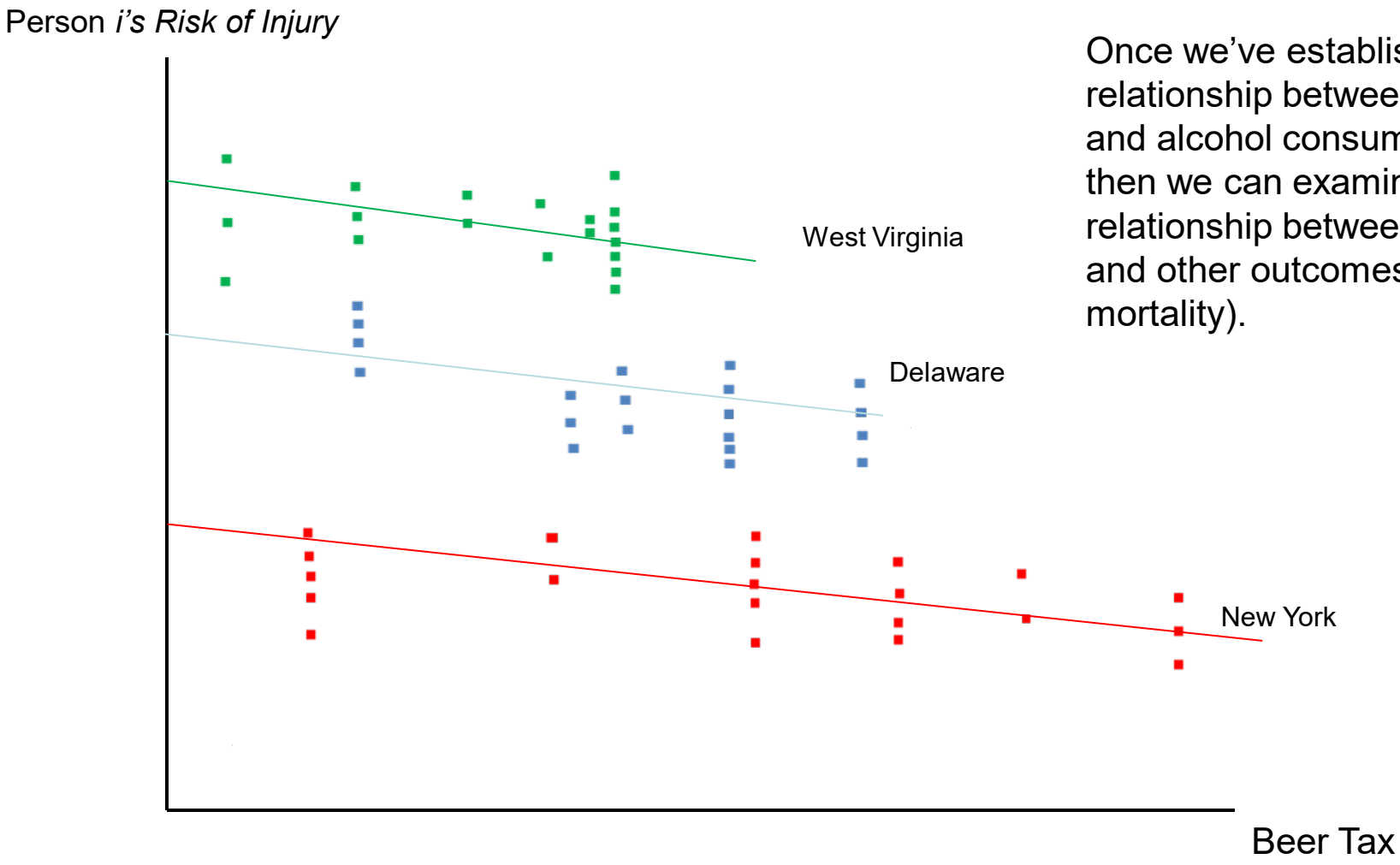
$$Drinks_{st} = \alpha_0 + \alpha_1 Tax_{st} + \delta_1 NY_s + \delta_2 DE_s + \varepsilon_{st}$$

$$Drinks_{st} = \alpha_0 + \alpha_1 Tax_{st} + \delta_s + \varepsilon_{st}$$

Micro data with state and year fixed effects in the model. Each point corresponds to an individual.



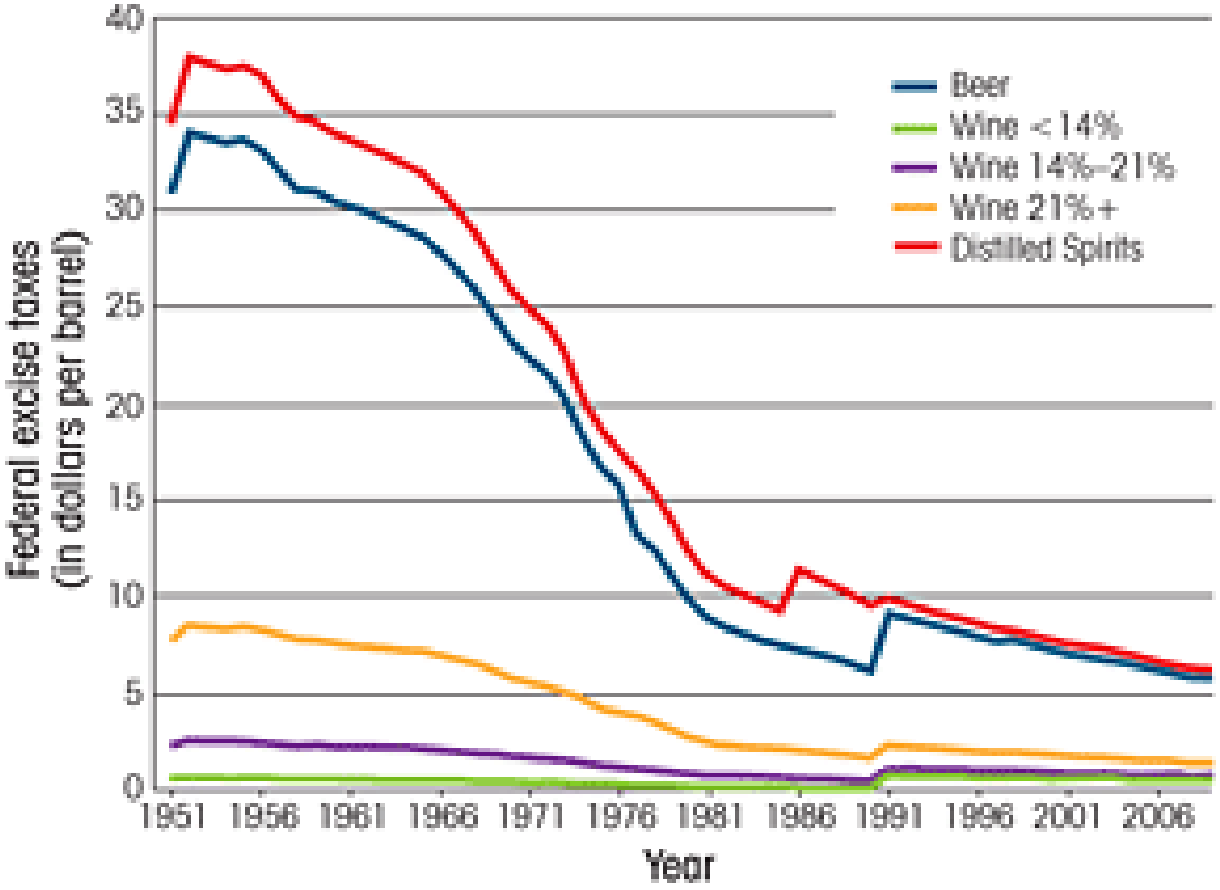
$$Drinks_{ist} = \alpha_0 + \alpha_1 Tax_{st} + \beta_1 X_{1ist} + \beta_2 X_{2ist} + \delta_s + \pi_t + \varepsilon_{ist}$$



Once we've established a relationship between taxes and alcohol consumption, then we can examine the relationship between taxes and other outcomes (e.g., mortality).

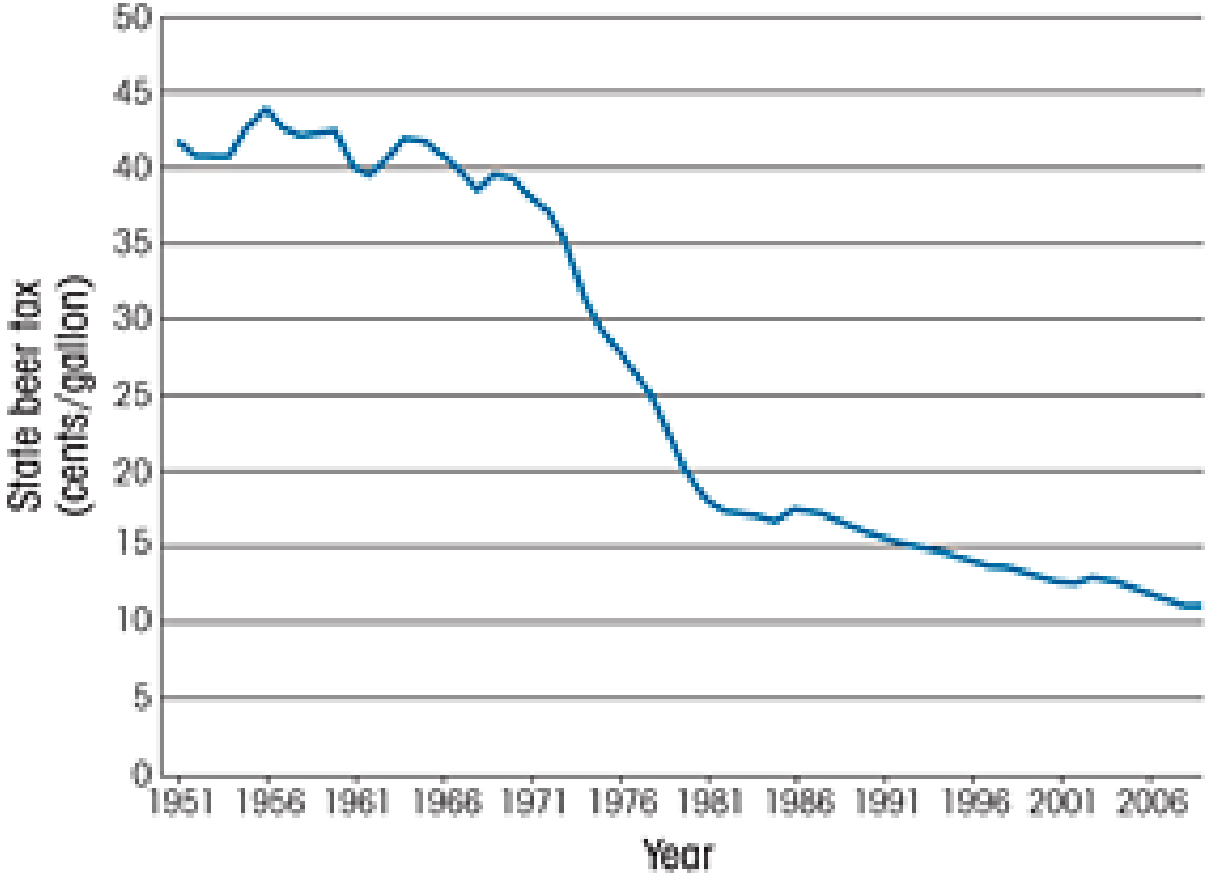
$$Risk\ of\ Injury_{ist} = \alpha_0 + \alpha_1 Tax_{st} + \beta_1 X_{1ist} + \beta_2 X_{2ist} + \delta_s + \pi_t + \varepsilon_{ist}$$

Figure 1 Average real Federal excise taxes (in dollars per barrel) on alcoholic beverages 1951–2009



SOURCE: U.S. Department of Treasury, Alcohol and Tobacco Tax and Trade Bureau. Historical tax rates

Figure 2 Average real State taxes on beer tax 1951–2009



SOURCE: Brewers Almanac 2009: Beer Institute.

A Review by Xu and Chaloupka

Xu and Chaloupka (2011) wrote:

State excise taxes, for the most part, have followed the same patterns as Federal taxes, with only infrequent and modest increases that have resulted in substantial declines over time in the real values of these taxes…More than 20 States have not raised their beer taxes for at least 20 years, and only about 10 States have raised them in the last decade.

They concluded:

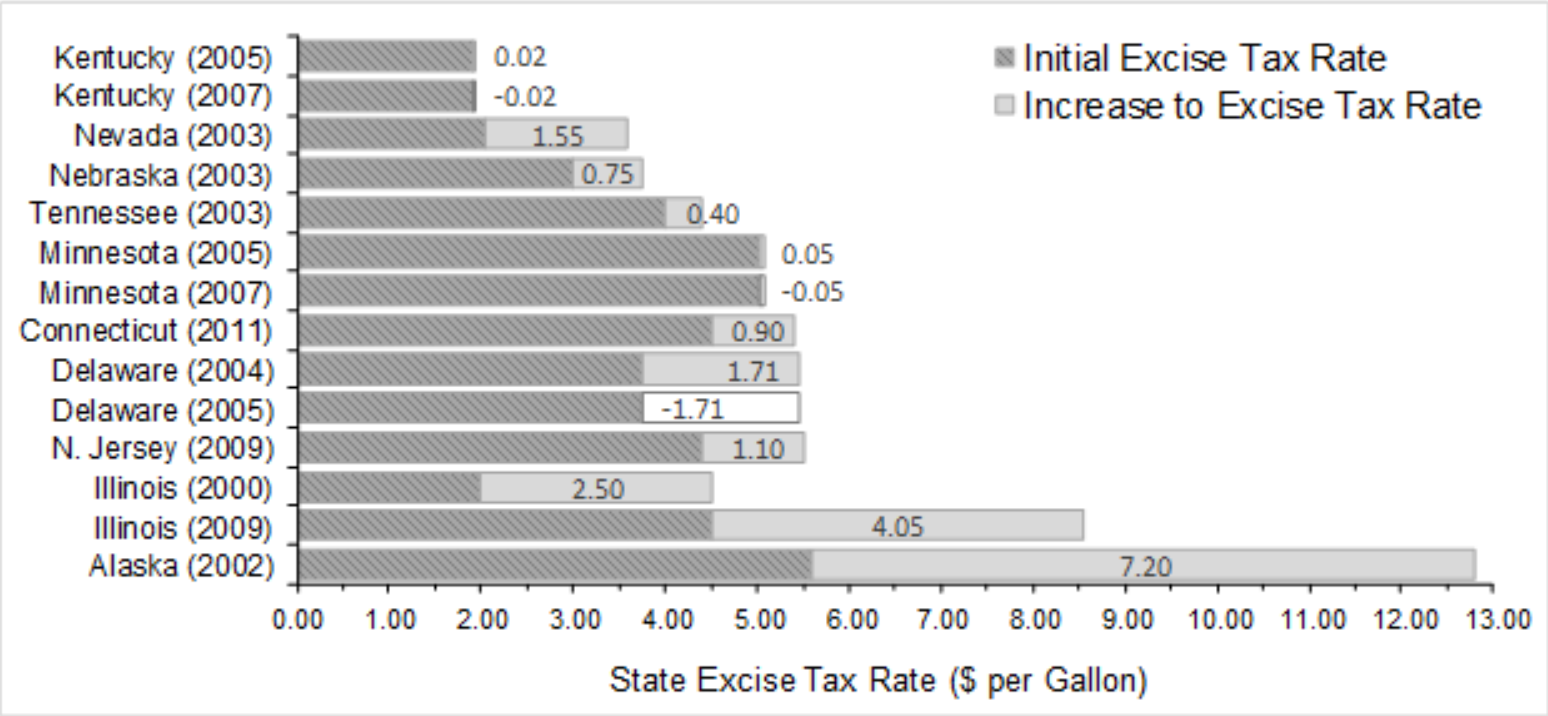
The vast majority of…studies provide strong evidence supporting efforts to raise Federal or State taxes to promote public health by reducing drinking, including abusive drinking and its consequences. More importantly, these studies clearly indicate that adolescents and youth are more responsive to changes in prices than the general population, implying that the implementation of tax policies not only could produce immediate public health benefits but achieve even greater success in the long run

But this too strong. Because there is so little within-state variation in taxes, and because state tax rates on alcohol are so low, it is difficult to predict what would happen if a state were to increase its tax rate substantially.

Are there any specific tax hikes that might serve as a good natural experiment?

- On September 1, 2009 the Illinois liquor tax went from $4.50 to $8.55 per gallon, the Illinois wine tax went from $0.73 to $1.39 per gallon, and the Illinois beer tax went from $0.185 to $0.231 per gallon.
- These increases were clearly motivated by budgetary as opposed to public health concerns and were quite large by historical standards.
- The Illinois alcohol tax increase can be thought of as a natural experiment, affording us the opportunity to estimate the impact of a potentially important policy lever.

Figure 1: Changes in State Excise Tax Rates on Spirits from 2000 to 2012



Source: The Tax Foundation (http://taxfoundation.org).
Note: The numbers inside the bars indicated the change in the State's excise tax rate.

Figure 1: Monthly Spirit Sales in Illinois (2007 - 2012)

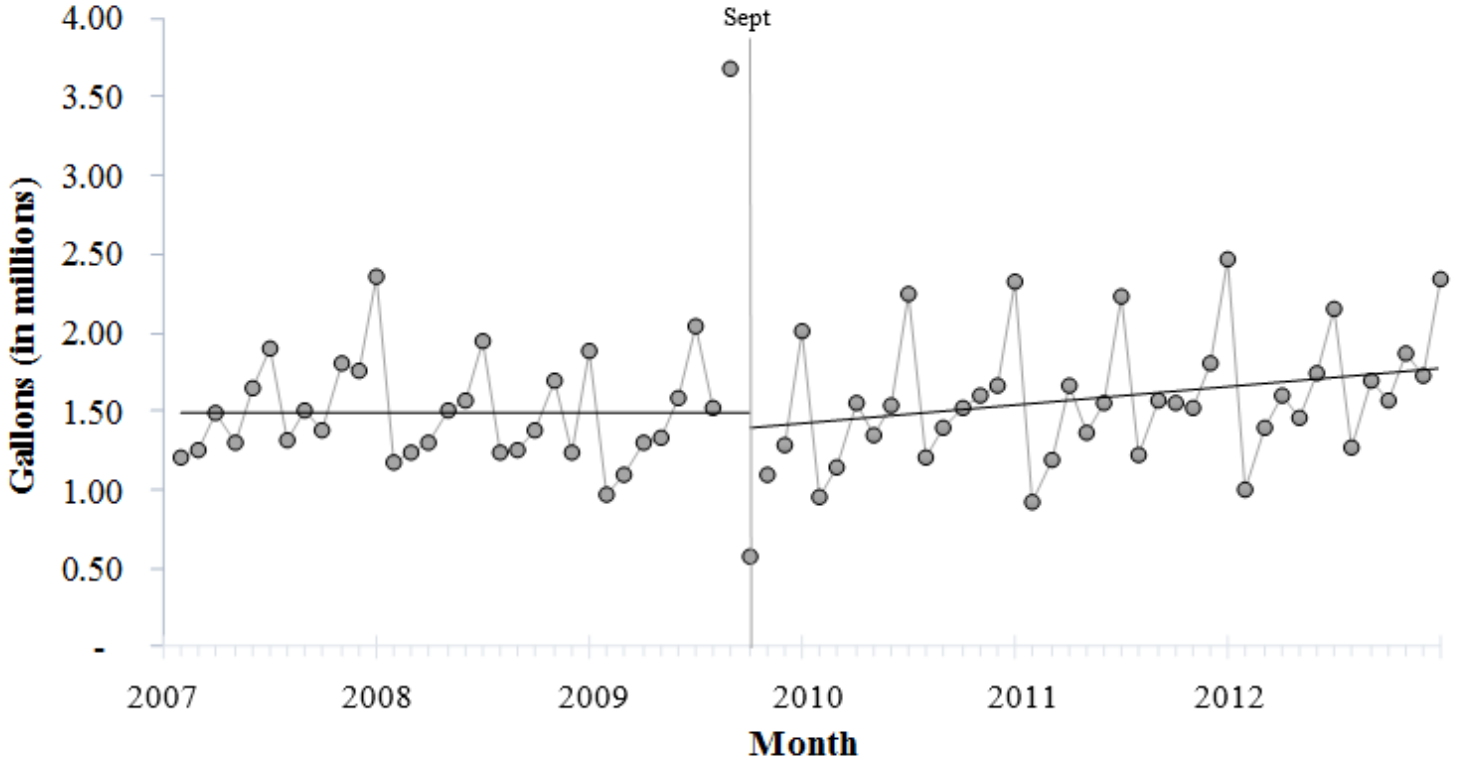
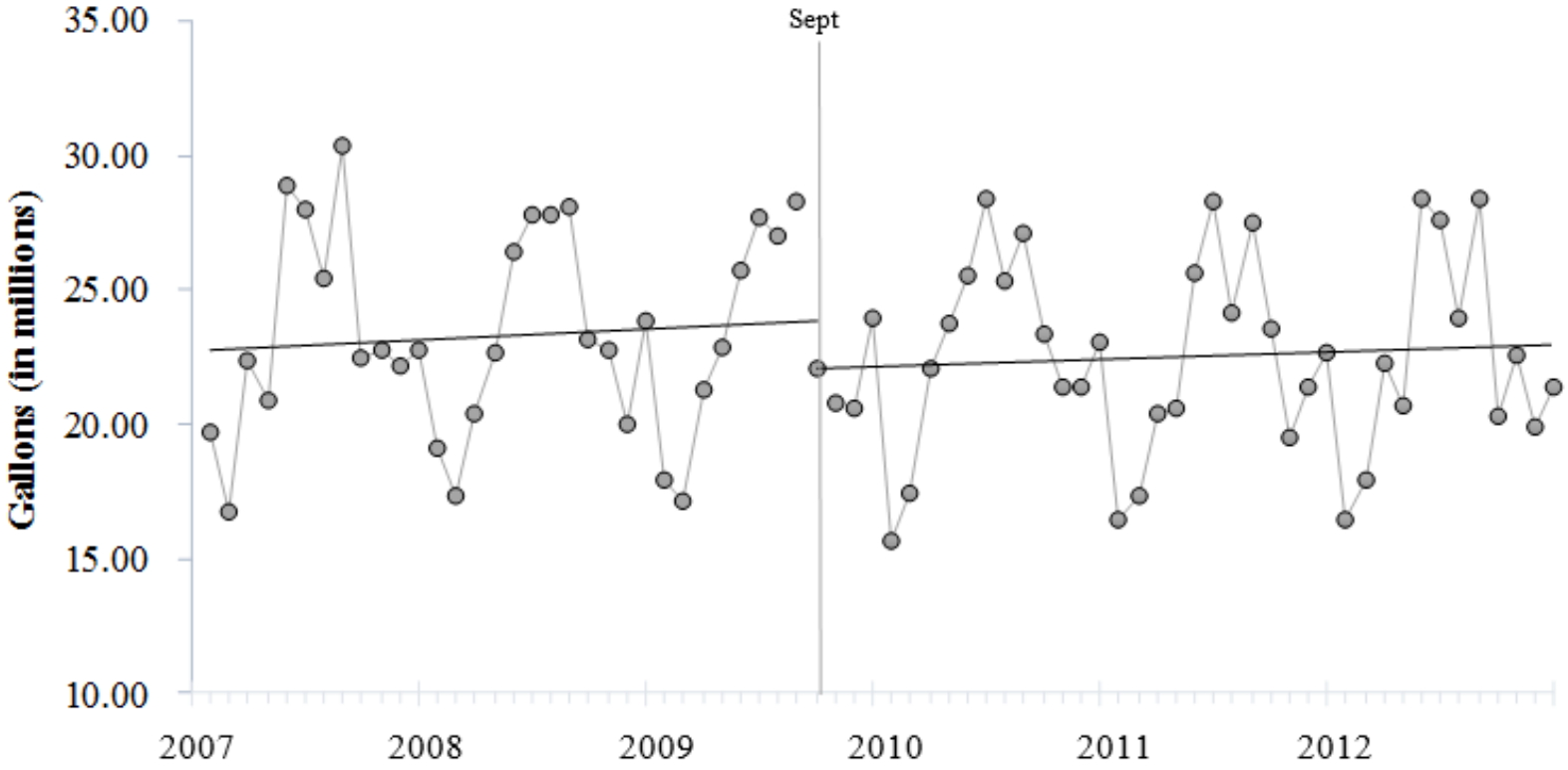


Figure 2: Monthly Beer Sales in Illinois (2007 - 2012)



If Taxes Aren't of Much Use…

As economists, we are interested in understanding how much of the strong observed relationship between drinking and adverse health outcomes (e.g. risk of injury) is causal.

Taxes are not a good instrument for the reasons we just discussed, but the Minimum Legal Drinking Age (MLDA) has promise…

RD Estimates of the Relationship between the MLDA and Drinking

Carpenter and Dobkin (2009, 2011) used the fact that the **"full price"** of alcohol falls discontinuously in the United States at age 21 and Regression Discontinuity (RD) methods to show the relationship between drinking and a variety of health outcomes

References

Carpenter, Christopher and Carlos Dobkin. 2009. "The Effect of Alcohol Consumption on Mortality: Regression Discontinuity Evidence from the Minimum Drinking Age." *American Economic Journal: Applied Economics*, 1(1): 164-182.

Carpenter, Christopher and Carlos Dobkin. 2011. "The Minimum Legal Drinking Age and Public Heath" 2011. *Journal of Economic Perspectives*, 25(2): 133-156.

Carpenter, Christopher and Carlos Dobkin. 2015. "The Minimum Legal Drinking Age and Crime." *Review of Economics and Statistics*, 97(2): 521-524**. (required reading)**

RD Model

Linear in age interacted with a dummy for over age 21

$$Y_i = \alpha_0 + \alpha_1 Z_i + \alpha_2 AGE_i + \alpha_3 Z_i * AGE_i + \alpha_4 Birthday_i + \varepsilon_i$$

Y_i = outcome

Z_i = dummy variable =1 if age ≥ 21

$Birthday_i$ = 1 if i was interviewed on or immediately after their 21st birthday

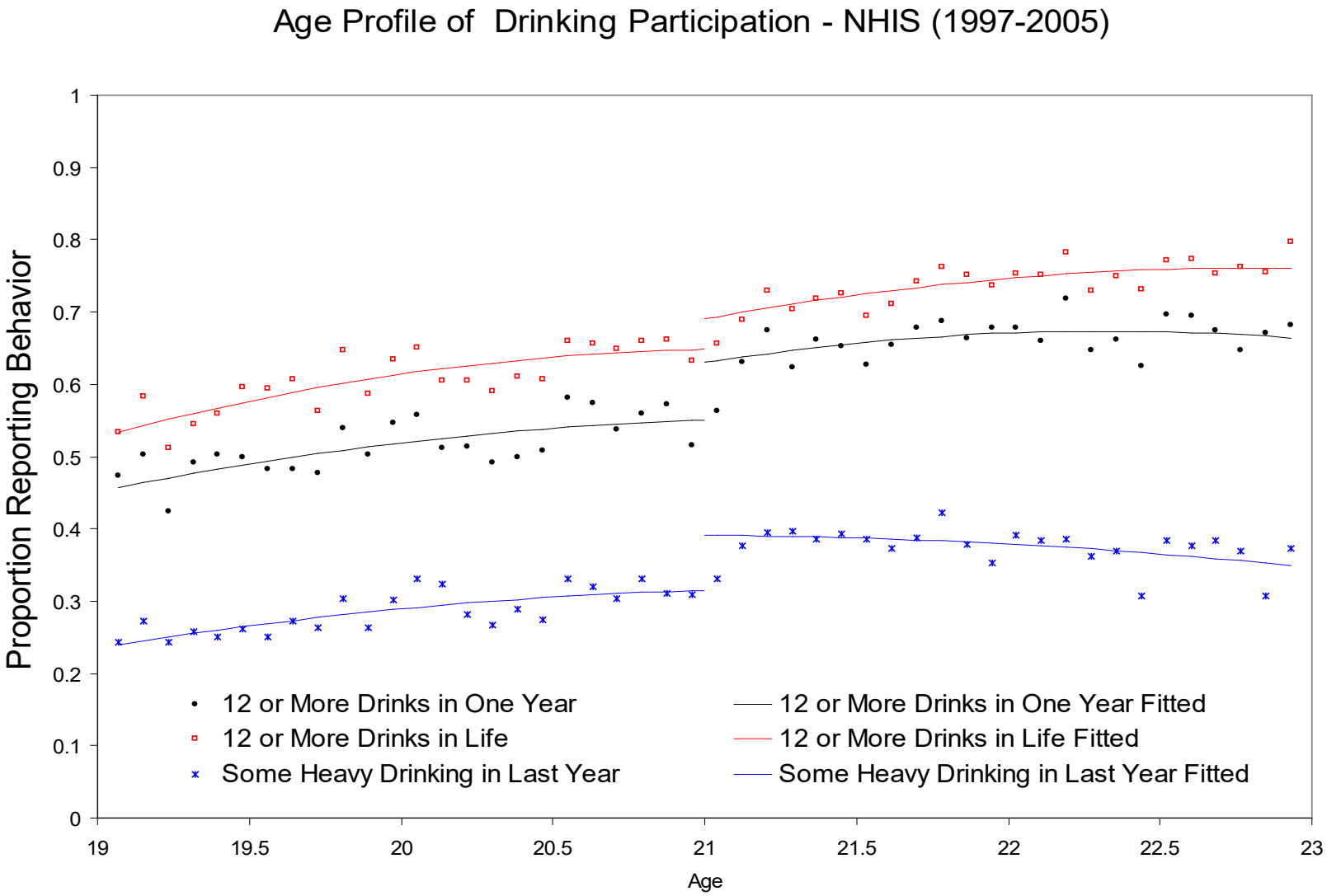
Can add Xs to the model, but shouldn't matter.

Data Used by Carpenter and Dobkin (2009)

- 1997-2005 National Health Interview Survey (Sample Adult Supplement)
  - 16,107 Adults 19-22 Years of Age
  - Date of birth and date of interview
  - Questions about lifetime drinking, past year drinking participation, heavy drinking

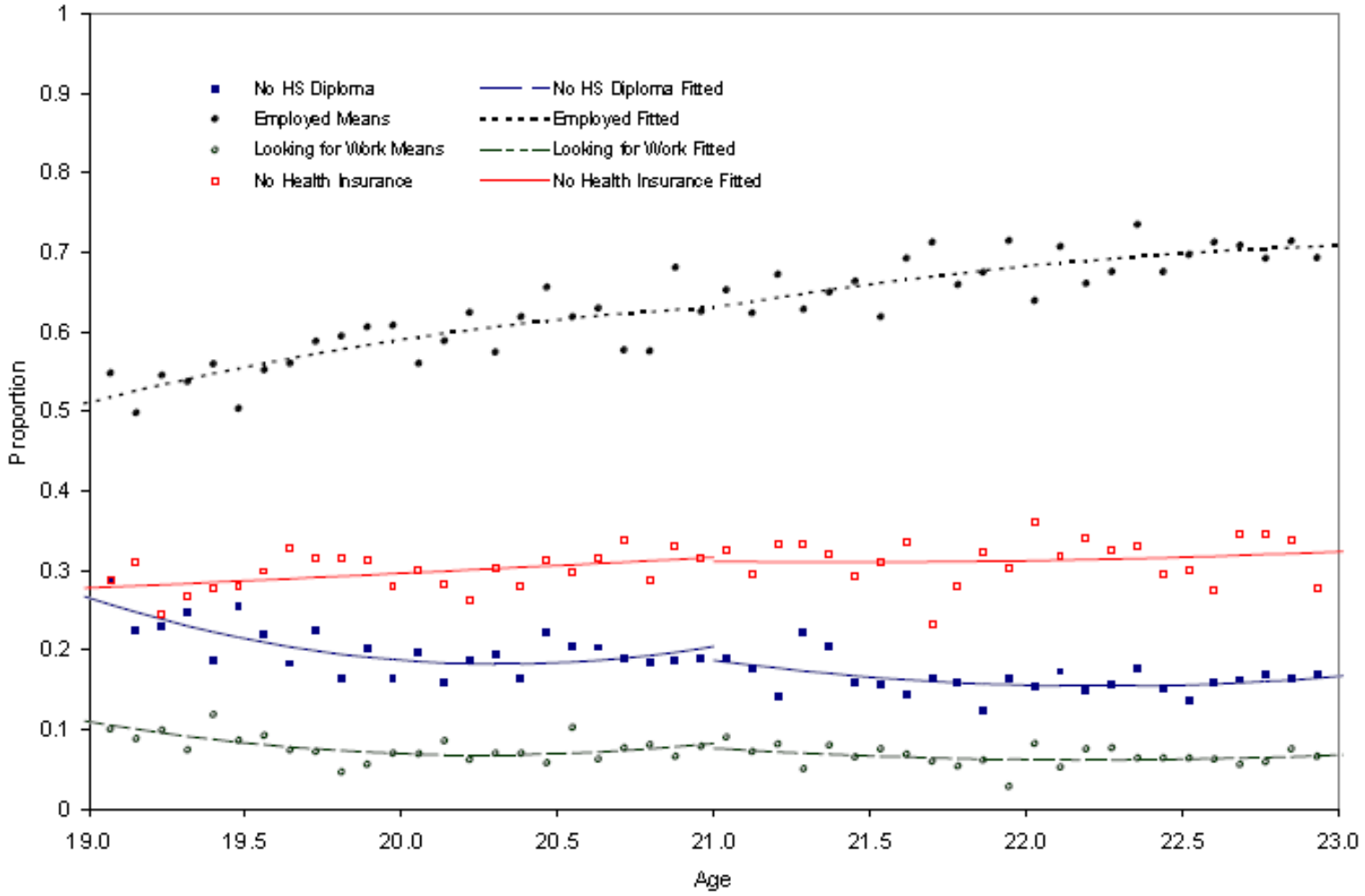
- 1997-2004 Vital Statistics Mortality
  - Exact date of birth and date of death
  - Census of Deaths in the United States
  - Considerable Detail on Cause of Death

Carpenter and Dobkin (2009)

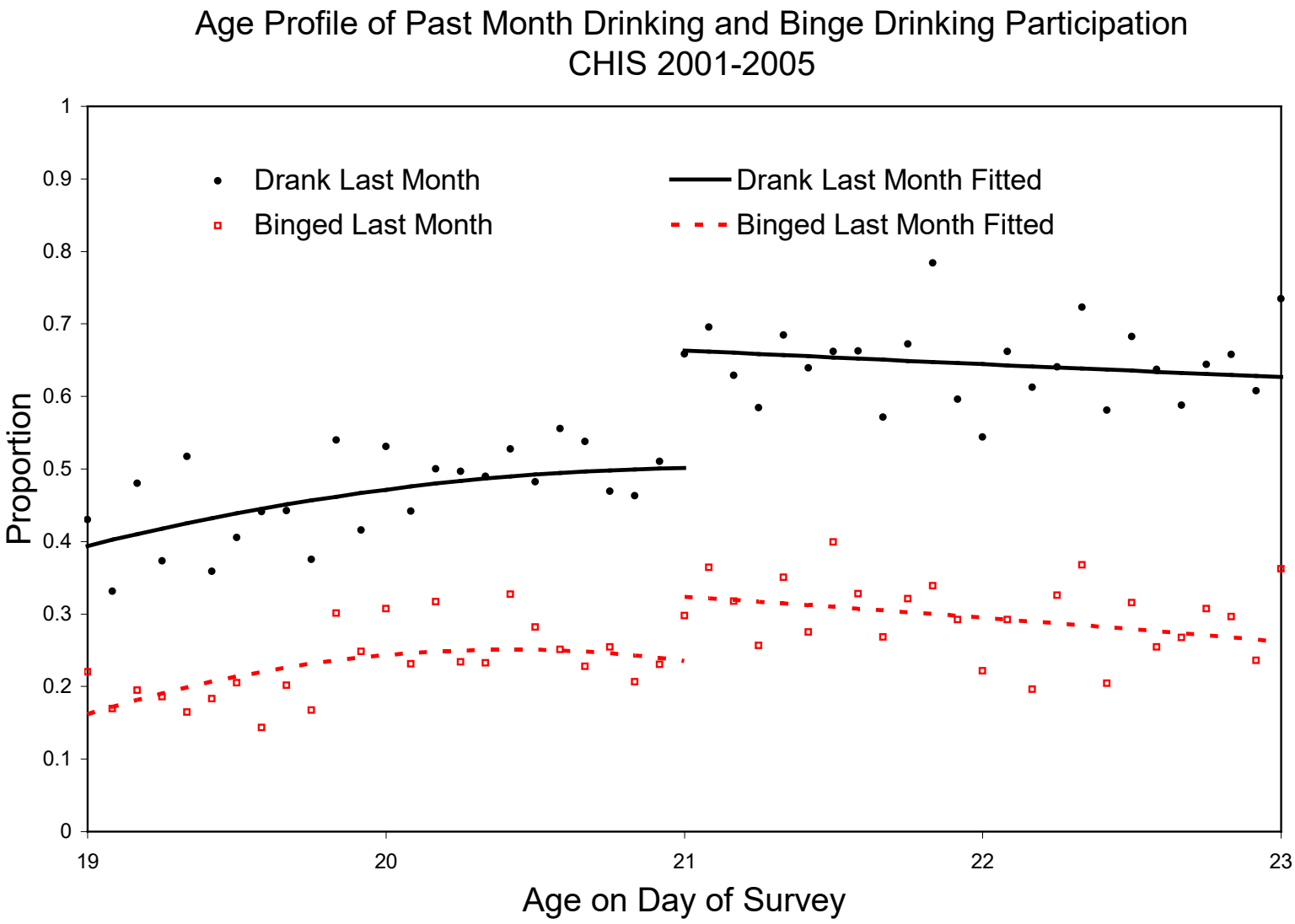


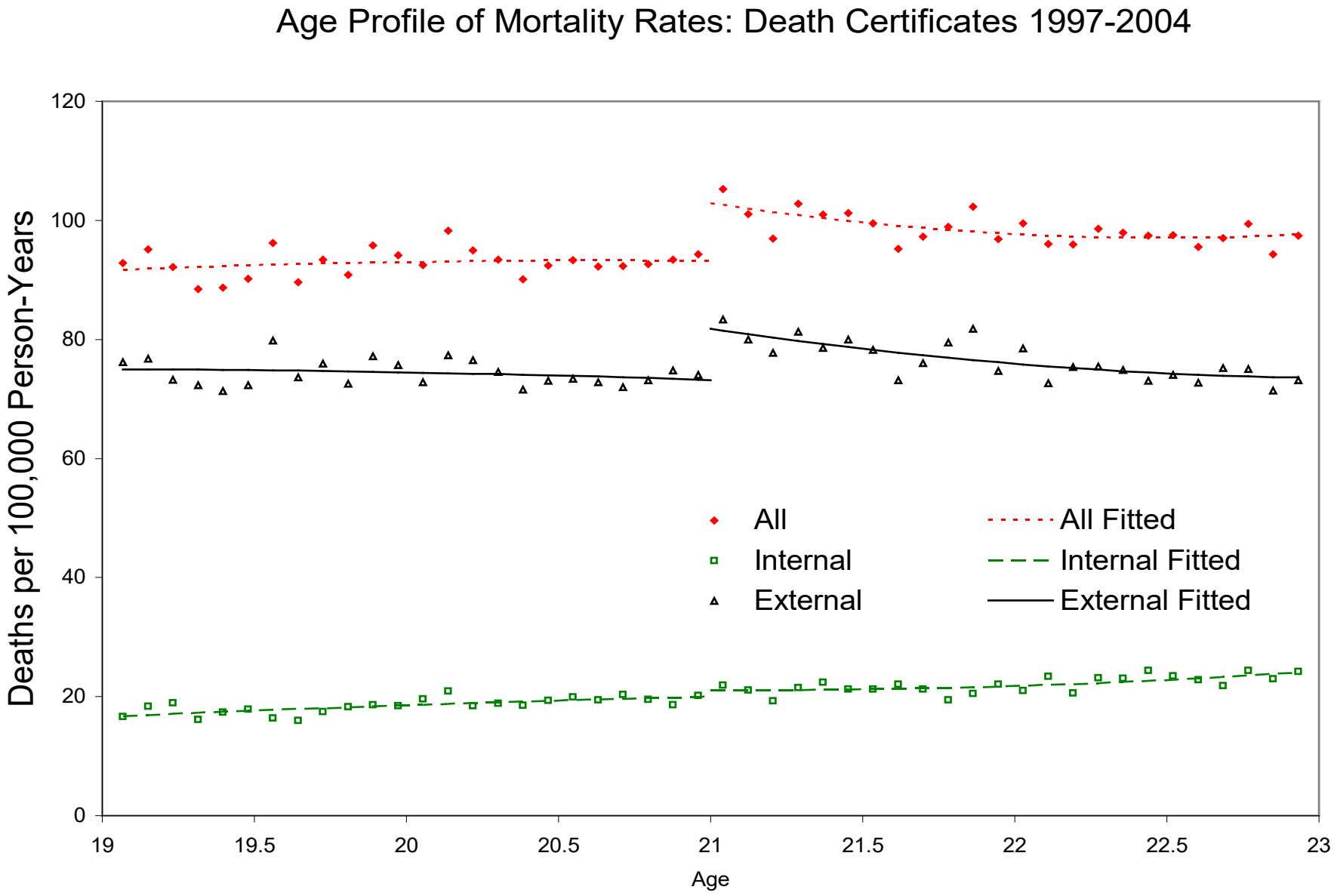
To make the age profile less noisy, the proportions have been calculated for 30-day blocks of age rather than individual days. Heavy drinking is defined as consuming 5 or more drink in one sitting.

Appendix D: Age Profile of Sample Surveyed in NHIS

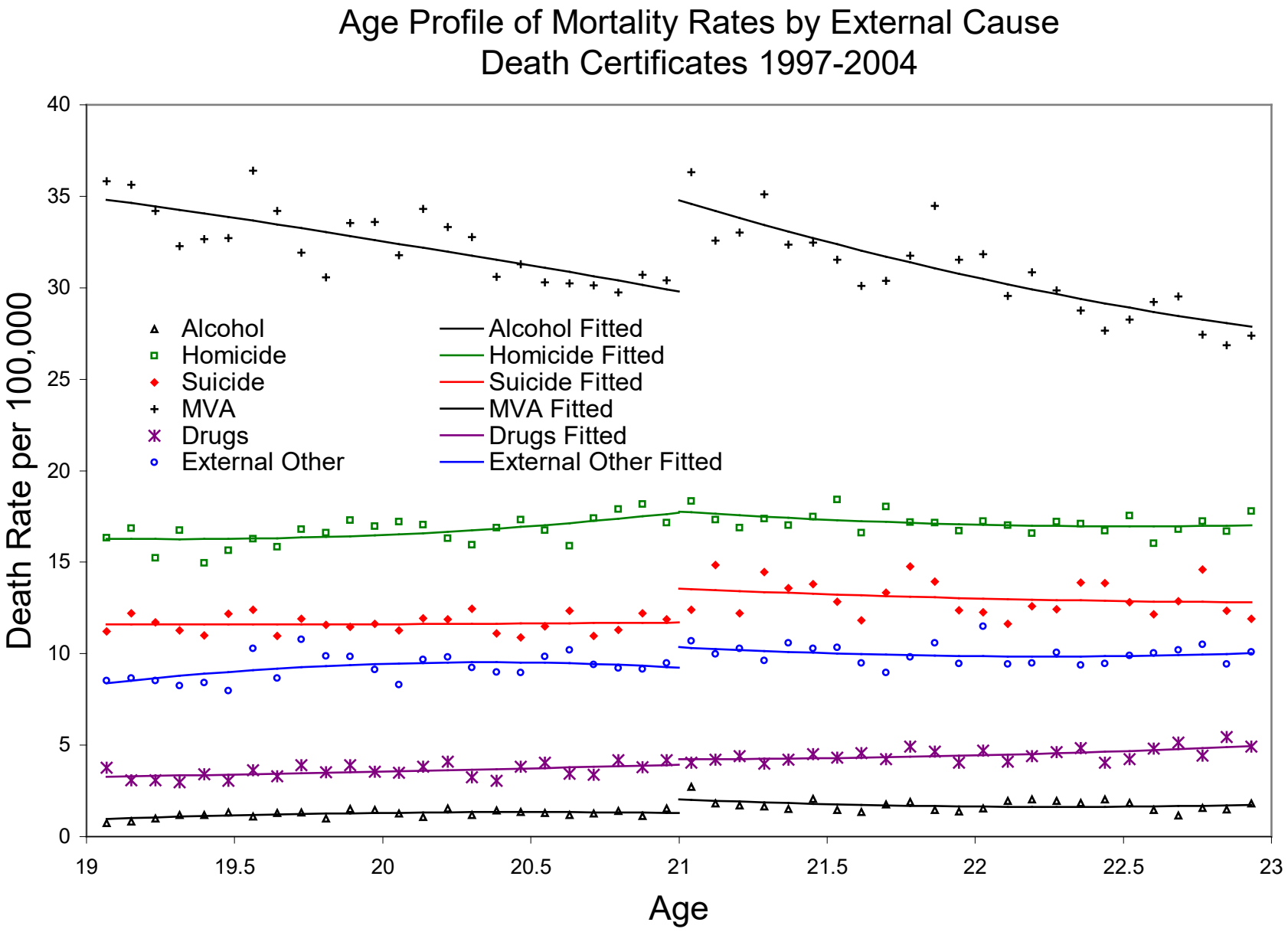


Carpenter and Dobkin (2011)





"…a statistically significant 9 percent increase in overall mortality when people turn 21 that is mostly due to a 10 percent increase in deaths due to external causes" (Carpenter and Dobkin 2009, p. 178).



Source: Carpenter and Dobkin (2009)

Carpenter and Dobkin (2009) found that reaching the MLDA was associated with a 21 percent increase in the number of days on which alcohol is consumed and a 15 percent increase in traffic fatalities. The implied elasticity from these estimates is .71 (i.e., .15/.21).

The implied elasticity for total mortality is 0.43 (i.e., 0.091/0.21). “This elasticity suggests that a substantial proportion of deaths among 21-year-olds are due directly to alcohol consumption” (Captenter and Dobkin 2009, p. 180).

Make sure to go through the required reading on Carpenter and Dobkin (2015) for their analysis on crime!

Other Policies

Would teens and young adults drink less if we lowered the BAC limit for drivers under the age of 21 to 0.02?

- Carpenter (2004) used BRFSS data to answer this question
- He took a "standard difference-in-differences type approach to identify the effects of ZT laws…"
- He also estimated DDD models, using individuals "aged 22-24 to test the stability and plausibility of the DD results."

Reference

Carpenter, Christopher. 2004. "How Do Zero Tolerance Drunk Driving Laws Work?" *Journal of Health Economics*, 23(1): 61-83.

The first approach considers only the sample of young adults who should have been treated by the laws, 18–20-year-olds. I estimate the models in a linear probability framework for simplicity and ease of interpretation, though results are robust to probit or logit estimation.[18] The general form of the model is given by:

$$Y_{ist} = \alpha + \beta_1 \boldsymbol{X}_{ist} + \beta_2 \text{Zero Tolerance}_{st} + u_m + w_s + v_t + (\text{trend}^* w_s) + \in \quad (1)$$

where Y_{ist} refers to the variety of drinking behaviors listed above. $\boldsymbol{X}$ is a vector of demographic information, including the individual's age, an indicator variable equal to one for respondents who are white non-hispanic, a "married" dummy, and five education categories (less than high school, high school, some college, college degree, and education missing). I estimate models on the full sample, as well as separately for men and women to account

Effects of Zero Tolerance Laws on drinking and drunk driving among youth age 18–20 (1984–2001 BRFSS)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Unconditional drinking ($N = 49{,}076$, pre-reform mean = 49.5%)							
Zero Tolerance Law	−0.023	−0.017	−0.012	−0.012	−0.013	−0.015	−0.008
	(0.012)	(0.019)	(0.018)	(0.018)	(0.018)	(0.018)	(0.016)
R^2	0.00	0.01	0.04	0.09	0.09	0.09	0.09
Unconditional heavy episodic drinking ($N = 49{,}076$, pre-reform mean = 24.2%)							
Zero Tolerance Law	−0.015	−0.041**	−0.041**	−0.043**	−0.040**	−0.042**	−0.041**
	(0.009)	(0.012)	(0.013)	(0.012)	(0.011)	(0.011)	(0.011)
R^2	0.00	0.01	0.03	0.10	0.10	0.10	0.11
Drunk driving, conditional on drinking ($N = 20{,}785$, pre-reform mean = 9.6%)							
Zero Tolerance Law	−0.028**	−0.026**	−0.007	−0.005	−0.004	−0.004	−0.010
	(0.007)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)
R^2	0.00	0.01	0.02	0.05	0.05	0.05	0.05
Heavy episodic drinking, conditional on drinking ($N = 23{,}836$, pre-reform mean = 48.7%)							
Zero Tolerance Law	−0.007	−0.068**	−0.071**	−0.075**	−0.067**	−0.067**	−0.074**
	(0.012)	(0.015)	(0.017)	(0.017)	(0.016)	(0.015)	(0.015)
R^2	0.00	0.01	0.02	0.11	0.11	0.11	0.11
log number of drinks, conditional on drinking ($N = 22{,}671$, pre-reform mean = 25.8 drinks)							
Zero Tolerance Law	−0.199**	−0.044	−0.029	−0.037	−0.029	−0.032	−0.058
	(0.046)	(0.094)	(0.105)	(0.096)	(0.095)	(0.090)	(0.087)
R^2	0.00	0.03	0.03	0.14	0.14	0.14	0.14
Year & month fixed		Y	Y	Y	Y	Y	Y

younger group except that they are not subject to the more restrictive ZT drunk driving policies. I therefore use the control group to ensure that any effects of the ZT policies found in the younger sample are not spurious (i.e. to check that the coefficient on Zero Tolerance in Eq. (1) above for the older subsample is small and not significantly different from zero). I also incorporate the control group in the multivariate analysis by estimating a regression adjusted difference-in-difference-in-differences (DDD) type model. In the presence of state and year fixed effects, this amounts to estimating the model on the full sample of 18–20 and 22–24-year-olds by interacting the ZT variable with a dummy variable equal to one for individuals in the treatment group. This corresponds to estimation of:

$$Y_{ist} = \alpha + \beta_1 \boldsymbol{X}_{ist} + \beta_2 \text{ Zero Tolerance}_{st} + \beta_3 \text{ Under 21}_{ist} + \beta_4 (\text{Zero Tolerance}^{*}\text{Under 21})_{ist} + u_m + w_s + v_t + \in \quad (2)$$

where all variables are as defined above. Under 21 is the indicator variable for members of the treatment group (those aged 18–20), and the key coefficient of interest is β_4—the marginal effect of the policy on the treatments relative to the controls.[20]

Table 3
Difference-in-Difference-in-Differences Type Models of the effect of Zero Tolerance Laws on heavy episodic drinking and number of drinks in past month (1984–2001)

	Males	Females	Males	Females
	Heavy episodic drinking conditional on drinking		log number of drinks conditional on drinking	
	(1)	(2)	(3)	(4)
	20 year olds vs. 22 year olds			
(Zero Tolerance* Under 21)	−0.074**	−0.014	−0.209**	0.029
	(0.030)	(0.029)	(0.075)	(0.0740)
R^2	0.05	0.07	0.07	0.11
Observations	10592	10820	9801	10452
	19 and 20 year olds vs. 22 and 23 year olds			
(Zero Tolerance* Under 21)	−0.058**	0.004	−0.164**	−0.009
	(0.022)	(0.019)	(0.062)	(0.058)
R^2	0.04	0.05	0.07	0.10
Observations	21433	21173	19856	20449
	18, 19, and 20 year olds vs. 22, 23, and 24 year olds			
(Zero Tolerance* Under 21)	−0.037[a]	0.0001	−0.090[a]	0.021
	(0.020)	(0.016)	(0.050)	(0.043)
R^2	0.04	0.05	0.07	0.09

Other Policies

What would happen if we banned the sale, manufacture and transportation of alcohol?

A number of studies have examined the effects of Federal Prohibition (1920-1933)

Prohibition appears to have had, at most, a modest impact on the consumption of alcohol (Dills et al. 2005).

Reference

Angela K. Dills, Mireille Jacobson, and Jeffrey A. Miron. 2005. “The Effect of Alcohol Prohibition on Alcohol Consumption: Evidence from Drunkenness Arrests.” Economics Letters, 86: 279-284.

1985–1988 Gorbachev Anti-Alcohol Campaign

- In May of 1985, shortly after Mikhail Gorbachev became Secretary General, the Politburo and the Central Committee passed resolutions entitled “Measures to Overcome Drunkenness and Alcoholism.”

- Bhattacharya et al. (2013) examined the effect of these resolutions on consumption and mortality.

- Just prior to the passage of the anti-alcohol campaign, annual consumption of pure alcohol in the Soviet Union exceeded 14 liters per capita.

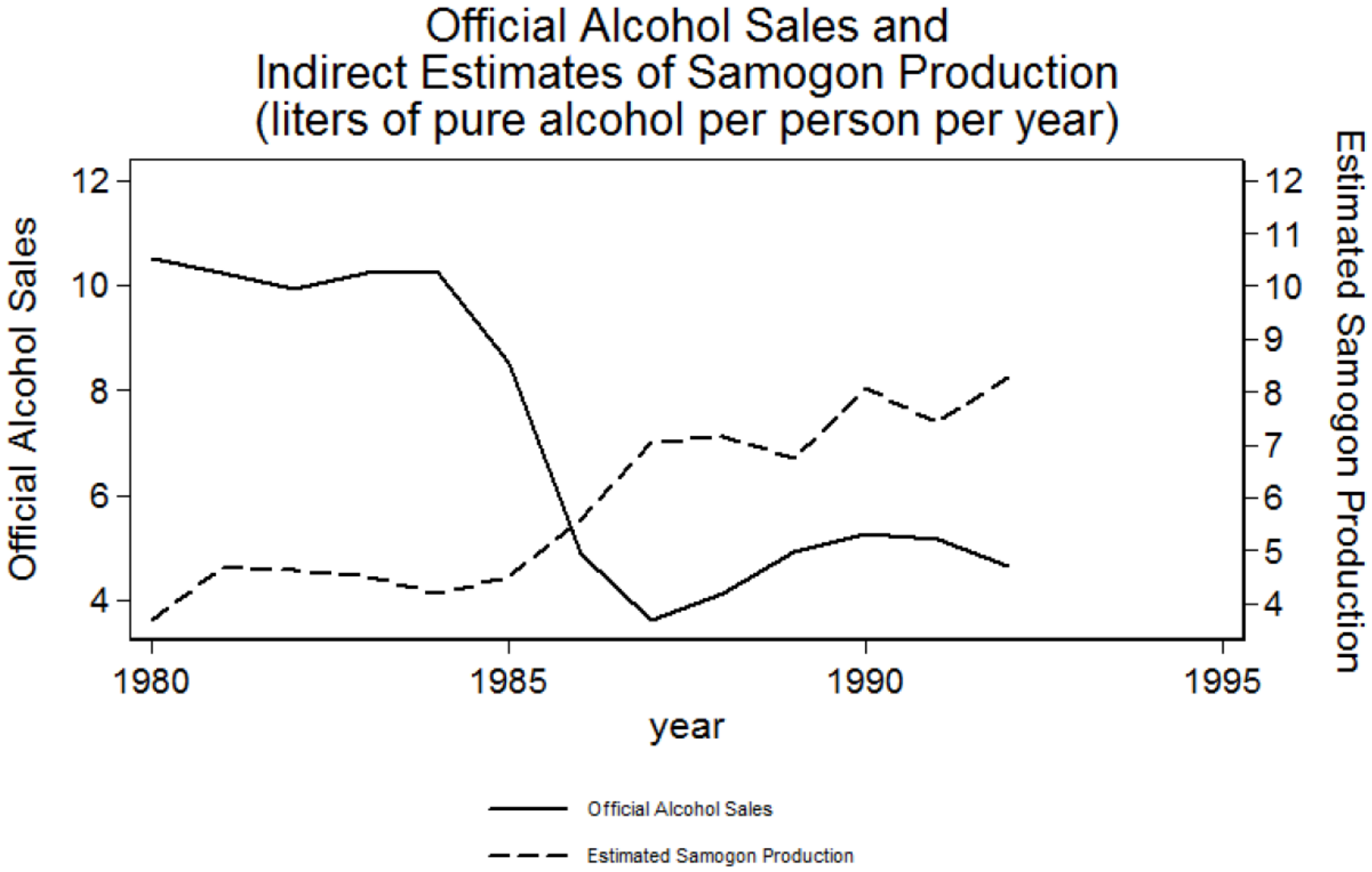
- In comparison, annual per capita consumption in the U.S. is roughly 8 liters.

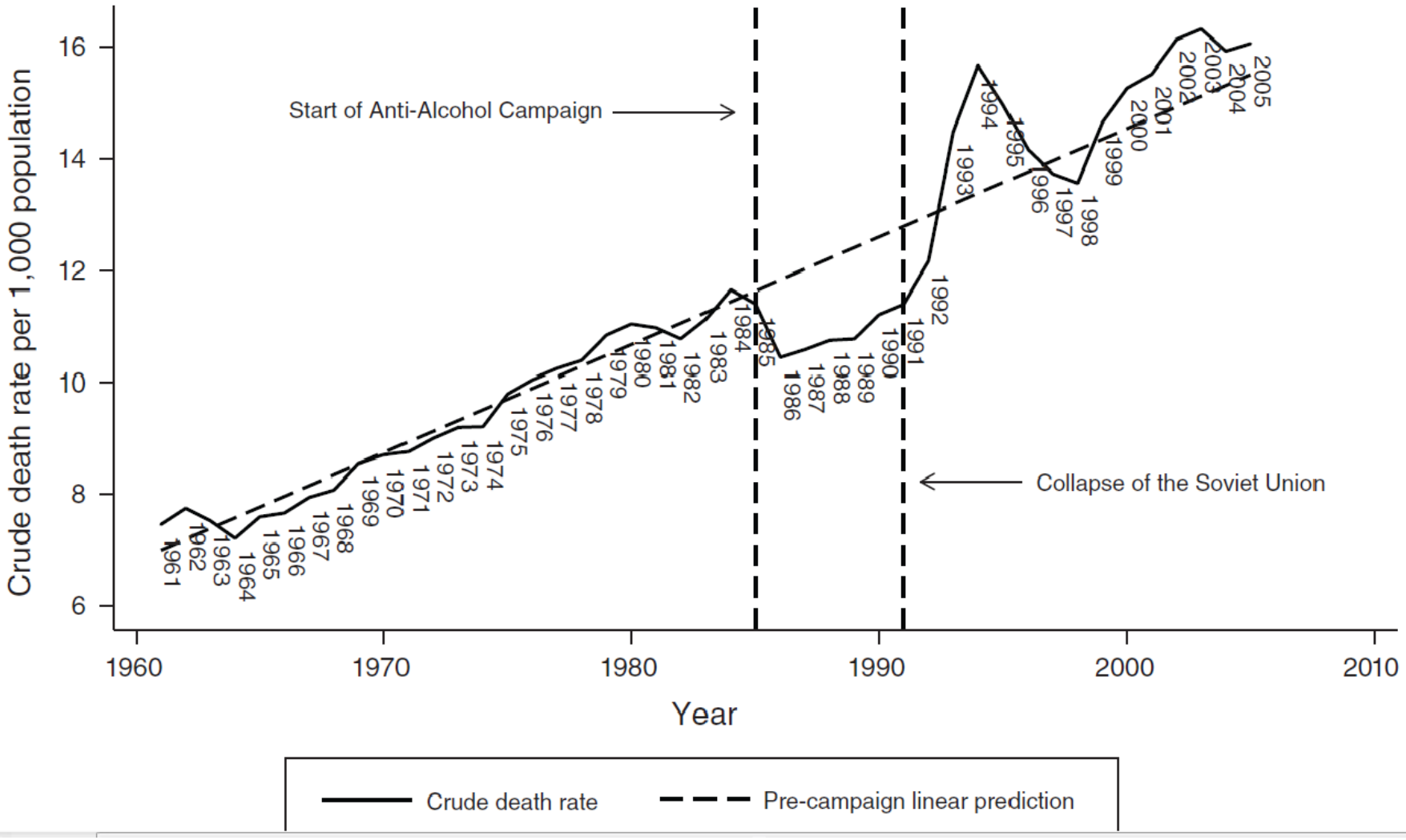
Reference

Bhattacharya, Jay Christina Gathmann, and Grant Miller. 2013. “The Gorbachev Anti-Alcohol Campaign and Russia’s Mortality Crisis.” *American Economic Journal: Applied Economics*, 5 (2): 232-260.

The anti-alcohol campaign was comprehensive. It included:

- A 30-40 percent reduction in state production of vodka and other hard liquor.
- Restrictions on sales (restaurants prohibited from selling hard liquor)
- Substantial increases in the price of hard liquor in (25% in 1985, 25% in 1986).
- Increase in the MLDA from 18 to 21.
- New sanctions on public drunkenness and home production.
- Anti-drinking propaganda coupled with health education programs.
- The creation of a national temperance society.


Official Alcohol Sales and
Indirect Estimates of Samogon Production
(liters of pure alcohol per person per year)
Official Alcohol Sales
Estimated Samogon Production
12
10
8
6
4
12
11
10
9
8
7
6
5
4
1980
1985
1990
1995
year
Official Alcohol Sales
Estimated Samogon Production


Crude death rate per 1,000 population
16
14
12
10
8
6
1960
1970
1980
1990
2000
2010
Year
Start of Anti-Alcohol Campaign
Collapse of the Soviet Union
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
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2002
2003
2004
2005
Crude death rate
Pre-campaign linear prediction

Political and economic transition is often blamed for Russia's 40 percent surge in deaths between 1990 and 1994. Highlighting that increases in mortality occurred primarily among alcohol-related causes and among working-age men (the heaviest drinkers),this paper investigates an alternative explanation: the demise of the 1985–1988 Gorbachev Anti-Alcohol Campaign. Using archival sources to build a new oblast-year dataset spanning 1978–2000, we find a variety of evidence suggesting that the campaign's end explains a large share of the mortality crisis, implying that Russia's transition to capitalism and democracy was not as lethal as commonly suggested.

--Bhattacharya et al. (2013, p. 232)