



Do Alcohol Excise Taxes Reduce Motor Vehicle Fatalities?

Evidence from Two Illinois Tax Increases

October 2017

Robert McClelland
John Iselin

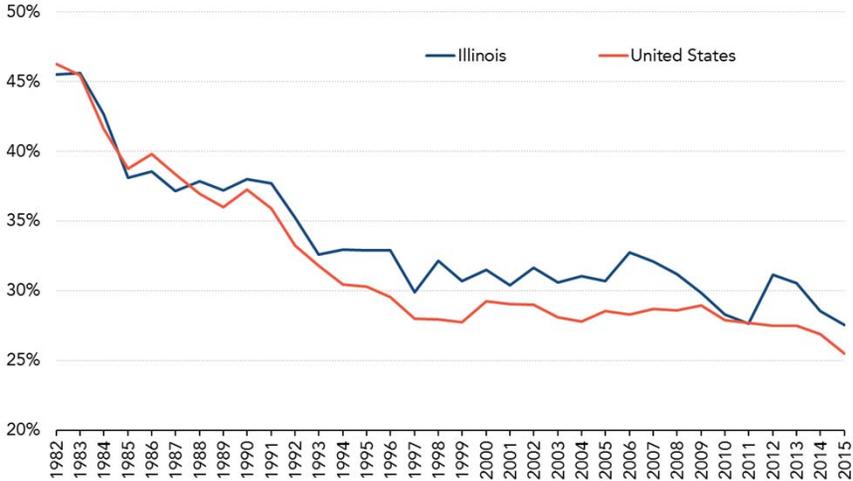


ACKNOWLEDGEMENTS

We would like to thank Aravind Boddupalli for research assistance, Kim S. Rueben for comments on an earlier version of this paper, and Yifan Powers for preparing the document for publication.

This publication relies on the analytical capability that was made possible in part by a grant from the Laura and John Arnold Foundation. The findings and conclusions contained in this report are those of the authors and do not necessarily reflect positions or policies of the Tax Policy Center or its funders

Over last 40 years, the share of fatal motor vehicle crashes involving alcohol has dropped over time...



Source: National Highway Traffic Safety Administration Fatality Analysis Reporting System data and author's calculations.
Note: FARMVC = fatal alcohol-related motor vehicle crash. "Alcohol-related" indicates that a driver involved in the crash had a blood-alcohol content at or above 0.08 percent.

...but there were still more than 10,000 fatalities in 2015.



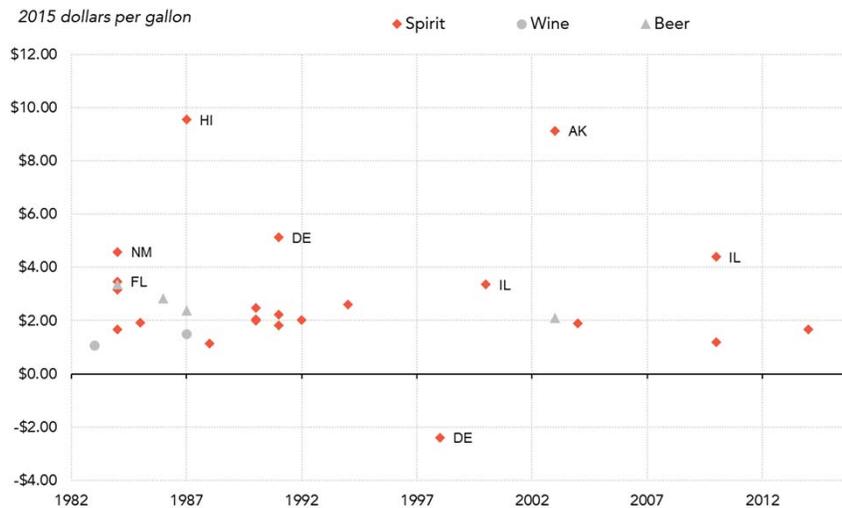
One commonly proposed solution: increase excise tax rates on alcohol

- Tax over-shifting
- Alcohol consumption responds to price changes

Yet evidence of the effect on fatal alcohol-related motor vehicle fatalities (FARMVCs) is mixed

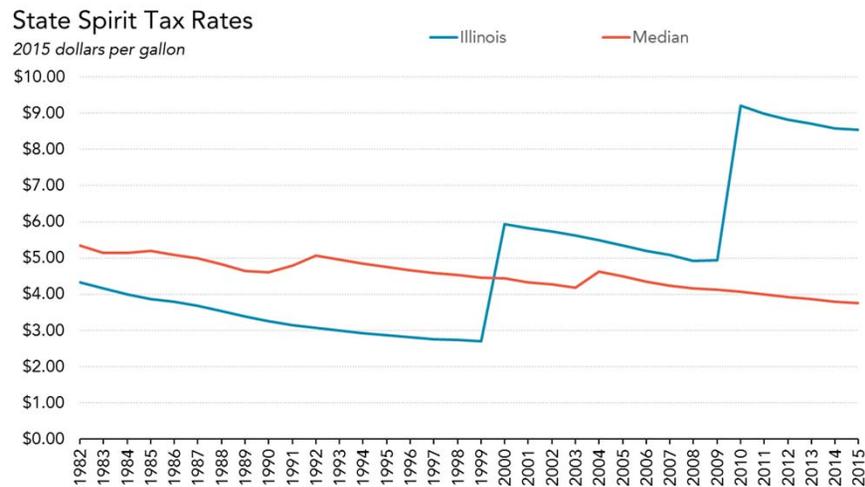
- Drivers may cross borders to avoid excise tax
- Heavy drinkers may reduce quality rather than quantity
- Other laws (maximum BAC of .08, drinking age of 21) reduced effectiveness of excise tax increases

Effects are difficult to estimate because large tax increases (> \$2) are rare.



Source: Tax Policy Center data on state alcohol excise taxes, the Bureau of Economic Analysis, and authors' calculations.

We examine the effect on FARMVCs of two substantial alcohol tax increases imposed by Illinois in 1999 and in 2009.



Source: Urban-Brookings Tax Policy Center data on state alcohol excise taxes and authors' calculations.
Note: Median tax rate of all non-monopoly states.



Our Approach

Method

- Synthetic Control (Stata code available)

Data

- US National Highway Traffic Safety Administration's Fatality Analysis Reporting System (FARS)
- State Level
- 1982 through 2015

Outcome Measures

- Share of fatal motor vehicle accidents in which driver BAC > .08
- Number of FARMVCs per driver in each state



Synthetic Control Method

- The SCM compares the actual outcomes to the outcomes of a synthetic state used as a control
- The synthetic state is formed as a weighted sum of states chosen from a pool of potential donors
- The weighted sum is created by matching predictors in the pre-treatment period of the donor states to the predictors for the treated state

Step 1: Identify predictors of the outcome variable.



- Choose predictor variables that should affect outcomes in states both before and after treatment.
- Determine the pretreatment year range over which the predictors will be averaged. Longer is better.
- Include several (but not all) lagged values of the outcome variable. Choose values that highlight the trend of the outcome before treatment.

We use death rate from liver cirrhosis, the unemployment rate, gas taxes, average personal income, share of population under 24, share of population over 65

Step 2: Identify possible donor states to synthesize the control state



- Exclude any states that enacted policy treatments of similar or larger size during the selected period. Relatively small treatments do not necessarily disqualify a state.
- States in the donor pool should have values of predictors that surround the values of the treated state before treatment.
- The larger the pool the higher the chance of overfitting

We eliminate states that changed alcohol excise tax rates by more than one dollar (in 2015 dollars) or that monopolize liquor sales, leaving 20 states.

For the 2009 tax increase we use 1983, 1985, 1991, 1997 and 2008

Step 3: Choose a method for selecting predictor weights

- The standard method minimizes the synthetic's mean squared prediction error.
- The cross-validation method shows promise, but currently the standard method is the safer choice.

We use the standard method

Step 4: Assess the pretreatment period goodness of fit of the synthetic control state

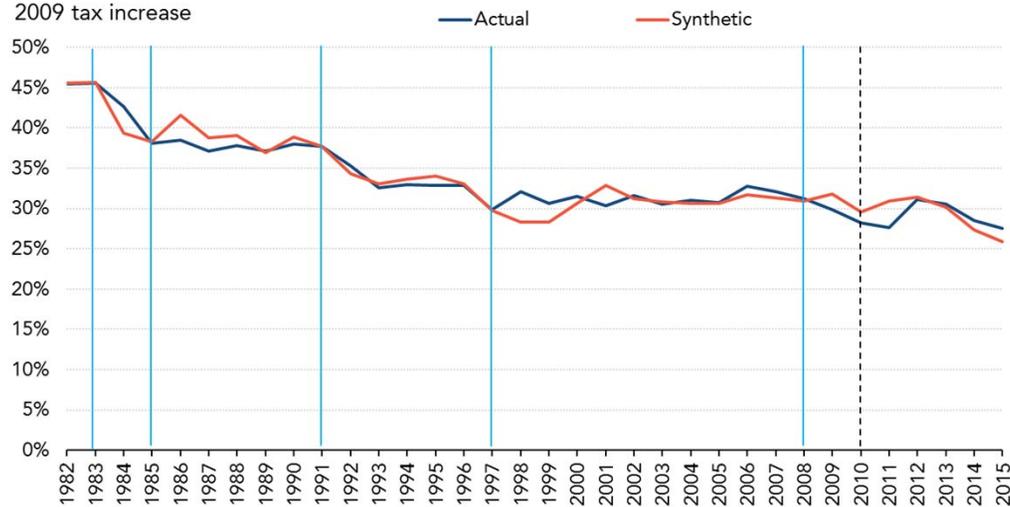
- Evaluate how closely the synthetic control fits the treated state during the pretreatment period (visual inspection, RMSPE)
- If the fit appears poor, try using all possible outcome lags as a test. But recognize that using all possible lags in the final model can bias the outcome path.
- Review state weights to judge similarities between the donor states and the treated state. Outcomes of donor states should have similar trends.
- Review predictor weights to determine the selected predictor variables' strength in explaining the outcome.

Step 4: Assess the pretreatment period goodness of fit of the synthetic control state



Actual vs. Synthetic Illinois FARMVC Share of Total Fatal Crashes

2009 tax increase



Source: Authors' calculations based on synthetic control methodology.

Step 4: Assess the pretreatment period goodness of fit of the synthetic control state 

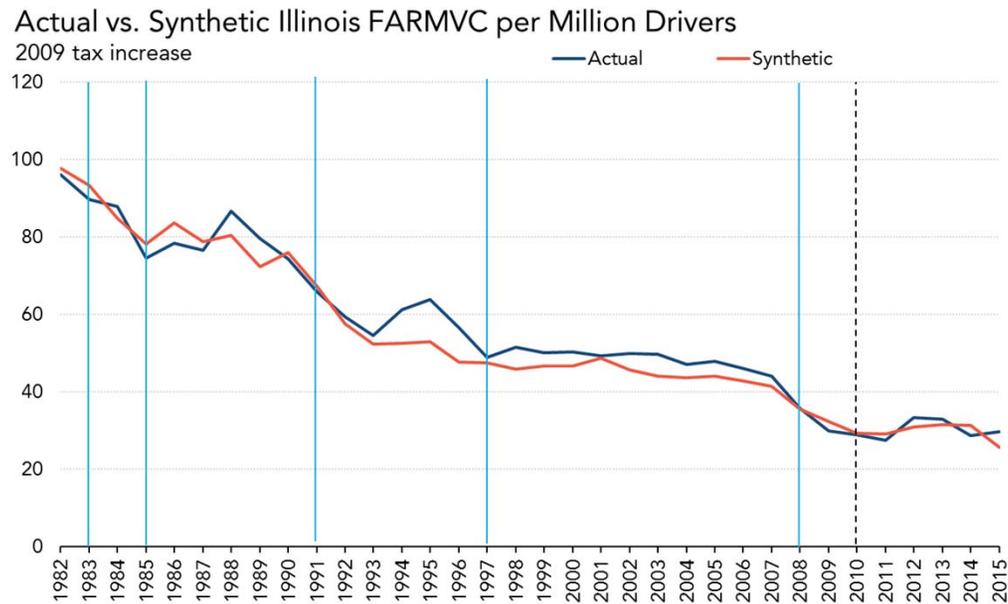
Missouri	47.30%
Maryland	20.60%
Louisiana	12.10%
South Carolina	8.30%
Colorado	7.70%
North Dakota	4.00%

Step 4: Assess the pretreatment period goodness of fit of the synthetic control state



Share of Vehicle Fatalities Alcohol Related	
1997	24.0%
2008	22.0%
1985	16.0%
1991	14.0%
1983	12.0%
Liver Deaths Per Capita	4.0%
Share of Population 15-24	4.0%
Share of Population 65 or older	3.0%

Step 4: Assess the pretreatment period goodness of fit of the synthetic control state



Source: Authors' calculations based on synthetic control methodology

Step 5: Conduct placebo test on states in the donor pool to evaluate significance of results



If the post-treatment difference between the treated state and its synthetic is larger than the difference for most of the placebo states, there is evidence that the treatment had an effect.

Evidence of significance should be treated as suggestive of an effect rather than as a rejection of a null hypothesis.

- The outcomes of placebo states in the treated period are not normally distributed
- The RMSPEs are also not normally distributed
- The ratio of treatment period RMSPE to pre-treatment period RMSPE is also flawed

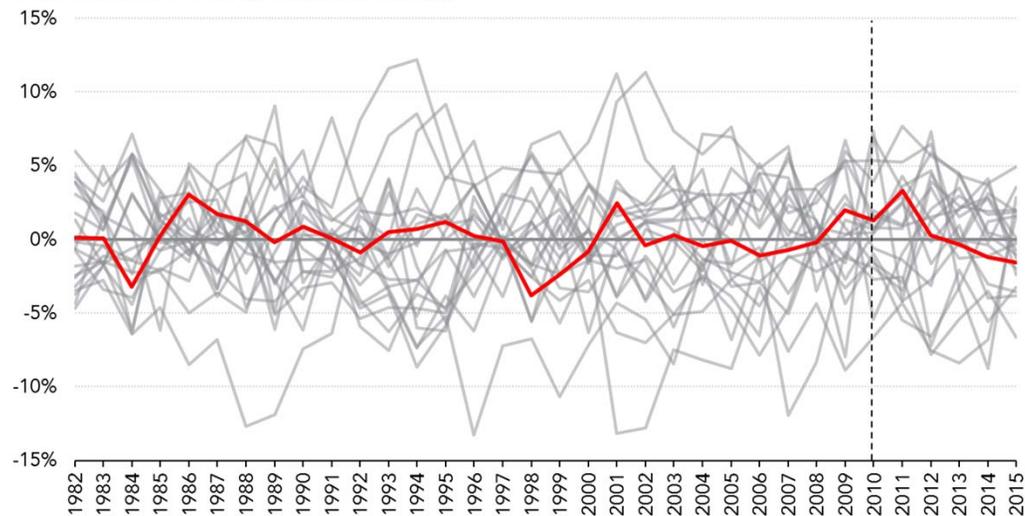
Step 5: Conduct placebo test on states in the donor pool to evaluate significance of results



Placebo Synthetic Control Test for 2009

Results for each potential donor state run through our chosen model

Actual state share minus synthetic state share (%)



Source: Authors' calculations based on synthetic control methodology.

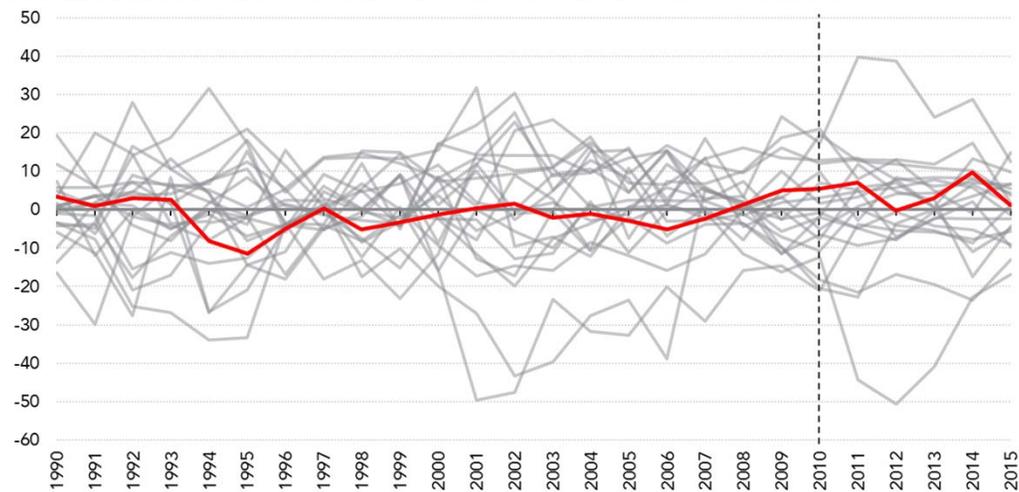
Step 5: Conduct placebo test on states in the donor pool to evaluate significance of results



Placebo Synthetic Control Test for 1990-2008 Pretreatment Period

Results for each potential donor state run through our chosen model

Actual minus synthetic fatal motor vehicle crashes that were alcohol related per 1,000,000 drivers



Source: Authors' calculations based on synthetic control methodology.

Step 6: Conduct sensitivity analyses to further test the credibility of the results.



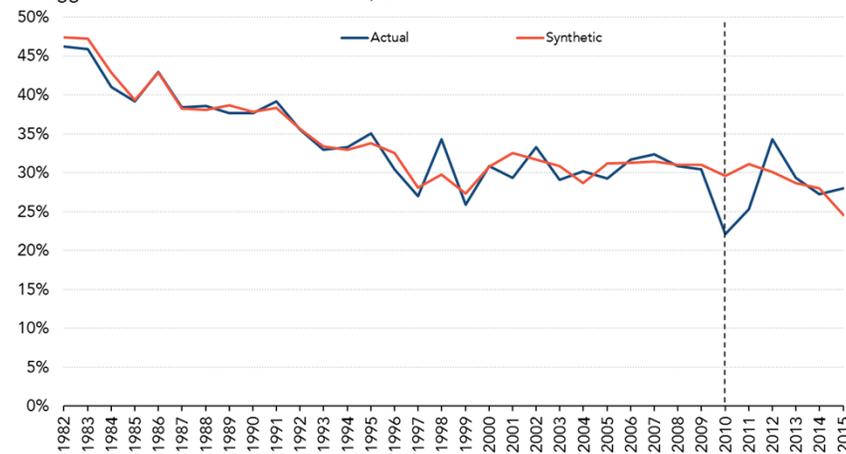
Some drivers live near state borders.

This allows them to evade tax increase.

We omit border counties and re-estimate

- Data limitations prevent us from using predictors
- We use all outcome lags

Actual versus Synthetic Illinois FARMVC Share of Total Fatal Crashes
All lagged model with no border counties, 2009 tax increase



Source: Authors' calculations based on synthetic control methodology.

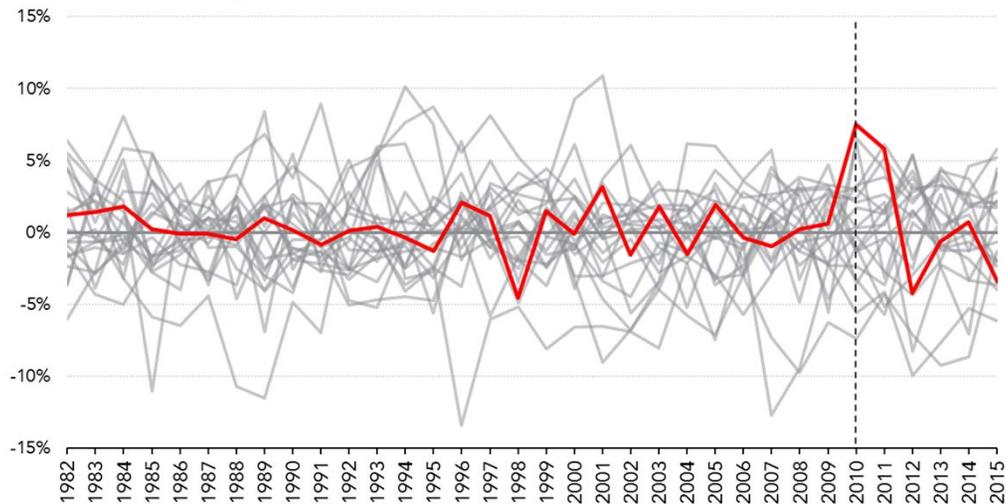
Step 6: Conduct sensitivity analyses to further test the credibility of the results.



Placebo Synthetic Control Test For 2009

Results for each potential donor state, all lags model with no border counties

Actual state share minus synthetic state share (%)



Source: Authors' calculations based on synthetic control methodology.



Conclusion

- No evidence of state-wide effect on FARMVCs from 1999 increase
- Evidence of a short-lived effect on drivers in interior counties from 2009 increase
- Paper available at <http://www.taxpolicycenter.org/publications/do-alcohol-excise-taxes-reduce-motor-vehicle-fatalities-evidence-two-illinois-tax>

- Paper on synthetic control method available at <http://www.taxpolicycenter.org/publications/synthetic-control-method-tool-understand-state-policy>