The effects of liquor licensing restrictions on alcohol related violence in NSW, 2008-2013

Patricia Menéndez, Fernando Tusell and Don Weatherburn, NSW Bureau of Crime Statistics and Research

February 19, 2015
Liquor Licensing Restrictions 2008-2013


30 October 2008: commencement of the freeze on 24 hour licenses.
Liquor Licensing Restrictions 2008-2013


30 October 2008: commencement of the freeze on 24 hour licenses.

1 December 2008: commencement of the declared premises scheme.
January 2012: commencement of the Three Strikes scheme.

Liquor Licensing Restrictions 2008-2013


30 October 2008: commencement of the freeze on 24 hour licenses.

1 December 2008: commencement of the declared premises scheme.

22 August 2011: commencement of the Responsible Service of Alcohol (RSA) re-training requirement for paper certificate holders required to obtain a competency card.
Liquor Licensing Restrictions 2008-2013


30 October 2008: commencement of the freeze on 24 hour licenses.

1 December 2008: commencement of the declared premises scheme.

22 August 2011: commencement of the Responsible Service of Alcohol (RSA) re-training requirement for paper certificate holders required to obtain a competency card.

January 2012: commencement of the Three Strikes scheme.
Need for a Rigorous Evaluation

Interventions are very close in time.
Long term dynamics in assaults are not constant.
Adequate models to lead to adequate conclusions.
Data and Sources

Criminal counts of the police incident categories of
  ▶ Actual bodily harm (ABH)
  ▶ Grievous bodily harm (GBH)

Consumer sentiment Index (CSI)

Recorded monthly data from January 1996 to December 2013.

Data sources:

NSW Bureau of Crime Statistics and Research.
NSW Police Computerized Operational Policing System (COPS).
Melbourne Institute of Applied Economic and Social Research.
Extraneous Factors

Alcopops

Global Financial Crisis
Modeling Approach

Model the different components in the time series of assaults.
Mean level, seasonal patterns and random disturbances.
Components are allowed to change over time.
General Approach: Time Series Structural Models

Model:

\[ y_t = \mu_t + \gamma_t + \epsilon_t, \quad \epsilon_t \sim N(0, \sigma_\epsilon^2) \]

\( \mu_t \Rightarrow \text{the level (intercept plus slope)} \)

\( \gamma_t \Rightarrow \text{the seasonal component} \)

\( \epsilon_t \Rightarrow \text{error or observation disturbances} \)

Aim:

Quantify changes in the level of the series due to the liquor licensing reforms.
ABH Structural Decomposition

- Intercept: 6.7, 6.9, 7.1, 7.3
- Slope: -0.015, 0.0, 0.015
- Seasonal: -0.2, 0.0, 0.2
Exploratory Data Analysis: ABH and GBH
Data Sets and Interventions

Increase up to 2008
Decrease from 2008
Intervention Representation

Smooth Break Interventions

Smooth transition from:
- January 2008 − January 2009
- January 2008 − January 2011
- January 2008 − January 2013

Assumption: New liquor licensing restriction is introduced → changes in crime are likely to happen in a smooth way.
Intervention Model

\[ x_t = \begin{cases} 
0, & \text{if } t \leq \tau_1 \\
(t - \tau_1)/(\tau_2 - \tau_1), & \text{if } t \in (\tau_1, \tau_2] \\
1, & \text{if } t > \tau_2
\end{cases} \]

where

\( \tau_1 \rightarrow \) beginning of the intervention and

\( \tau_2 \rightarrow \) the end of the intervention effect.
Model Including Intervention Variable

Time Series Structural Models:

\[ y_t = \mu_t + \gamma_t + \delta x_t + \epsilon_t, \quad \epsilon_t \sim N(0, \sigma) \]

\( x_t \) is the intervention
\( \mu_t \) is the level and \( \gamma_t \) is the seasonal component
\( \epsilon_t \) error or observation disturbances

Several covariates might be included in the model.
## Models Considered

<table>
<thead>
<tr>
<th>Models</th>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>July 2008 - July 2012</td>
</tr>
<tr>
<td>Model 2</td>
<td>July 2008 - July 2013</td>
</tr>
<tr>
<td>Model 3</td>
<td>July 2008 - December 2013</td>
</tr>
</tbody>
</table>
Model Selection Criterion: AIC

Akaike Information Criterion:

\[ AIC = -2\log(L) + k \]

Takes into account not only the model fit but also the model complexity.

- \( L \) is the likelihood and
- \( k \) the number of parameters in the model.
## Results Actual Bodily Harm

### Interventions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimate ($\delta$)</strong></td>
<td>-0.25</td>
<td>-0.38</td>
<td>-0.40</td>
</tr>
<tr>
<td><strong>t-statistic</strong></td>
<td>-2.19</td>
<td>-2.67</td>
<td>-2.44</td>
</tr>
<tr>
<td><strong>p-value</strong></td>
<td>0.03</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>-loglikelihood</strong></td>
<td>-381.04</td>
<td>-381.77</td>
<td>-381.63</td>
</tr>
<tr>
<td><strong>Shapiro test</strong></td>
<td>0.40</td>
<td>0.30</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>Box-Ljung test</strong></td>
<td>0.43</td>
<td>0.49</td>
<td>0.47</td>
</tr>
<tr>
<td><strong>AIC</strong></td>
<td>-761.92</td>
<td>-763.39</td>
<td>-763.10</td>
</tr>
<tr>
<td><strong>Crime Reduction</strong></td>
<td>-22.00 %</td>
<td>-31.27 %</td>
<td>-32.76 %</td>
</tr>
</tbody>
</table>
# Results Grievous Bodily Harm

## Interventions

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimate (δ)</strong></td>
<td>-0.51</td>
<td>-0.55</td>
<td>-0.61</td>
</tr>
<tr>
<td><strong>t-statistic</strong></td>
<td>-5.69</td>
<td>-4.66</td>
<td>-4.79</td>
</tr>
<tr>
<td><strong>p-value</strong></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td><strong>-loglikelihood</strong></td>
<td>-236.23</td>
<td>-235.82</td>
<td>-236.63</td>
</tr>
<tr>
<td><strong>Shapiro test</strong></td>
<td>0.12</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Box-Ljung test</strong></td>
<td>0.32</td>
<td>0.30</td>
<td>0.31</td>
</tr>
<tr>
<td><strong>AIC</strong></td>
<td>-472.31</td>
<td>-471.48</td>
<td>-473.10</td>
</tr>
<tr>
<td><strong>Crime Reduction</strong></td>
<td>-39.70 %</td>
<td>-42.27 %</td>
<td>-45.52 %</td>
</tr>
</tbody>
</table>
Results: Level, Slope and Intervention

Actual Bodily Harm

Grievous Bodily Harm
Conclusions and future research

Data driven dynamic model for time series.
No reliable control site (we looked at data from Victoria).
Proximity of interventions.
Consumer Sentiment Index was analyzed.
Role of unmeasured factors.
Conclusions and future research

Data driven dynamic model for time series.
No reliable control site (we looked at data from Victoria).
Proximity of interventions.
Consumer Sentiment Index was analyzed.
Role of unmeasured factors.

Thank you very much for your attention!