IS CHANGING THE MINIMUM LEGAL DRINKING AGE AN EFFECTIVE POLICY TOOL?

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IS CHANGING THE MINIMUM LEGAL DRINKING AGE AN EFFECTIVE POLICY TOOL? *

Nicolai Brachowicz Quintanilla, Judit Vall Castelló

ABSTRACT: In year 1991 regional governments in Spain started a period of implementation of a law that rose the Minimum Legal Drinking Age from 16 to 18 years old. This process was fully completed in year 2015. To evaluate the effects of this change on consumption of legal drugs and its related morbidity outcomes, we construct a regional panel dataset on alcohol consumption and hospital entry registers and compare variation in several measures of prevalence between the treatment group (16-18 years old individuals) and the control group (20-22 years old individuals). Our findings show important differences by gender. Firstly, our main result regarding overall drinking prevalence show reductions ranging from -11.57% for the subsample including both genders to -14.31% for the subsample of males. Secondly, effects on males are driven mainly by reductions in beer with alcohol consumption (-8.98%). Thirdly, effects on wine and/or cava drinking prevalence range from -12.62% for the subsample including both genders to -9.65% for the subsample of females. No effects regarding overall smoking prevalence are found. Fourthly, we do not find evidence that these reductions in alcohol consumption are translated into hospitalizations related to alcohol overdose. To our knowledge, this is the first paper providing evidence on gender-based differences to policies aimed at reducing alcohol consumption. Our results have important policy implications for countries currently considering changes in the Minimum Legal Drinking Age.

JEL Codes: H22, H75, I18, J19
Keywords: Evaluation of public policies, health economics, minimum legal drinking age, differences in differences, drug consumption

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1 Introduction

Undesired and fatal consequences of the abuse of alcohol consumption have been studied from multiple perspectives, ranging from direct effects on individuals (Carpenter, 2004a; Mann, Smart, & Govoni, 2003; Rosenberg, Ventura, Maurer, Heuser, & Freedman, 1996; Wagenaar & Toomey, 2002) to negative externalities exerted on the society as a whole (Carpenter, 2005, 2007; Markowitz, 2000, 2005). According to the latest figures provided by the Report on Survey on Drugs Use in Secondary Schools in Spain (Observatorio Español de las Drogas y las Adicciones (OEDT). Ministerio de Sanidad y Servicios Sociales e Igualdad, 2016), corresponding to survey years 2014/2015, the average age at first use of alcohol considering weekly consumption, has remained almost invariable since year 1996 at around 15 years old. Moreover, around 48%, 61%, and 74% of youngsters, aged 14, 15, and 16 respectively, declared to have consumed alcohol during the last 30 days in years 2014/2015. There is a growing body of evidence pointing at the limitation of access to alcohol consumption as an effective policy tool for preventing unhealthy habits and fatal consequences (Carpenter, 2004b; Carpenter & Dobkin, 2011; Dee, 1999; Deza, 2015; Yörük & Yörük, 2011, 2013). In an effort to reduce the prevalence of alcohol consumption and its undesired outcomes, regional authorities in Spain decided to restrict the access of teenagers to alcohol by increasing the Minimum Legal Drinking Age (hereafter, MLDA) from 16 to 18 years old. Figure 1 shows a chronological description of the implementation of the new MLDA in Spain.

![Figure 1: Spain - Years of Implementation of the New MLDA](image)

Note: MLDA = Minimum Legal Drinking Age. Source: Official National/Regional Bulletins. All seventeen regions considered.

Having a uniform MLDA threshold at 18 years old in all seventeen regions took more than two decades, although most of them implemented the legal modification during the period 1994-2002. Until year 1991 the MLDA in all regions was 16 years old. On April 1991 the region of Navarra was the first to rise the MLDA to 18 years old. This was followed progressively by Region of Castilla y León in 1994, and Region of Castilla - La Mancha in 1995. In year 1997 most of the regions, namely Andalucía, Canarias, Cantabria, Comunitat Valenciana, Extremadura, and Murcia, updated its corresponding law. Region of País Vasco implemented the new threshold in 1998, Madrid in year 2000, Region of La Rioja and Region of Aragón in 2001, and the Region of Catalunya in 2002. Late joiners, namely Galicia, Baleares, and Asturias shifted the threshold in 2011, 2014, and 2015, respectively. Table C1, in Appendix C provides detailed regional information.

Our empirical study takes advantage of this quasi-natural experiment using a differences in differences (hereafter, DiD) method, with the aim of evaluating and quantifying the prospective effects of changing the MLDA on the consumption of legal drugs (i.e. alcoholic drinks and cigarettes) and their related morbidity outcomes.

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1Regions of Castilla y León, and Comunitat Valenciana kept permitting teenagers aged 16 or older to consume alcoholic drinks up to 18° alcoholic degrees until year 2007 and 2002, respectively. In order to provide conservative estimates, we consider year of partial ban, when proceeds, as if it were the case of a full prohibition.
2 Methods

2.1 Differences-in-Differences

We compare variation in prevalence measures between the treatment group (16-18 years old individuals) and the control group (20-22 years old individuals) before and after policy implementation. The key identifying assumption in our DiD setting is that the variables reflecting the answers of individuals within the treatment group would have followed parallel trends to those variables reflecting the answers of individuals in the control group, if the MLDA had not changed. Figures 1 - 7, provided in Appendix B, show graphical evidence to assess the validity of this assumption.

2.2 Analysis

We constructed each regional outcome variable $y_{str}$ as prevalence per treatment status, for each year before and after policy implementation. Our treatment dummy variable $d_{treatment}$ takes on value 1 for the treatment group, and value 0 for the control group. Our pre-post policy dummy variable $d_{policy}$ takes on value 1 for the year of implementation and subsequent years, and 0 for all years prior to the year of the legal change. Variable $DD_{str}$ is the interaction between dummy variables $d_{treatment}$ and $d_{policy}$.

Our econometric model is the following:

$$y_{str} = \beta_0 + \beta_1 \ast d_{treatment} + \beta_2 \ast d_{policy} + \beta_3 DD_{str} + \alpha_r + \psi_t + \theta_{rt} + \epsilon_{str}$$ (1)

Equation 1 includes region fixed-effects ($\alpha_r$), year fixed-effects ($\psi_t$), as well as region-specific linear trends ($\theta_{rt}$), and an error term ($\epsilon_{str}$). Standard errors were clustered at the regional level and computed using wild-bootstrapping (Bertrand, Duflo, & Mullainathan, 2004). Furthermore, regional size differences are taken into account by using as analytical weights the corresponding population per treatment status, region and year. The coefficients of interest that would quantify the causal effect of this policy reform, provided our parallel trends assumption holds, would be a statistically significant estimate of $\beta_3$.

3 Data

Figure 2: Spain - Implementation of the New MLDA during years 1994-2002

Note: MLDA = Stands for Minimum Legal Drinking Age. Source: Official National/Regional Bulletins.

The National Health Survey, (Encuesta Nacional de Salud or ENS), and The Hospital Morbidity Survey (Encuesta de Morbilidad Hospitalaria or EMH) are the two main data sources used in this study. While ENS available waves correspond to years 1991, 1993, 1995, 1997, 2001, 2003, 2004, 2006, and 2007, EMH available waves correspond to each natural year between the 1991-2007 period. In order to use the same available data from both sources, we only used yearly datasets corresponding to ENS available waves. From these foregoing sources, we extracted data for the same thirteen regions that shifted the MLDA between years 1994-2002 (see Figure 2). Data for the four remaining regions that shifted the MLDA in years, 1991, 2011, 2014, 2015, were not included due to a lack of enough pre or
post policy survey datasets. Three regional panel datasets were prepared, the first including males and females altogether, the second considering only females, and the third including just males. We only considered individuals aged 16-18 or 20-22. Data regarding regional population were extracted from the Population Statistics Database provided by the National Statistics Institute (Instituto Nacional de Estadística or INE).

4 Results

4.1 Overall Prevalence

Table 1: Overall Drinking Prevalence
DiD - Summarized Results

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD=Dummy treatment*Dummy policy</td>
<td>-0.06**</td>
<td>-0.02</td>
<td>-0.08**</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.05)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Dummy treatment</td>
<td>-0.17***</td>
<td>-0.14***</td>
<td>-0.19***</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.05)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Dummy policy</td>
<td>0.00</td>
<td>-0.02</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.05)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.72***</td>
<td>0.26***</td>
<td>0.50***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Observations</td>
<td>208</td>
<td>203</td>
<td>207</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.63</td>
<td>0.48</td>
<td>0.54</td>
</tr>
<tr>
<td>Mean Before Policy for Treated</td>
<td>0.48</td>
<td>0.38</td>
<td>0.54</td>
</tr>
<tr>
<td>Implied impact of New MLDA in %</td>
<td>-11.57</td>
<td>-5.12</td>
<td>-14.31</td>
</tr>
</tbody>
</table>

Note: Region and Year fixed effects included. Region-specific linear trends also included. Clustered standard errors using wild bootstrap method (400 reps, 200 seeds), in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Weighted by corresponding population per each region, year, and treatment status. Source: Encuesta de Nacional de Salud (ENS): 1993; 1995; 1997; 2001; 2003(2004); 2006(2007). Ministerio de Sanidad, Servicios Sociales e Igualdad.

Table 1 show two statistically significant $DD_{str}$ estimated coefficients of -0.06 and -0.08, both significant at the 5% level, corresponding to causal effects of -11.57% and -14.31% in overall drinking prevalence for the subsample including both genders and the subsample of males, respectively. However, for the case of overall smoking prevalence, Table A1, shows that none of the $DD_{str}$ estimated coefficients in any the three subsamples is statistically significant. Figure 1 in Appendix B provide graphical evidence suggesting that our parallel trends assumption holds.

4.2 Drink type Prevalence

Firstly, for the beer with alcohol case, the third column in Table 2, corresponding to the subsample of males, shows a $DD_{str}$ estimated coefficient of -0.07, statistically significant at the 1% level, suggestive of a causal effect of -8.98%. Secondly, for the mixed drinks and/or liquors case, the first column in Table 3 regarding the subsample including both genders shows a $DD_{str}$ estimated coefficient of -0.04, statistically significant at the 10% level, that corresponds to a causal effect of -9.53%, whereas the third column, with regard to the subsample of males, shows a $DD_{str}$ estimated coefficient of -0.08, statistically significant at the 10% level, that implies a causal effects of -16.66%. Thirdly, the first and second columns in Table 4 for the wine and/or cava case, show estimates, at the 5% level, of -0.06 and -0.08 corresponding to an implied effect of -12.62% and -15.16% respectively. Interestingly, these latter effects are identified for the subsample of both genders and the subsample of just females, correspondingly. Figures 3, 4, and 5, in Appendix B, provide graphical evidence supporting the validity of our parallel trends assumption.

$DD_{str}$

In Appendix C, Table C1 shows precise implementation dates; Table C2 depicts a summary of descriptive statistics for ENS and EMH waves; finally, Table C3 lists diseases (diagnoses) considered for the case of morbidity outcomes.
Table 2: Beer with alcohol drinking Prevalence
DiD - Summarized Results

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD=Dummy treatment*Dummy policy</td>
<td>-0.03</td>
<td>0.01</td>
<td>-0.07***</td>
</tr>
<tr>
<td>Dummy treatment</td>
<td>-0.10***</td>
<td>-0.10***</td>
<td>-0.10**</td>
</tr>
<tr>
<td>Dummy policy</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>Constant</td>
<td>0.74***</td>
<td>1.02***</td>
<td>0.91***</td>
</tr>
</tbody>
</table>

Observations | 204 | 190 | 203 |
R-squared | 0.62 | 0.39 | 0.56 |
Mean Before Policy for Treated | 0.72 | 0.61 | 0.80 |
Implied impact of New MLDA in % | -4.62 | 2.14 | -8.98 |

Note: Region and Year fixed effects included. Region-specific linear trends also included. Clustered standard errors using wild bootstrap method (400 reps, 200 seeds), in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Weighted by corresponding population per each region, year, and treatment status. Source: Encuesta de Nacional de Salud (ENS): 1993; 1995; 1997; 2001; 2003(2004); 2006(2007). Ministerio de Sanidad, Servicios Sociales e Igualdad.

Table 3: Mixed drinks and/or liquors drinking Prevalence
DiD - Summarized Results

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD=Dummy treatment*Dummy policy</td>
<td>-0.04*</td>
<td>0.07</td>
<td>-0.08*</td>
</tr>
<tr>
<td>Dummy treatment</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.05</td>
</tr>
<tr>
<td>Dummy policy</td>
<td>-0.03</td>
<td>-0.04</td>
<td>-0.01</td>
</tr>
<tr>
<td>Constant</td>
<td>0.36***</td>
<td>0.36***</td>
<td>0.31***</td>
</tr>
</tbody>
</table>

Observations | 181 | 164 | 173 |
R-squared | 0.62 | 0.39 | 0.65 |
Mean Before Policy for Treated | 0.43 | 0.36 | 0.47 |
Implied impact of New MLDA in % | -9.53 | 2.14 | -16.66 |

Note: Region and Year fixed effects included. Region-specific linear trends also included. Clustered standard errors using wild bootstrap method (400 reps, 150 seeds), in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Weighted by corresponding population per each region, year, and treatment status. Source: Encuesta de Nacional de Salud (ENS): 1993; 1995; 1997; 2001; 2003(2004); 2006(2007). Ministerio de Sanidad, Servicios Sociales e Igualdad.
Table 4: Wine and/or Cava drinking Prevalence
DiD - Summarized Results

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD=Dummy treatment*Dummy policy</td>
<td>-0.06**</td>
<td>-0.08**</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Dummy treatment</td>
<td>-0.07**</td>
<td>-0.07</td>
<td>-0.06**</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.05)</td>
<td>(0.03)</td>
</tr>
<tr>
<td>Dummy policy</td>
<td>-0.08**</td>
<td>-0.08</td>
<td>-0.07</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.10)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.34***</td>
<td>0.51***</td>
<td>0.28***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
<tr>
<td>Observations</td>
<td>198</td>
<td>186</td>
<td>194</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.52</td>
<td>0.49</td>
<td>0.48</td>
</tr>
<tr>
<td>Mean Before Policy for Treated</td>
<td>0.49</td>
<td>0.51</td>
<td>0.48</td>
</tr>
<tr>
<td>Implied impact of New MLDA in %</td>
<td>-12.62</td>
<td>-15.16</td>
<td>-9.65</td>
</tr>
</tbody>
</table>

Note: Region and Year fixed effects included. Region-specific linear trends also included. Clustered standard errors using wild bootstrap method (400 reps, 200 seeds), in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Weighted by corresponding population per each region, year, and treatment status. Source: Encuesta de Nacional de Salud (ENS): 1993; 1995; 1997; 2001; 2003(2004); 2006(2007). Ministerio de Sanidad, Servicios Sociales e Igualdad.

4.3 Morbidity Outcomes

Tables A2 and A3 in Appendix A show that none of the $DD_{str}$ estimates is statistically significant. Figures 6 and 7 in Appendix B supports our parallel trends assumption.

5 Discussion

Firstly, our main result regarding overall drinking prevalence show reductions ranging from -11.57% for the subsample including both genders to -14.31% for the subsample of males. Secondly, effects on males are driven mainly by reductions in beer with alcohol consumption (-8.98%) and to a lesser extend to reductions in mixed drinks and/or liquors consumption (-16.66%). Thirdly, effects on wine and/or cava drinking prevalence range from -12.62% for the subsample including both genders to -9.65% for the subsample of females. No effects regarding overall smoking prevalence are found. Fourthly, we do not find evidence that these reductions in alcohol consumption are translated into hospitalizations related to alcohol overdose.

We argue that the mechanism of transmission of this policy is closely related to bench drinking or “botellón” given that the identified effects are observed on popular drink types amongst teenagers. Nonetheless, analysing the degree of effective enforcement in public areas as well as the existing alternative ways youngsters use to have access to alcoholic drinks could help to put these findings in context. These effects can be considered as a lower bound given the usual limitations of surveys of this sort (i.e. underreporting). Finally, there may also be unobserved confounding factors that were not controlled by comparison with the 20-22 cohort.

6 Conclusions

Our findings provide evidence to argue that shifting the MLDA from 16 to 18 years old caused important reductions in alcohol consumption. To our knowledge we are the first to provide evidence regarding gender-based differences related to policies aimed at reducing alcohol consumption. This results suggest that the inclusion of gender perspectives in the process of policy design can contribute to identify more effective policy levers. Furthermore, a quite interesting exercise would be to assess the findings of this study to those that could be obtained from a more focused set of surveys such as the Survey on Alcohol and other Drugs in Spain (Encuesta sobre alcohol y otras drogas en España, 2009).

5
EDADES)³. We believe our results have important policy implications for countries currently considering changes in the Minimum Legal Drinking Age. If this reduction had an impact on the prospective consequences of excessive drinking, such as performance on standardized tests, crime rate, or traffic accidents, remains as key topics for future research.

Source of Financial Support

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Conflict of Interest

The authors have no conflict of interest.

Acknowledgements

CRES-UPF fellows. The authors are solely responsible for errors or omissions.

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References


## Appendix A: Auxiliary Results

### 6.1 Tables - Overall Smoking Prevalence

#### Table A1: Overall Smoking Prevalence  
DiD - Summarized Results

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD=Dummy treatment*Dummy policy</td>
<td>-0.02 (0.03)</td>
<td>-0.03 (0.05)</td>
<td>0.01 (0.04)</td>
</tr>
<tr>
<td>Dummy treatment</td>
<td>-0.16*** (0.05)</td>
<td>-0.15** (0.06)</td>
<td>-0.16** (0.07)</td>
</tr>
<tr>
<td>Dummy policy</td>
<td>-0.04 (0.03)</td>
<td>-0.05 (0.05)</td>
<td>-0.03 (0.05)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.54*** (0.00)</td>
<td>0.31*** (0.00)</td>
<td>0.35*** (0.00)</td>
</tr>
</tbody>
</table>

Observations: 208, 203, 207  
R-squared: 0.57, 0.39, 0.44  
Mean Before Policy for Treated: 0.35, 0.33, 0.35  
Implied impact of New MLDA in %: -4.68, -9.58, 2.75

Note: Region and Year fixed effects included. Region-specific linear trends also included. Clustered standard errors using wild bootstrap method (400 reps, 200 seeds), in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Weighted by corresponding population per each region, year, and treatment status. Source: Encuesta de Nacional de Salud (ENS): 1993; 1995; 1997; 2001; 2003(2004); 2006(2007). Ministerio de Sanidad, Servicios Sociales e Igualdad.

#### Table A2: Hospitalizations by MDALC  
DiD - Summarized Results

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD=Dummy treatment*Dummy policy</td>
<td>-1.58 (15.68)</td>
<td>-0.87 (1.63)</td>
<td>-1.55 (8.79)</td>
</tr>
<tr>
<td>Dummy treatment</td>
<td>-36.77*** (12.92)</td>
<td>-8.05*** (2.83)</td>
<td>-28.26*** (9.92)</td>
</tr>
<tr>
<td>Dummy policy</td>
<td>-1.22 (4.37)</td>
<td>-2.14 (3.90)</td>
<td>2.25 (3.58)</td>
</tr>
<tr>
<td>Constant</td>
<td>12.14*** (4.27)</td>
<td>4.95*** (0.00)</td>
<td>31.47*** (0.00)</td>
</tr>
</tbody>
</table>

Observations: 200, 190, 188  
R-squared: 0.81, 0.77, 0.77  
Mean Before Policy for Treated: 21.81, 8.71, 15.83  
Implied impact of New MLDA in %: -7.23, -9.58, -9.82

Note: MDALC = Main diagnostic related to alcohol consumption. Region and Year fixed effects included. Region-specific linear trends also included. Clustered standard errors using wild bootstrap method (400 reps, 200 seeds), in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Weighted by corresponding population per each region, year, and treatment status. Source: Encuesta de Mordilidad Hospitalaria (EMH): 1993-2007. Ministerio de Sanidad, Servicios Sociales e Igualdad.
Table A3: Ratio Hospitalizations by MDALC/population (per 1000 individuals)
DiD - Summarized Results

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DD=Dummy treatment*Dummy policy</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.04</td>
</tr>
<tr>
<td></td>
<td>(0.08)</td>
<td>(0.02)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>Dummy treatment</td>
<td>-0.16***</td>
<td>-0.07**</td>
<td>-0.23***</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.03)</td>
<td>(0.08)</td>
</tr>
<tr>
<td>Dummy policy</td>
<td>-0.02</td>
<td>-0.03</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.35***</td>
<td>0.31***</td>
<td>1.34***</td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
</tr>
</tbody>
</table>

Observations 200 190 188
R-squared 0.73 0.63 0.70
Mean Before Policy for Treated 0.15 0.14 0.20
Implied impact of New MLDA in % -3.97 14.29 -20.00

Note: MDALC = Main diagnostic related to alcohol consumption. Region and Year fixed effects included. Region-specific linear trends also included. Clustered standard errors using wild bootstrap method (400 reps, 200 seeds), in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Weighted by corresponding population per each region, year, and treatment status. Source: Encuesta de Mordilidad Hospitalaria (EMH): 1993-2007. Ministerio de Sanidad, Servicios Sociales e Igualdad.
Appendix B: Auxiliary Figures

Figures - Overall prevalence

Figure 1: Trends - Overall drinking prevalence

(a) Both genders  
(b) Females  
(c) Males

Note: MLDA = Minimum Legal Drinking Age. Source: Ministerio de Sanidad y Asuntos Sociales.

Figure 2: Trends - Overall smoking prevalence

(a) Both genders  
(b) Females  
(c) Males

Note: MLDA = Minimum Legal Drinking Age. Source: Ministerio de Sanidad y Asuntos Sociales.
Figures - Drink type prevalence

Figure 3: Trends - Beer with alcohol drinking prevalence

(a) Both genders

(b) Females

(c) Males

Note: MLDA = Minimum Legal Drinking Age. Source: Ministerio de Sanidad y Asuntos Sociales.

Figure 4: Trends - Mixed drinks and/or Liquors drinking prevalence

(a) Both genders

(b) Females

(c) Males

Note: MLDA = Minimum Legal Drinking Age. Source: Ministerio de Sanidad y Asuntos Sociales.
Figure 5: Trends - Wine and/or Cava drinking prevalence

(a) Both genders

(b) Females

(c) Males

Note: MLDA = Minimum Legal Drinking Age. Source: Ministerio de Sanidad y Asuntos Sociales.

Figures - Morbidity Outcomes

Figure 6: Trends - Hospitalizations by MDALC

(a) Both genders

(b) Females

(c) Males

Note: MDALC = Mean diagnostic related to alcohol consumption. Source: Ministerio de Sanidad y Asuntos Sociales.
Figure 7: Trends - Ratio Hospitalizations by MDALC/Population (per 1000 individuals)

(a) Both genders

(b) Females

(c) Males

Note: MDALC = Mean diagnostic related to alcohol consumption. Source: Ministerio de Sanidad y Asuntos Sociales.
### Appendix C: Auxiliary Tables

#### Table C1: Spain - Implementation of New MLDA in all seventeen regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Date of implementation</th>
<th>Regional or National Official Bulletins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Castilla y León</td>
<td>April 7th, 1994 (partial ban)</td>
<td>BOCL nm. 65, de 6 de abril de 1994</td>
</tr>
<tr>
<td></td>
<td>June 14th, 2007 (full ban)</td>
<td>BOCL nm. 52, de 14 de marzo de 2007</td>
</tr>
<tr>
<td>Castilla-La Mancha</td>
<td>April 22nd, 1995</td>
<td>Diario Oficial de Castilla-La Mancha núm. 19, de 21 de abril de 1995</td>
</tr>
<tr>
<td>Canarias</td>
<td>February 18th, 1997</td>
<td>BOE-A-1997-5498</td>
</tr>
<tr>
<td>Cantabria</td>
<td>November 15th, 1997</td>
<td>Boletín Oficial de Cantabria núm. 205, de 14 de noviembre de 1997</td>
</tr>
<tr>
<td>C. Valenciana</td>
<td>June 19th, 1997 (partial ban)</td>
<td>Diario Oficial de la Generalitat Valenciana núm. 3.016, de 18 de junio de 1997</td>
</tr>
<tr>
<td></td>
<td>August 27th, 2002 (full ban)</td>
<td>BOE-A-2002-14189</td>
</tr>
<tr>
<td>Extremadura</td>
<td>May 18th, 1997</td>
<td>Diario Oficial de Extremadura núm. 57, de 17 de mayo de 1997</td>
</tr>
<tr>
<td>Aragón</td>
<td>May 1st, 2001</td>
<td>BOE-A-2001-9342</td>
</tr>
<tr>
<td>La Rioja</td>
<td>February 18th, 2001</td>
<td>BOE-A-2000-21563</td>
</tr>
<tr>
<td>Cataluña</td>
<td>April 8th, 2002</td>
<td>DOGC nm. 3598, de 19 de marzo de 2002</td>
</tr>
<tr>
<td>Galicia†</td>
<td>February 28th, 2011</td>
<td>BOE-A-2011-1647</td>
</tr>
<tr>
<td>Baleares†</td>
<td>February 28th, 2014</td>
<td>BOE-A-2014-655</td>
</tr>
<tr>
<td>Asturias†</td>
<td>May 20th, 2015</td>
<td>BOE-A-2015-4847</td>
</tr>
</tbody>
</table>

Note: MLDA = Minimum Legal Drinking Age. BOE = Boletín Oficial del Estado (National Official Bulletin). BOCL = Boletín Oficial de Castilla y León (Official Bulletin of Region of Castilla y León). DOGC = Diario Oficial de la Generalitat de Catalunya (Official Bulletin of the Region of Catalonia). † Data for these regions was not used because New MLDA was implemented outside the 1993-2007 inclusive range of years. Source: Regional or National Official Bulletins.
Table C2: National Health Survey and Hospital Morbidity Survey  
Summary of Descriptive Statistics

Panel A: National Health Survey (ENS)  
1993-2007

<table>
<thead>
<tr>
<th></th>
<th>count</th>
<th>1993-2007</th>
<th>mean</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dummy Treatment: 0=Cohorts 20-22=0; 1=Cohorts 16-18</td>
<td>208</td>
<td></td>
<td>0.50</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Dummy gender: 0=Females; 1=Males</td>
<td>208</td>
<td></td>
<td>0.53</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Have you drunk recently?</td>
<td>208</td>
<td></td>
<td>0.54</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Do you smoke nowadays?</td>
<td>208</td>
<td></td>
<td>0.37</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Do you drink beer with alcohol?</td>
<td>204</td>
<td></td>
<td>0.66</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Do you drink mixed drinks and/or liquors?</td>
<td>181</td>
<td></td>
<td>0.48</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Do you drink wine and/or cava?</td>
<td>198</td>
<td></td>
<td>0.41</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Do you drink aperitives with alcohol?</td>
<td>189</td>
<td></td>
<td>0.16</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Do you drink whisky?</td>
<td>190</td>
<td></td>
<td>0.22</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Panel B: Hospital Morbidity Survey (EMH)  
1993-2007

<table>
<thead>
<tr>
<th></th>
<th>count</th>
<th>1993-2007</th>
<th>mean</th>
<th>min</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospitalizations due to MDALC</td>
<td>200</td>
<td></td>
<td>33.95</td>
<td>1.00</td>
<td>180.00</td>
</tr>
<tr>
<td>Hospitalizations/Population(per 1000 hab.)</td>
<td>200</td>
<td></td>
<td>0.29</td>
<td>0.02</td>
<td>1.28</td>
</tr>
</tbody>
</table>

Table C3: List of diseases (diagnostics) considered. ICD-9 codes

Codes: 290-319 Mental disorders

Psychosis (290-299)
Organic psychotic conditions (290-294)
(291) Alcoholic psychoses
(292) Drug psychoses

Neurotic disorders, personality disorders, and other nonpsychotic mental disorders (300-316)
Sexual deviations and disorders (302)
(302) Sexual deviations and disorders

Psychoactive substance (303-305)
(303) Alcohol dependence syndrome (Include: acute drunkenness in alcoholism, dipsomania, chronic alcoholism)
(304) Drug dependence
(305) Nondependent abuse of drugs

Codes: 520-579 Diseases of the digestive system

Other diseases of digestive system (570-579)
Liver
(570) Acute and subacute necrosis of liver
(571) Chronic liver disease and cirrhosis
(572) Liver abscess and sequelae of chronic liver disease
(573) Other disorders of liver

Codes: 800-999 Injury and poisoning

Poisoning by drugs, medicinal and biological substances (960-979)
(967) Poisoning by sedatives and hypnotics
(968) Poisoning by other Central nervous system depressants and anesthetics
(969) Poisoning by psychotropic agents
(970) Poisoning by central nervous system stimulants
(971) Poisoning by drugs primarily affecting the autonomic nervous system
(972) Poisoning by agents primarily affecting the cardiovascular system

Source: Ministerio de Sanidad, Servicios Sociales e Igualdad.


2013/4, Montolio, D.; Planells, S.: "Does tourism boost criminal activity? Evidence from a top touristic country"

2013/5, García-López, M.A.; Holl, A.; Viladecans-Marsal, E.: "Suburbanization and highways: when the Romans, the Bourbons and the first cars still shape Spanish cities"

2013/6, Bosch, N.; Espasa, M.; Montolio, D.: "Should large Spanish municipalities be financially compensated? Costs and benefits of being a capital/central municipality"

2013/7, Escardíbul, J.O.; Mora, T.: "Teacher gender and student performance in mathematics. Evidence from Catalonia"

2013/8, Arqué-Castells, P.; Viladecans-Marsal, E.: "Banking towards development: evidence from the Spanish banking expansion plan"

2013/9, Asensio, J.; Gómez-Lobo, A.; Matas, A.: "How effective are policies to reduce gasoline consumption? Evaluating a quasi-natural experiment in Spain"

2013/10, Jofre-Monseny, J.: "The effects of unemployment benefits on migration in lagging regions"


2013/12, Jerrim, J.; Choi, A.: "The mathematics skills of school children: How does England compare to the high performing East Asian jurisdictions?"


2013/14, Lundqvist, H.: "Is it worth it? On the returns to holding political office"

2013/15, Ahlfeldt, G.M.; Maennig, W.: "Homevoters vs. leasevoters: a spatial analysis of airport effects"

2013/16, Lampón, J.F.; Lago-Peñas, S.: "Factors behind international relocation and changes in production geography in the European automobile components industry"

2013/17, Guío, J.M.; Choi, A.: "Evolution of the school failure risk during the 2000 decade in Spain: analysis of Pisa results with a two-level logistic mode"

2013/18, Dahlby, B.; Rodden, J.: "A political economy model of the vertical fiscal gap and vertical fiscal imbalances in a federation"

2013/19, Acacia, F.; Cubel, M.: "Strategic voting and happiness"

2013/20, Hellerstein, J.K.; Kutzbach, M.J.; Neumark, D.: "Do labor market networks have an important spatial dimension?"

2013/21, Pellegrino, G.; Savona, M.: "Is money all? Financing versus knowledge and demand constraints to innovation"

2013/22, Lin, J.: "Regional resilience"

2013/23, Costa-Campi, M.T.; Duch-Brown, N.; García-Quevedo, J.: "R&D drivers and obstacles to innovation in the energy industry"

2013/24, Huisman, R.; Stradic, V.; Westgaard, S.: "Renewable energy and electricity prices: indirect empirical evidence from hydro power"

2013/25, Dargaud, E.; Mantovani, A.; Reggiani, C.: "The fight against cartels: a transatlantic perspective"

2013/26, Lambertini, I.; Mantovani, A.: "Feedback equilibria in a dynamic renewable resource oligopoly: pre-emption, voracity and exhaustion"

2013/27, Feld, I.P.; Kalb, A.; Moessinger, M.D.; Osterloh, S.: "Sovereign bond market reactions to fiscal rules and no-bailout clauses – the Swiss experience"


2013/29, Reveli, F.: "Tax limits and local democracy"


2013/31, Dargaud, E.; Mantovani, A.; Reggiani, C.: "The fight against cartels: a transatlantic perspective"

2013/32, Saarimaa, T.; Tukiainen, J.: "Local representation and strategic voting: evidence from electoral boundary reforms"

2013/33, Agassisti, T.; Murtinu, S.: "Are we wasting public money? No! The effects of grants on Italian university students' performances"


2013/35, Carozzi, F.; Repetto, L.: "Sending the pork home: birth town bias in transfers to Italian municipalities"

2013/36, Coad, A.; Frankish, J.S.; Roberts, R.G.; Storey, D.J.: "New venture survival and growth: Does the fog lift?"

2013/37, Giulietti, M.; Grossi, L.; Waterson, M.: "Revenues from storage in a competitive electricity market: Empirical evidence from Great Britain"
2014/1, Montolio, D.; Planells-Struse, S.: "When police patrols matter. The effect of police proximity on citizens' crime risk perception"

2014/2, García-López, M.A.; Solé-Ollé, A.; Viladecans-Marsal, E.: "Do land use policies follow road construction?"

2014/3, Piolatto, A.; Rablen, M.D.: "Prospect theory and tax evasion: a reconsideration of the Yitzhaki puzzle"


2014/5, Durán-Cabrè, J.M.; Esteller-Moré, E.: "Tax professionals’ view of the Spanish tax system: efficiency, equity and tax planning"

2014/6, Cubel, M.; Sanchez-Pages, S.: "Difference-form group contest"

2014/7, Del Rey, E.; Racionero, M.: "Choosing the type of income-contingent loan: risk-sharing versus risk-pooling"


2014/9, Piolatto, A.: "Itemised deductions: a device to reduce tax evasion"


2014/12, Calero, J.; Escardibul, J.O.: "Barriers to non-formal professional training in Spain in periods of economic growth and crisis. An analysis with special attention to the effect of the previous human capital of workers"

2014/13, Cubel, M; Sanchez-Pages, S.: "Gender differences and stereotypes in the beauty"

2014/14, Piolatto, A.; Schuet, F.: "Media competition and electoral politics"


2014/16, Lopez-Rodriguez, J.; Martínez, D.: "Beyond the R&D effects on innovation: the contribution of non-R&D activities to TFP growth in the EU"


2014/18, Vona, F.; Nicolli, F.: "Energy market liberalization and renewable energy policies in OECD countries"

2014/19, Curto-Grau, M.: "Voters’ responsiveness to public employment policies"

2014/20, Duro, J.A.; Teixidó-Figueras, J.; Padilla, E.: "The causal factors of international inequality in co2 emissions per capita: a regression-based inequality decomposition analysis"


2014/23, Mir-Artigues, P.; del Río, P.: "Combining tariffs, investment subsidies and soft loans in a renewable electricity deployment policy"


2014/26, Solé-Ollé, A.; Sorribas-Navarro, P.: "Does corruption erode trust in government? Evidence from a recent surge of local scandals in Spain"

2014/27, Costas-Pérez, E.: "Political corruption and voter turnout: mobilization or disaffection?"


2014/29, Teresa Costa, M.T.; Trujillo-Baute, E.: "Retail price effects of feed-in tariff regulation"

2014/30, Kilic, M.; Trujillo-Baute, E.: "The stabilizing effect of hydro reservoir levels on intraday power prices under wind forecast errors"

2014/31, Costa-Campi, M.T.; Duch-Brown, N.: "The diffusion of patented oil and gas technology with environmental uses: a forward patent citation analysis"


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2014/34, Huismann, R.; Trujillo-Baute, E.: "Costs of power supply flexibility: the indirect impact of a Spanish policy change"

2014/35, Jerrim, J.; Choi, A.; Simancas Rodríguez, R.: "Two-sample two-stage least squares (TSTLS) estimates of earnings mobility: how consistent are they?"

2014/36, Mantovani, A.; Tarola, O.; Vergari, C.: "Hedonic quality, social norms, and environmental campaigns"

2014/37, Ferraresi, M.; Galmárini, U.; Rizzo, L.: "Local infrastructures and externalities: Does the size matter?"

2014/38, Ferraresi, M.; Rizzo, L.; Zanardi, A.: "Policy outcomes of single and double-ballot elections"
2015/1, Foremny, D.; Freier, R.; Moessinger, M-D.; Yeter, M.: "Overlapping political budget cycles in the legislative and the executive"
2015/2, Colombo, L.; Galmarini, U.: "Optimality and distortionary lobbying: regulating tobacco consumption"
2015/3, Pellegrino, G.: "Barriers to innovation: Can firm age help lower them?"
2015/5, Cubel, M.; Sanchez-Pages, S.: "An axiomatization of difference-form contest success functions"
2015/7, Durán-Cabrè, J.M.; Esteller-Moré, A.; Salvadori, L.: "Empirical evidence on tax cooperation between sub-central administrations"
2015/8, Batalla-Bejerano, J.; Trujillo-Baute, E.: "Analysing the sensitivity of electricity system operational costs to deviations in supply and demand"
2015/9, Salvadori, L.: "Does tax enforcement counteract the negative effects of terrorism? A case study of the Basque Country"
2015/11, Piolatto, A.: "Online booking and information: competition and welfare consequences of review aggregators"
2015/12, Boffa, F.; Pingali, V.; Sala, F.: "Strategic investment in merchant transmission: the impact of capacity utilization rules"
2015/13, Siemrod, J.: "Tax administration and tax systems"
2015/14, Arqué-Castells, P.; Cartadox, R.M.; García-Quevedo, J.; Mira Godinho, M.: "How inventor royalty shares affect patenting and income in Portugal and Spain"
2015/15, Montolío, D.; Planells-Struse, S.: "Measuring the negative externalities of a private leisure activity: hooligans and pickpockets around the stadium"
2015/17, Batalla-Bejerano, J.; Trujillo-Baute, E.: "Impacts of intermittent renewable generation on electricity system costs"
2015/18, Costa-Campi, M.T.; Paniagua, J.; Trujillo-Baute, E.: "Are energy market integrations a green light for FDI?"
2015/19, Jofre-Monseny, J.; Sánchez-Vidal, M.; Viladecans-Marsal, E.: "Big plant closures and agglomeration economies"
2015/21, Esteller-Moré, A.; Galmarini, U.; Rizzo, L.: "Fiscal equalization under political pressures"
2015/23, Aidt, T.; Asatryan, Z.; Badalyan, L.; Heinemann, F.: "Vote buying or (political) business (cycles) as usual?"
2015/24, Alback, K.: "A test of the ‘lose it or use it’ hypothesis in labour markets around the world"
2015/25, Angelucci, C.; Russo, A.: "Petty corruption and citizen feedback"
2015/26, Moriconi, S.; Picard, P.M.; Zanaj, S.: "Commodity taxation and regulatory competition"
2015/28, Redonda, A.: "Market structure, the functional form of demand and the sensitivity of the vertical reaction function"
2015/30, García-López, M.A.; Pasidís, I.; Viladecans-Marsal, E.: "Express delivery to the suburbs the effects of transportation in Europe’s heterogeneous cities"
2015/32, Choi, H.; Choi, A.: "When one door closes: the impact of the hagwon curfew on the consumption of private tutoring in the republic of Korea"
2015/37, Daniele, G.: “Strike one to educate one hundred: organized crime, political selection and politicians’ ability”
2015/41, Daniele, G.; Geys, B.: “Exposing politicians’ ties to criminal organizations: the effects of local government dissolutions on electoral outcomes in Southern Italian municipalities”
2015/42, Ooghe, E.: “Wage policies, employment, and redistributive efficiency”

2016/1, Galletta, S.: “Law enforcement, municipal budgets and spillover effects: evidence from a quasi-experiment in Italy”
2016/3, Calero, J.; Murillo Huertas, I.P.; Raymond Bara, J.L.: “Education, age and skills: an analysis using the PIAAC survey”
2016/5, Falck, O.; Heimisch, A.; Wiederhold, S.: “Returns to ICT skills”
2016/6, Halmschlagner, C.; Mantovani, A.: “On the private and social desirability of mixed bundling in complementary markets with cost savings”
2016/10, Bianchini, S.; Pellegrino, G.; Tamagni, F.: “Innovation strategies and firm growth”
2016/12, Sanchez-Vidal, M.: “Small shops for sale! The effects of big-box openings on grocery stores”
2016/13, Costa-Campi, M.T.; García-Quevedo, J.; Martínez-Ros, E.: “What are the determinants of investment in environmental R&D?”
2016/17, Scandurra, R.I.; Calero, J.: “Modelling adult skills in OECD countries”
2016/19, Del Rio, P.; Mir-Artigues, P.; Trujillo-Baute, E.: “Analysing the impact of renewable energy regulation on retail electricity prices”
2016/21, Ferraresi, M.; Galmarini, U.; Rizzo, L.; Zanardi, A.: “Switch towards tax centralization in Italy: A wake up for the local political budget cycle”
2016/26, Bruttì, Z.: “Cities drifting apart: Heterogeneous outcomes of decentralizing public education”
2016/27, Backus, P.; Cubell, M.; Guid, M.; Sánchez-Pages, S.; Lopez Manas, E.: “Gender, competition and performance: evidence from real tournaments”
2016/29, Daniele, G.; Dipoppa, G.: “Mafia, elections and violence against politicians”
2016/30, Di Cosmo, V.; Malaguzzi Valeri, L.: “Wind, storage, interconnection and the cost of electricity”

2017

2017/2, Gómez San Román, T.: “Integration of DERs on power systems: challenges and opportunities”
2017/5, Solé-Ollé, A.; Viladecans-Marsal, E.: “Housing booms and busts and local fiscal policy”
2017/6, Esteller, A.; Piolatto, A.; Rahlen, M.D.: “Taxing high-income earners: Tax avoidance and mobility”
2017/9, Carozzi, F.; Repetto, L.: “Distributive politics inside the city? The political economy of Spain’s plan E”
2017/12, Murillo, I.P; Raymond, J.L.; Calero, J.: “Efficiency in the transformation of schooling into competences: A cross-country analysis using PIAAC data”
2017/13, Ferrer-Esteban, G.; Mediavilla, M.: “The more educated, the more engaged? An analysis of social capital and education”
2017/14, Sanchez-Guarnier, R.: “Decomposing the impact of immigration on house prices”
2017/18, González-Val, R.: “City size distribution and space”
2017/19, García-Quevedo, J.; Mas-Verdu, F.; Pellegrino, G.: “What firms don’t know can hurt them: Overcoming a lack of information on technology”

2018

2018/1, Boardway, R.; Pesticieau, P.: “The tenuous case for an annual wealth tax”
2018/2, García-López, M.A.: “All roads lead to Rome ... and to sprawl? Evidence from European cities”
2018/4, Cavalcanti, F.; Daniele, G.; Galletta, S.: “Popularity shocks and political selection”
2018/6, Agrawal, D. R.; Foremny, D.: “Relocation of the rich: migration in response to top tax rate changes from spanish reforms”
2018/7, García-Quevedo, J.; Kesidou, E.; Martínez-Ros, E.: “Inter-industry differences in organisational eco-innovation: a panel data study”
2018/9, Curci, F.; Masera, F.: “Flight from urban blight: lead poisoning, crime and suburbanization”
2018/14, Firmino, J.: “Class composition effects and school welfare: evidence from Portugal using panel data”


2018/18, Di Cosmo, V.; Trujillo-Baute, E.: “From forward to spot prices: producers, retailers and loss averse consumers in electricity markets”