Tobacco Sales Prohibition and Teen Smoking

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Disclosure

- Funding sources: University of Basel, Swiss National Science Foundation, Faculty of Business and Economics at the University of Basel Forum Grant
- No funding at any point from tobacco companies or advocacy organizations
- Other researchers can apply for access to the data sources and we are happy to share our code
Smokers start as teens

Starting Age

Minors

Adults

Percent

0 5 10 15 20

10 14 18 22 26 30
The WHO wants sales bans

Each party shall prohibit the sales of tobacco products to persons under the age set by national law or eighteen.
Health officials think sales bans work

Expect Decrease $\geq 5\text{ Perc. P.}$
Should sales bans work?

1. Cost
Should sales bans work?

1. Cost
2. Information
Should sales bans work?

1. Cost
2. Information
3. Forbidden fruit
Should sales bans work?

1. Cost
2. Information
3. Forbidden fruit
4. Circumvention
What we add

- Test of arguments
- Policy evaluation
Previous evidence

▶ Smoking bans and smoking

(Boes et al., 2015; Mazzonna and Salari, 2018)
Previous evidence

- Smoking bans and smoking
  (Boes et al., 2015; Mazzonna and Salari, 2018)

- Taxes and teen smoking
Previous evidence

- Smoking bans and smoking
  (Boes et al., 2015; Mazzonna and Salari, 2018)

- Taxes and teen smoking

- Sales bans and teen smoking:
  - Before and after
  - Policy mix in the US
    (Gruber and Zinman, 2000; Cawley et al., 2006; Nesson, 2017)
Previous evidence

- Smoking bans and smoking
  (Boes et al., 2015; Mazzonna and Salari, 2018)

- Taxes and teen smoking

- Sales bans and teen smoking:
  - Before and after
  - Policy mix in the US
    (Gruber and Zinman, 2000; Cawley et al., 2006; Nesson, 2017)
  - Drivers?
  - Natural experiment?
Identification
Our setting

▶ Well-defined policy change
Our setting

- Well-defined policy change
- Staggered introduction
Our setting

- Well-defined policy change
- Staggered introduction
- Homogeneous taxes
Our setting

- Well-defined policy change
- Staggered introduction
- Homogeneous taxes
- High smoking prevalence
Swiss data

- Quarterly repeated cross-section of individuals from 14 to 98
- 2001 to 2016 – N=167,000
  - Tobacco and Addiction Monitoring
Swiss data

- Quarterly repeated cross-section of individuals from 14 to 98
- 2001 to 2016 – N=167,000
  - Tobacco and Addiction Monitoring

- Smoking status
- Attitudes toward smoking
- Purchasing behavior
Swiss data on pupils

- Data on pupils aged 11 to 15 years
  - Health Behaviour in School-aged Children
  - Subset of cantons
Swiss data on pupils

- Data on pupils aged 11 to 15 years
  - Health Behaviour in School-aged Children
  - Subset of cantons

- Smoke status
- Age of first puff
Variation and data: EU

- Introduction or increase of minimum ages
  - 17 introductions
  - 8 increases
Variation and data: EU

- Introduction or increase of minimum ages
  - 17 introductions
  - 8 increases
- 9 repeated cross-sections of individuals
- 1990 to 2012, 32 countries – N=138,000
  - Eurobarometer
- Smoking status
Empirical strategy

\[ Smoker_{ict} = \beta BindingSalesBan_{ict} + \alpha SalesBan_{ct} \]

- \( Smoker_{ict} \) 1 if an individual smokes
- \( BindingSalesBan_{ict} \) 1 if the sales ban binds
- \( SalesBan_{ct} \) 1 if a sales ban exists
Empirical strategy

\[ Smoker_{ict} = \beta BindingSalesBan_{ict} + \alpha SalesBan_{ct} \]

- \( Smoker_{ict} \): 1 if an individual smokes
- \( BindingSalesBan_{ict} \): 1 if the sales ban binds
- \( SalesBan_{ct} \): 1 if a sales ban exists
Empirical strategy

\[ Smoker_{ict} = \beta BindingSalesBan_{ict} + \alpha SalesBan_{ct} + \gamma_a + \eta_{cxteen} + \theta_{yxteen} \]

\( \gamma_a \)  Age FE

\( \eta_{cxteen} \)  Age group \((< 21 \text{ vs. } \geq 21)\) specific canton FE

\( \theta_{yxteen} \)  Age group specific year FE
Empirical strategy

\[ Smoker_{ict} = \beta \ BindingSalesBan_{ict} + \alpha \ SalesBan_{ct} \]
\[ + \gamma_a + \eta_{cteen} + \theta_{yxteen} + X'_{ict}\delta + \varepsilon_{ict} \]

\[ X'_{ict} \] Gender, foreigner, household size
    dummies, physician density,
youth and general unempl.

\[ \varepsilon_{ict} \] Clustering on 26 cantons
Cantons have common trends

Share of Smokers

Year

2001 2003 2005 2007 2009 2011 2013 2015

Before Bans  Bans

.3  .25  .2  .15  .1  .1  .05  .0  

2001 2003 2005 2007 2009 2011 2013 2015
Results
Smoking trend does not change

Before

After

Share of Smokers

Distance to Introduction in Years
<table>
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<th>All Ages</th>
<th>11–15 Years Old</th>
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<td>X</td>
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<tr>
<td>Year FE</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Canton x Teen FE</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Year x Teen FE</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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Effect is smaller than expected
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<tr>
<td>Year FE</td>
<td>X</td>
</tr>
<tr>
<td>Country x Teen FE</td>
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<td>Year x Teen FE</td>
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<tr>
<td>Country Trends</td>
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Further results and robustness

- Common trends
  - Trends
  - Lead
  - Sample restrictions, balance checks
Further results and robustness

- Common trends
  - Trends
  - Lead
- Sample restrictions, balance checks
- Advertisement and smoking bans
Further results and robustness

- Common trends
- Trends
- Lead
- Sample restrictions, balance checks
- Advertisement and smoking bans
- Sensitivity to cantons
Further results and robustness

- Common trends
  - Trends
  - Lead
  - Table EU
- Sample restrictions, balance checks
- Advertisement and smoking bans
- Sensitivity to cantons
  - Figure
- Heterogeneities
  - Low education
Debate Over Prohibition
Prohibition could affect:

1. Cost
2. Information
3. Forbidden fruit
4. Circumvention
Prohibition could affect:

1. Cost
2. Information
3. Forbidden fruit
4. Circumvention
Danger and smoking

| Not at All | 0.54 |
| 2          | 0.33 |
| 3          | 0.28 |
| 4          | 0.24 |
| 5          | 0.19 |
| Very Dangerous | 0.21 |
Coolness and smoking

- Nonsmokers Cooler: 0.19
- Equally Cool: 0.35
- Smokers Cooler: 0.29
<table>
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<th>Dependent Variable</th>
<th>Smokers Are More:</th>
<th>Smoking is Dangerous</th>
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<tr>
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<td>Avg. Smokers</td>
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<td>Cant. Controls</td>
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<td>5,662</td>
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<td>Canton Clusters</td>
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<td>26</td>
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<tr>
<td>R-squared</td>
<td>0.03</td>
<td>0.06</td>
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</table>
Prohibition could affect:

1. Cost
2. Information
3. Forbidden fruit
4. Circumvention
Self purchase

Percent

Kiosk

Store

Rest.

Vend. M.
Reduction in sales to minors

![Graph showing reduction in sales to minors over years after introduction. The x-axis represents years after introduction, ranging from 'Up to 3' to '7 to 10'. The y-axis shows the share of sales violating the law, ranging from 0 to 100. The graph indicates a decreasing trend in the share of sales violating the law as the years after introduction increase.]
Peers as a cigarette source

- Friends: 80%
- Parents: 10%
- Siblings: 5%
### Tobacco and Addiction Monitoring, Ages 14-20

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Own Purchase (Smokers)</th>
<th>Smoker Sample</th>
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<tr>
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<td>Yes = 1</td>
<td>All</td>
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<td>Avg. for Minors:</td>
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<td></td>
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<td>Binding Sales Ban</td>
<td>-0.088**</td>
<td>-0.003</td>
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<tr>
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<td>Sales Ban</td>
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<td>-0.009</td>
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<td></td>
<td>(0.027)</td>
<td>(0.019)</td>
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<tr>
<td>Age FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Canton FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Year FE</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Canton x Teen FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Year x Teen FE</td>
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<td>X</td>
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<tr>
<td>Ind. Controls</td>
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<td>X</td>
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<tr>
<td>Cant. Controls</td>
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<tr>
<td>Observations</td>
<td>2,245</td>
<td>15,735</td>
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<td>Canton Clusters</td>
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<td>26</td>
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<tr>
<td>R-squared</td>
<td>0.08</td>
<td>0.09</td>
</tr>
</tbody>
</table>
Further results

- Cantonal heterogeneities
  - Test purchases
  - Minimum ages, minimum smoking age
  - Lag and vending machines
Further results

- Cantonal heterogeneities
- Test purchases
- Minimum ages, minimum smoking age
- Lag and vending machines
- Circumvention by travelling
Further results

- Cantonal heterogeneities
- Test purchases
- Minimum ages, minimum smoking age
- Lag and vending machines
- Circumvention by travelling
- Experience
The effects of sales prohibition

- Small if any effect on smoking
The effects of sales prohibition

- Small if any effect on smoking
- No information effect
- Evidence against forbidden fruit
- Teens substitute sources
- Reduction only if no peers who smoke
- Peers as gatekeepers
The effects of sales prohibition

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- Evidence against forbidden fruit
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The effects of sales prohibition

- Small if any effect on smoking
- No information effect
- Evidence against forbidden fruit
- Teens substitute sources
- Reduction only if no peers who smoke
- Peers as gatekeepers
Does tobacco sales prohibition for teens reduce smoking?

Not really
Staggered introduction of bans

Figure: Cantons with Bans by Year
Staggered introduction of bans

Figure: Share of Minors in Cantons with Bans
<table>
<thead>
<tr>
<th>Canton</th>
<th>Introduction Date</th>
<th>Minimum Age</th>
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<td>VD</td>
<td>01.01.2006</td>
<td>18</td>
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<tr>
<td>LU</td>
<td>01.01.2006</td>
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<tr>
<td>GR</td>
<td>01.07.2006</td>
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<tr>
<td>SG</td>
<td>01.10.2006</td>
<td>18</td>
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<tr>
<td>SO</td>
<td>01.01.2007</td>
<td>18</td>
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<td>BL</td>
<td>01.01.2007</td>
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<td>TG</td>
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### Tobacco Monitoring

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<th>SD</th>
<th>Min.</th>
<th>Max.</th>
<th>N</th>
<th>Mean</th>
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### Health Behaviour in School-aged Children

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Trends in smoking prevalence: teens

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Trend pupils, 11–15

![Graph showing the trend of current smokers among pupils aged 11–15 from 2002 to 2014.]
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<th>Sales Ban 18 (Min. Smoking Age 18)</th>
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<td>France</td>
<td>03.08.2003 (0)</td>
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<td>Ireland</td>
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<tr>
<td>$R$-squared</td>
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## Tobacco and Addiction Monitoring

### All Ages 11–15 Years Old

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<th>&gt;=100 Cigar.</th>
<th>Smoke Freq.</th>
<th>Cigarettes per Week</th>
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<td>(0.048)</td>
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<td>X</td>
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|                                | (1)    | (2)    | (3)    | (4)    |
|------------------------------------------------|-----------------------|
| Binding Sales Ban                | -0.016  | -0.007  | -0.006  | 0.006  |
|                                 | (0.022) | (0.021) | (0.021) | (0.030) |
| Sales Ban                       | -0.019  | -0.019  | -0.001  | -0.009 |
|                                 | (0.015) | (0.013) | (0.013) | (0.021) |
| Age FE                          | X       | X       | X       | X      |
| Country FE                      | X       | X       | X       | X      |
| Year FE                         | X       | X       | X       | X      |
| Country x Teen FE               | X       | X       | X       | X      |
| Year x Teen FE                  | X       | X       | X       | X      |
| Country Trends                  |                     | X       | X       |
| Ind. Controls                   | X       | X       | X       | X      |
| Country Controls                | X       | X       | X       |         |

<p>| Observations                    | 138,311 | 138,311 | 138,311 | 38,853 |
| Clusters                        | 32      | 32      | 32      | 32     |
| $R$-squared                     | 0.06    | 0.10    | 0.10    | 0.12   |</p>
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<tr>
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<td>(0.001)</td>
<td>(0.004)</td>
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<tr>
<td>Early Introd. Trend x Minor</td>
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<td>-0.013</td>
<td>(0.001)</td>
</tr>
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<td>-0.005</td>
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</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.004)</td>
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</tr>
<tr>
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<td>(0.006)</td>
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**Observations**: 167,376

**Canton Clusters**: 26

**R-squared**: 0.05
Sensitivity to cantons

Canton Left Out

Coefficient Binding Sales Ban

AG AI AR BE BS BL FR GE GL GR JU LU NE NW OW SG SH SO SZ TG TI UR VD VS ZG ZH
## Tobacco and Addiction Monitoring

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<th>Ages 11–15</th>
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### Tobacco and Addiction Monitoring
#### Ages 14–20

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<td>Successful 0.312</td>
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<td>Attractive 0.230</td>
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<td>appreciate 0.320</td>
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<td>Appreciative 0.260</td>
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<td>Happy 0.263</td>
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<td>Successful 0.312</td>
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| Age FE | X | X | X | X | X | X | X | X |
| Canton FE | X | X | X | X | X | X | X | X |
| Year FE | X | X | X | X | X | X | X | X |
| Canton x Teen FE | X | X | X | X | X | X | X | X |
| Year x Teen FE | X | X | X | X | X | X | X | X |
| Ind. Controls | X | X | X | X | X | X | X | X |
| Cant. Controls | X | X | X | X | X | X | X | X |

**Observations**: 6,010 5,983 5,988 5,950 5,939 5,662 1,532 1,446

**R-squared**: 0.03 0.07 0.08 0.02 0.07 0.06 0.06 0.05
## Attitudes 2

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## Tobacco and Addiction Monitoring

### Dependent Variable Smoker Avg. for Minors

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<th>(4)</th>
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<tbody>
<tr>
<td>Binding Sales Ban</td>
<td>0.006</td>
<td>-0.019</td>
<td>0.007</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.014)</td>
<td>(0.011)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>Sales Ban</td>
<td>-0.000</td>
<td>0.001</td>
<td>-0.004</td>
<td>-0.005</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.006)</td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Binding Sales Ban x Share Sold in Test Purch.</td>
<td>-0.009</td>
<td>(0.039)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Ban x Share Sold in Test Purch.</td>
<td>0.005</td>
<td>(0.017)</td>
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<td>Binding Sales Ban x Test Purchase</td>
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<tr>
<td>Sales Ban x Test Purchase</td>
<td>-0.003</td>
<td>(0.006)</td>
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<tr>
<td>Binding Sales Ban x Early Test Purchase</td>
<td>-0.014</td>
<td>(0.014)</td>
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<tr>
<td>Sales Ban x Early Test Purchase</td>
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<td>(0.006)</td>
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</tr>
<tr>
<td>Binding Sales Ban – Age 18</td>
<td>*** -0.031</td>
<td>*** (0.011)</td>
<td></td>
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<tr>
<td>Sales Ban – Age 18</td>
<td>0.007</td>
<td>(0.005)</td>
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</table>

### Control Variables

- **Age FE**: X X X X X
- **Canton FE**: X X X X X
- **Year FE**: X X X X X
- **Canton x Teen FE**: X X X X X
- **Year x Teen FE**: X X X X X
- **Ind. Controls**: X X X X X
- **Cant. Controls**: X X X X X

### Model Summary

- **Observations**: 117,752, 167,376, 167,376, 167,376
- **Canton Clusters**: 14, 26, 26, 26
- **R-squared**: 0.05, 0.05, 0.05, 0.05
## Tobacco and Addiction Monitoring

**All Ages**

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Smoker</th>
<th>No Circumv.</th>
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<tr>
<td>Avg. for Minors</td>
<td>0.178</td>
<td>0.182</td>
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<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
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<td>Binding Sales Ban</td>
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<td>0.002</td>
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<tr>
<td></td>
<td>(0.018)</td>
<td>(0.014)</td>
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<td>(0.004)</td>
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<tr>
<td>Binding Sales Ban x Distance to Nonb. in 10k km</td>
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<td>Binding Sales Ban x Distance &gt; 75 perc.</td>
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<td>Binding Sales Ban Lag 1</td>
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<tr>
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<tr>
<td>Sales Ban x Vending Machine Contr.</td>
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<tr>
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<tr>
<td>Age FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Canton FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Year FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Canton x Teen FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Year x Teen FE</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ind. Controls</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cant. Controls</td>
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<td>X</td>
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<tr>
<td>Observations</td>
<td>164,533</td>
<td>164,533</td>
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<tr>
<td>Canton Clusters</td>
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<tr>
<td>R-squared</td>
<td>0.05</td>
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## Tobacco and Addiction Monitoring

<table>
<thead>
<tr>
<th>Dependent Variable Avg. for Minors</th>
<th>Smoker 0.178</th>
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<tbody>
<tr>
<td></td>
<td>(1)</td>
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<tr>
<td>Binding Sales Ban</td>
<td>-0.007</td>
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<td>(0.014)</td>
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<tr>
<td>Sales Ban</td>
<td>-0.001</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
</tr>
<tr>
<td>Binding Sales Ban – Age 18</td>
<td>-0.031</td>
</tr>
<tr>
<td></td>
<td>(0.014)</td>
</tr>
<tr>
<td>Sales Ban – Age 18</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
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<tr>
<td>Experienced a Binding Sales Ban</td>
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<tr>
<td>Years of Experience with a Binding Sales Ban</td>
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<tr>
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<tr>
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<td>0.004</td>
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<td>0.003</td>
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<tr>
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</tr>
<tr>
<td>Age FE</td>
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<td>Canton FE</td>
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</tr>
<tr>
<td>Year FE</td>
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<tr>
<td>Canton x Teen FE</td>
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<td>R-squared</td>
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</table>

*Notes: Standard errors in parentheses.*