Do Alcohol Excise Taxes Reduce Motor Vehicle Fatalities?
Evidence from Two Illinois Tax Increases

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

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

**Method**
- Synthetic Control (Stata code available)

**Data**
- 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.*

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

Source: Authors’ calculations based on synthetic control methodology.
## Step 4: Assess the pretreatment period goodness of fit of the synthetic control state

<table>
<thead>
<tr>
<th>State</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missouri</td>
<td>47.30%</td>
</tr>
<tr>
<td>Maryland</td>
<td>20.60%</td>
</tr>
<tr>
<td>Louisiana</td>
<td>12.10%</td>
</tr>
<tr>
<td>South Carolina</td>
<td>8.30%</td>
</tr>
<tr>
<td>Colorado</td>
<td>7.70%</td>
</tr>
<tr>
<td>North Dakota</td>
<td>4.00%</td>
</tr>
</tbody>
</table>
Step 4: Assess the pretreatment period goodness of fit of the synthetic control state

<table>
<thead>
<tr>
<th>Share of Vehicle Fatalities Alcohol Related</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1997</td>
<td>24.0%</td>
</tr>
<tr>
<td>2008</td>
<td>22.0%</td>
</tr>
<tr>
<td>1985</td>
<td>16.0%</td>
</tr>
<tr>
<td>1991</td>
<td>14.0%</td>
</tr>
<tr>
<td>1983</td>
<td>12.0%</td>
</tr>
<tr>
<td>Liver Deaths Per Capita</td>
<td>4.0%</td>
</tr>
<tr>
<td>Share of Population 15-24</td>
<td>4.0%</td>
</tr>
<tr>
<td>Share of Population 65 or older</td>
<td>3.0%</td>
</tr>
</tbody>
</table>
Step 4: Assess the pretreatment period goodness of fit of the synthetic control state

![Graph showing Actual vs. Synthetic Illinois FARMVC per Million Drivers](image)

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 (%)
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
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 (%)
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

- Paper on synthetic control method available at