Historical Cigarette Prohibition, Tobacco Use, and Mortality

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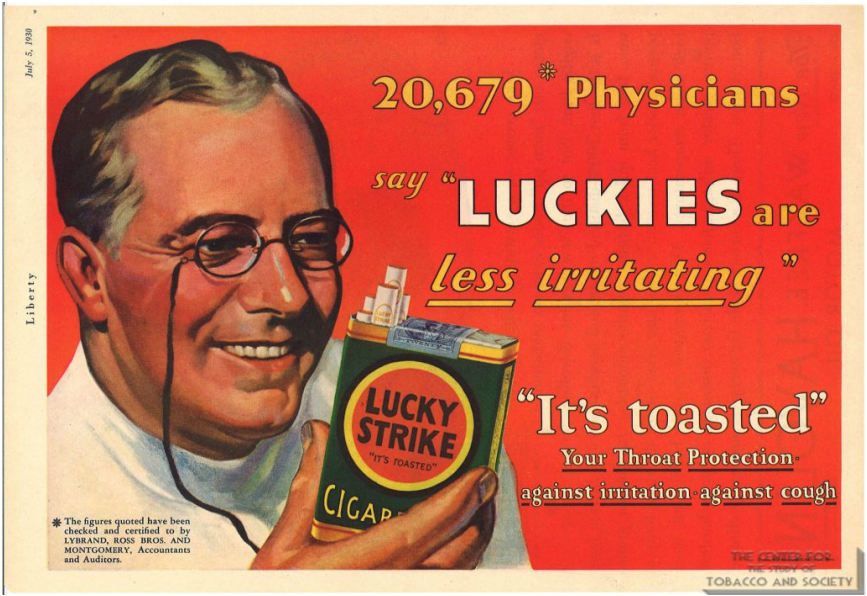
- I have not received any tobacco-related research funding over the last 10 years.


July 5, 1930
Liberty
20,679* Physicians
say "LUCKIES are
less irritating"
LUCKY STRIKE
"IT'S TOASTED"
"It's toasted"
Your Throat Protection
against irritation against cough
*The figures quoted have been checked and certified to by LYBRAND, ROSS BROS. AND MONTGOMERY, Accountants and Auditors.
THE CENTER FOR THE STUDY OF TOBACCO AND SOCIETY

Cigarettes in the Early 20th Century

- The harmful effects of cigarette-smoking are widely known today, due largely to the 1964 Surgeon General's Report
- In the early 20th century however:
  - Mass-produced cigarettes were a new product, and less was understood about how smoking affected health
  - Life expectancy was much lower (47 vs. almost 79 today)
  - Infectious diseases posed more immediate health threats
- Likely leading to differences in behavior and health outcomes:
  - Mickey Mantle Effect: Shorter life expectancy reduced incentives to avoid long-term risks
  - Long-term health consequences may not have had time to manifest
  - Smoking rates were less correlated with education compared to today

Early Cigarette Regulation

- As cigarettes gained popularity in the early 1900s, opposition also grew
- Anti-cigarette movement in the 1890s–1920s pushed for legislation, leading to outright bans implemented in 14 states between 1892–1921, all were repealed by 1927

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- This paper studies the effects of these early bans on cigarette use and mortality, exploiting variation from:
  (i) Staggered repeals of the cigarette bans
  (ii) Pseudo-repeals from veterans' exposure to cigarettes during WWI

Outline

1. Background
2. Literature Review
3. Data
4. Repeal of Cigarette Bans on Cigarette Use
5. Pseudo-Repeal from Enlistment in WWI on Cigarette Use
6. Pseudo-Repeal from Enlistment in WWI on Later-life Mortality
7. Robustness
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Cigarette Industry

- A combination of technological change and shifting consumer behavior drove rapid rise in cigarette production and consumption Tobacco Industry
  - Mechanization reduced cost and increased production capacity
  - Low price and ease of access made cigarettes particularly appealing to young men

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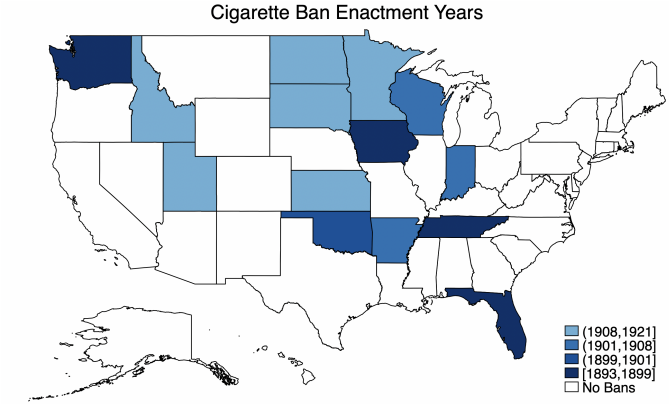
  - Mechanization reduced cost and increased production capacity
  - Low price and ease of access made cigarettes particularly appealing to young men
- Smokeless tobacco and cigars were still the main forms of tobacco consumed in the U.S.
  - Cigarettes accounted for just 2.2% of total tobacco consumed in 1900 and 12.6% by 1916
  - Still, by the first decade of the 20th century, cigarette smoking had become common and socially accepted, particularly among men in urban areas [Segrave (2005)]
  - By 1917, 30% of young men had initiated smoking by age 19 Cigarette Use

Cigarette Prohibition Laws

- Hand-collected policy data from historical State Statutes and Session Laws
- Between 1893 and 1921, 16 states enacted (14 implemented) laws banning the sale of cigarettes, all repealed by 1927



Political Economy and Development of Cigarette Bans

"If you will study the history of almost any criminal you will find that he is an inveterate cigarette smoker. . . . The cigarette drags them down."

– Henry Ford

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- Anti-cigarette movement was part of broader Progressive Era reforms [Tate, 1999; Alston, Dupré, and Nonnenmacher, 2002]
  - Primarily motivated by moral opposition rather than health concerns
  - Progressive states were more likely to have brought cigarette prohibition bills to the floor [Alston, Dupré, and Nonnenmacher, 2002]

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  - Primarily motivated by moral opposition rather than health concerns
  - Progressive states were more likely to have brought cigarette prohibition bills to the floor [Alston, Dupré, and Nonnenmacher, 2002]
- Growing cigarette industry fought against legislation
  - American Tobacco challenged statutes, lobbied, and bribed legislators [Tate, 1999]
  - Likelihood of a bill passing declined with a state's cigarette production [Alston, Dupré, and Nonnenmacher, 2002]

WWI and the Expansion of Cigarette Access

"You ask me what we need to win this war. I answer tobacco, as much as bullets."

– General John J. Pershing

WWI and the Expansion of Cigarette Access

- World War I marked a turning point for the cigarette industry
- Cigarettes were tolerated as a "necessary evil" while the military sought to ban more disruptive vices like alcohol and prostitution
- Cigarettes were made widely available to soldiers, the government sent 5.5 billion cigarettes overseas during the war
- Broader public support, with many donating to "smoke funds" to send cigarettes to troops overseas

Cigarettes in Newspapers

- Before turning to cigarette use and health outcomes, we first examine whether repeal of the laws affected public visibility and commercial presence of cigarettes
- If repeals truly relaxed constraints on access, we should observe increases in newspaper coverage and brand advertising

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- We collect historical newspaper data from the Chronicling America collection, and perform keyword searches for
  (i) All cigarette mentions
  (ii) Cigarette mentions excluding legal/policy terms
  (iii) Direct brand mentions

Cigarettes in Advertisements

Table: Effect of Repeals on Mentions of Cigarettes in Newspapers

	(1) Cigarettes	(2) Cigarettes excl. Legal	(3) Cigarette Ads
Estimator: CSDID	5.300**	2.660*	0.424**
	(2.064)	(1.419)	(0.212)
Ban state mean in period −1	14.34	7.74	0.16
Observations	866	866	866

Notes: Standard errors clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

- Newspaper mentions of cigarettes increased by over 30% after repeals
- Mentions of cigarette brand names increased almost three-fold, suggesting increased market presence and commercial activity
- Heightened visibility provides a pathway through which legal access to cigarettes could influence behavior

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7. Robustness
8. Discussion

Related Literature

- Effect of tobacco control policies [Evans and Ringel 1999; Farrally et al. 2004; Gruber and Koszegi 2004; Lien and Evans 2005; O'Donoghue and Rabin 2006; DeCicca and McLeod 2008; Nesson 2017; Friedson and Rees 2020; Hoehn-Velasco, Pesko, and Phillips 2023]
- Progressive Era policies [Tate, 1999; Gottsegen 1940; Brandt 2007; Alston, Dupré, and Nonnenmacher 2001; Appollonio and Glantz 2016, Miron and Zwiebel 1991; Jacks, Pendakur, and Shigeoka 2021, 2023; Jacket et al. 2024]
- Military service and cigarette use [Bedard and Deschênes 2006; Deza and Mezza 2025]
- Modern tobacco policy debates: "Tobacco-free generation" proposals in the UK and New Zealand

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Data

- **Tobacco Use**: U.S. Veterans Mortality Study (Dorn Study)
  - Conducted in 1954, covers men who served in the armed forces between 1917–1940 Sample Cohorts
  - Includes state of residence, year of birth, and tobacco use histories Details
  - Construct repeated cross-section for cigarette initiation by ages 19, 24, or ever

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  - Survival profiles at the state-cohort-sex-level:

$$Survival_{asyf} = \frac{Population_{asyf}}{Population_{19,syf}}$$

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- **Tobacco Production**: Annual Reports of the Commissioner of Internal Revenue (1890–1936)
- **Alcohol Prohibition**: State-level dry status [Sechrist, 2012; Jacks, Pendakur, and Shigeoka, 2021]

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Empirical Method: Repeal on Cigarette Use

We estimate the staggered difference-in-differences regression below using methods proposed by Callaway and Sant'Anna (2021):

$$Y_{isy} = \beta Repealk_{sy} + \lambda X_{sy} + \delta_s + \delta_y + \varepsilon_{isy},$$

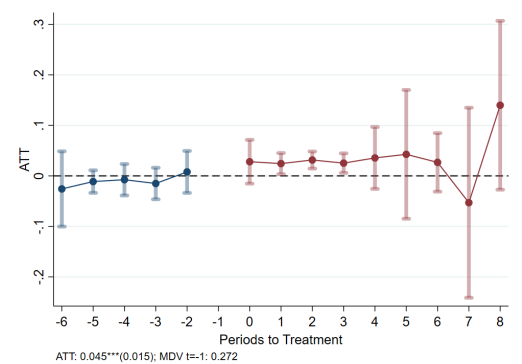
- Y_{isy}: Indicator for smoking initiation by age k
- $Postk_{sy}$: Indicator for individual i being age k or younger at time of repeal
- X_{sy}: Control for teen exposure to alcohol prohibition

- Regressions are unweighted, and standard errors are clustered at the state level
- Focus on repeals (and not enactments) due to limited data for pre-enactment cohorts

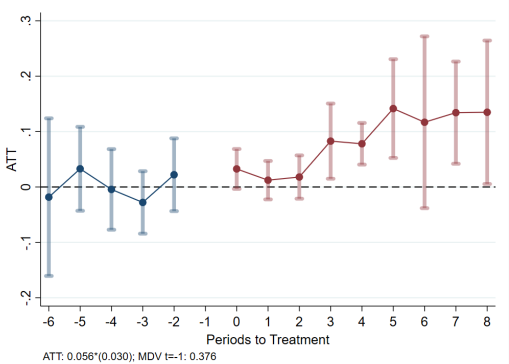
Cigarette Use Increased Following Repeals

- Turning 19 after a repeal increased smoking by age 19 by 14.5%
- Turning 24 after a repeal increased smoking by age 24 by 13.5%

(a) Repeal by 19



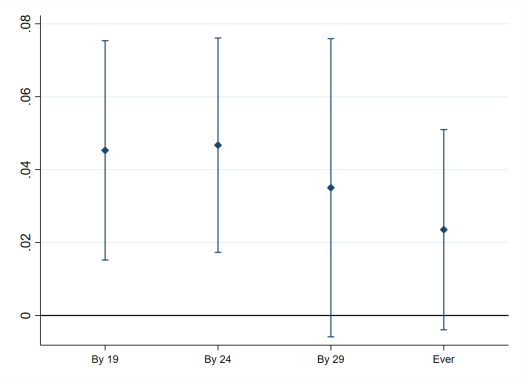
(b) Repeal by 24



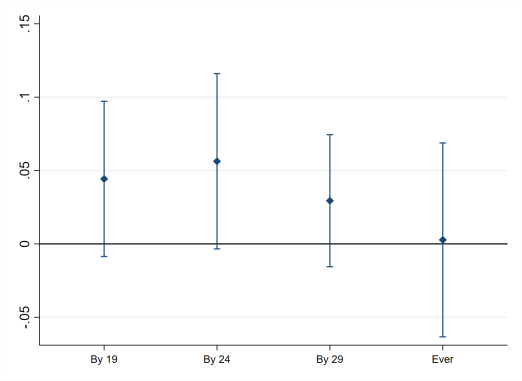
Robustness

Earlier Initiation but No Increase in Lifetime Use

(a) Repeal by 19



(b) Repeal by 24



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Empirical Method: Pseudo-Repeal on Cigarette Use

We estimate with TWFE whether respondents from states with active bans in 1917 were more likely to have started using cigarettes in 1917:

$$
\begin{aligned}
Started1519_{isy} &= \alpha_{1,1} Age1719_{isy} \times Ban1917_s + \lambda X_{sy} + \delta_s + \delta_y + \varepsilon_{isy};\\
Started2024_{isy} &= \alpha_{2,1} Age1719_{isy} \times Ban1917_s\\
&\quad + \alpha_{2,2} Age2024_{isy} \times Ban1917_s + \lambda X_{sy} + \delta_s + \delta_y + \varepsilon_{isy};\\
Started2529_{isy} &= \alpha_{3,1} Age1719_{isy} \times Ban1917_s\\
&\quad + \alpha_{3,2} Age2024_{isy} \times Ban1917_s\\
&\quad + \alpha_{3,3} Age2529_{isy} \times Ban1917_s + \lambda X_{sy} + \delta_s + \delta_y + \varepsilon_{isy},
\end{aligned}
$$

- $Started k_{isy}$: Indicator for cigarette initiation at ages 15–19, 20–24, or 25–29
- $Age k_{isy}$: Indicator for being ages k in 1917
- $Ban1917_s$: Cigarette ban active in state s in 1917
- X_{sy}: controls for teenage exposure to alcohol prohibition
- Sample: Men ages 17–45 in 1917 (likely to have served in WWI)

Psuedo-Repeals Increased Initiation into Smoking

- Veterans from states with cigarette bans in place in 1917 were more likely to have started smoking cigarettes upon enlisting
- Those ages 17–19 in 1917 were 3.3pp (16.9%) more likely to have started smoking cigarettes between ages 15 to 19, and those ages 20–24 and 25–29 were 19.3% and 40.2% more likely to have started smoking at those ages

VARIABLES	(1) Started 15-19	(2) Started 20-24	(3) Started 25-29
Ages 17-19 in 1917 x Ban State 1917	0.0333**	0.00130	0.00757
	(0.0135)	(0.0125)	(0.00760)
Ages 20-24 in 1917 x Ban State 1917		0.0270***	0.0112
		(0.00819)	(0.00767)
Ages 25-29 in 1917 x Ban State 1917			0.0189***
			(0.00673)
Observations	170,204	170,204	170,204
Ban State Pre-WWI Mean	0.197	0.140	0.0470

Notes: Standard errors clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Robustness | Lifetime Use & Intensity of Use

Comparing Effects of Repeals to Pseudo-Repeals

"Pseudo-repeals" from WWI enlistment had comparable but larger effects than state repeals

- State repeals often occurred when cigarette use and distribution were still developing
- Military service presented an abrupt transition from prohibition to full access: cigarettes were rationed, sold cheaply, and actively promoted
- Stress of wartime environment likely amplified initiation among men with little exposure at home

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Empirical Method: Pseudo-Repeal on Later-life Mortality

We compare survival rates between men who were just old enough to enlist in 1917 (ages 17+) to those who were just too young, in states with and without active bans in 1917:

$$\text{Survival}_{asyf} = \beta \text{Eligible}_y \times \text{Ban 1917}_s + \delta_a + \delta_s + \delta_y + \delta_{r(s)a} + \varepsilon_{asyf},$$

- Survival_{asyf}: Survival rate at age a for those born in state s in year y of sex f
- Eligible_y: Indicator for cohort y being ages 17+ in 1917 and hence eligible to enlist in WWI
- Sample: Men ages 7–27 in 1917
- Regressions are weighted by cohort population at age 19, standard errors are clustered at the state level

Reduced Survival for Those Enlisting from States with Active Bans

- Cohorts of men from states with bans in 1917 who were eligible to enlist in WWI had 3.14pp lower survival at ages 25–64
- Effects manifest early in life, and we find no statistically significant difference in survival rates by ages 55–64

VARIABLES	(1) Ages 25-64	(2) Ages 25-34	(3) Ages 35-44	(4) Ages 45-54	(5) Ages 55-64
Panel A: Male					
Age 17+ in 1917 × Ban State 1917	-0.0314**	-0.0282***	-0.0413***	-0.0344*	-0.0217
	(0.0123)	(0.00937)	(0.0142)	(0.0174)	(0.0151)
Observations	37,577	9,392	9,390	9,399	9,396

Notes: Standard errors clustered at the state level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

No Corresponding Reductions Among Women

- Cohorts of men from states with bans in 1917 who were eligible to enlist in WWI had 3.14pp lower survival at ages 25–64
- Effects manifest early in life, and we find no statistically significant difference in survival rates by ages 55–64

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	(0.0123)	(0.00937)	(0.0142)	(0.0174)	(0.0151)
Observations	37,577	9,392	9,390	9,399	9,396
Panel B: Female					
Age 17+ in 1917 × Ban State 1917	0.0108	0.00112	0.0210	0.00881	0.0121
	(0.0127)	(0.0147)	(0.0155)	(0.0126)	(0.0127)
Observations	37,407	9,368	9,356	9,339	9,344

Notes: Standard errors clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1.

Quantifying Mortality Effects

- A 3.14 percentage point reduction in the survival rate corresponds to a 4.72% increase in mortality
  - Implies 0.07pp higher annual mortality
  - Based on average annual mortality rate of 1.5% in 1900
- Comparable to other quasi-experimental evidence
  - \$1 increase in cigarette taxes at ages 14–17 reduces adult mortality by 4% [Friedson et al. (2023)]
  - Being born in wet states during prohibition increases later-life mortality by 3.3% [Jacks et al. (2024)]

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Robustness Checks

- Measurement Error and Selective Migration Details
- Repeal on cigarette use
  - Alternative samples/specifications Details
  - Leave-one-out Details
- Pseudo-repeal on cigarette use
  - Alternative samples/specifications Details

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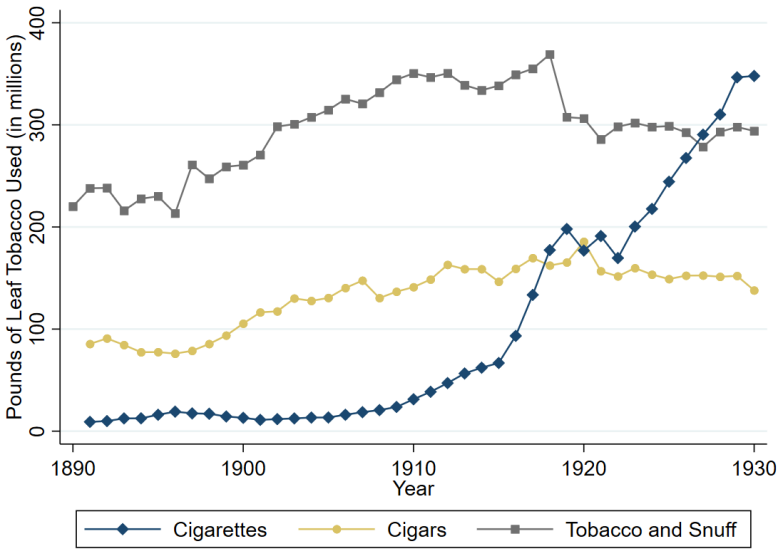
Discussion

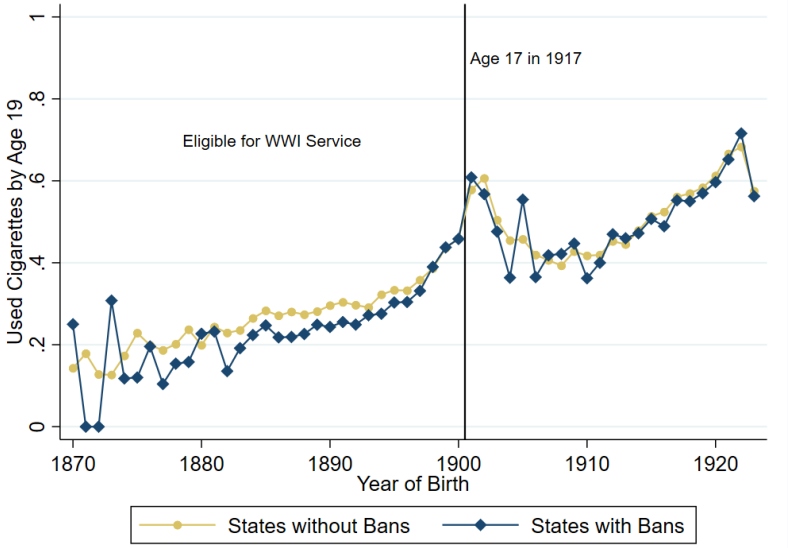
- Repeal of early cigarette bans had real behavioral and health effects
  - Repeals and pseudo-repeals increased cigarette use by over 14%
  - 4.72% increase in later-life mortality
- Even though short-lived and imperfectly enforced, bans altered behavior and influence health
- Legal restrictions on harmful products can be effective even when individuals underappreciate long-term risks
- Contemporary proposals to restrict access have similar potential for lasting effects

Tobacco Industry in the Early 20th Century



Back

Dorn Study: Cigarette Use by Age 19



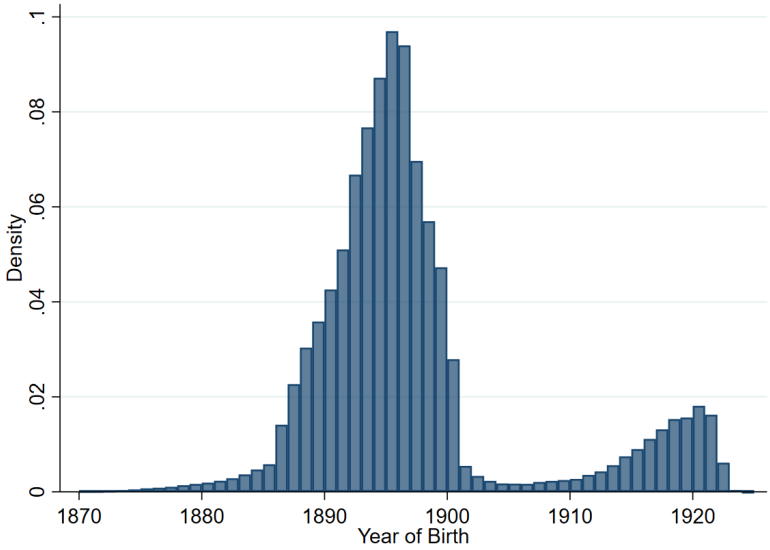
Back

Cigarettes in Newspapers

- While we have 1,300 titles between 1886-1935, we do not observe each title for the entire period
  - The mean number of years we observe a title is 9.7
  - Around 50% of titles we only observe for 5 years or fewer
- To construct a measure of keyword mentions for each state-year that is independent of compositional changes, we
  1. Count whether each keyword is present in each issue (title-date)
  2. Compute the number of times per 100 issues for which each keyword is present at the title-year level
  3. Regress this measure on year and title FEs, and subtract the title FEs to obtain a demean-ed measure of mentions at the title-year level
  4. Compute the average de-meaned fraction of mentions at the state-year level

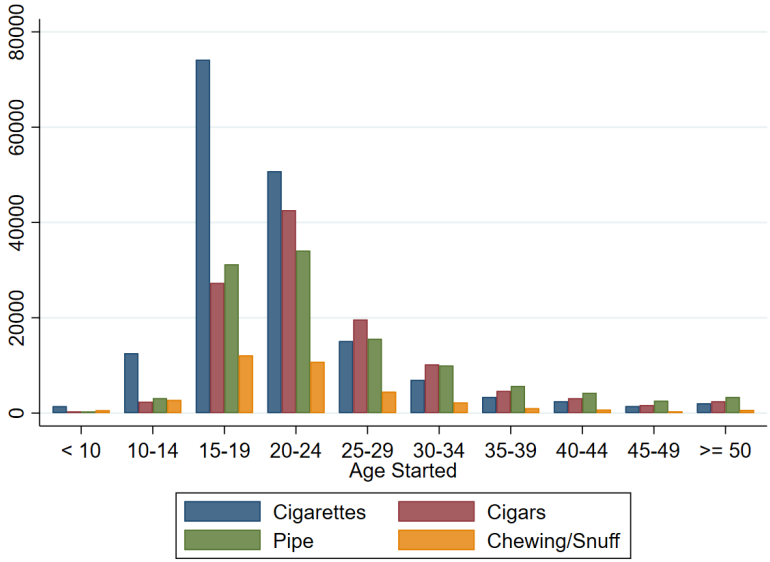
Back

Dorn Study: Sample Cohorts



Back

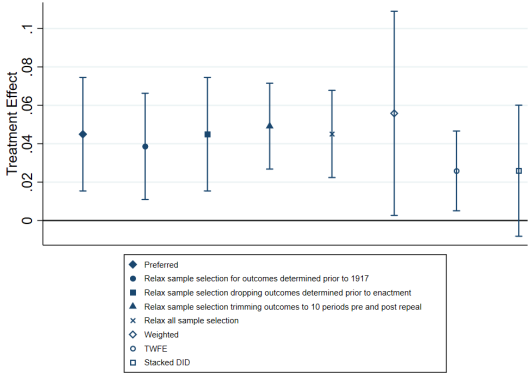
Dorn Study: Tobacco Use



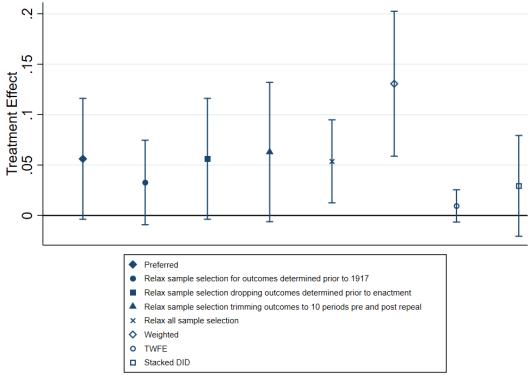
Back

Robustness to Alternative Samples/Specifications

(a) Repeal by 19



(b) Repeal by 24



Back Robustness

Robustness to Alternative Samples/Specifications

	(1)	(2)	(3)	(4)
Ages 17-19 in 1917 x Ban in 1917	0.0437**	0.0469***	0.0315**	0.0199
	(0.019)	(0.017)	(0.012)	(0.012)
N	170,204	170,204	170,204	36,412
Ban State Pre-WWI Mean	0.23	0.23	0.23	0.23
Ages 20-24 in 1917 x Ban in 1917	0.0293***	0.0300***	0.0232***	0.0131
	(0.010)	(0.010)	(0.008)	(0.010)
N	170,204	170,204	170,204	36,412
Ban State Pre-WWI Mean	0.16	0.16	0.16	0.16
Ages 25-29 in 1917 x Ban in 1917	0.0216***	0.0215***	0.0224***	0.00341
	(0.006)	(0.006)	(0.007)	(0.010)
N	170,204	170,204	170,204	36,412
Ban State Pre-WWI Mean	0.03	0.03	0.03	0.03
State & YOB FE	Yes	Yes	Yes	Yes
Controls	No	Yes	Yes	Yes
Region-by-YOB FE	No	No	Yes	Yes
Sample	All states	All states	All states	Ever-treated states

Notes: Standard errors clustered at the state level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Back Robustness

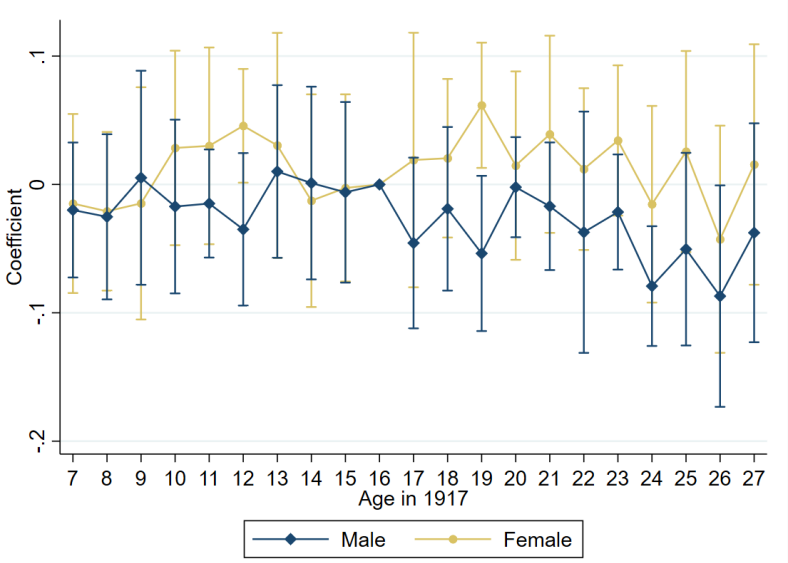
Suggestive Increases in Lifetime Use and Intensity of Use

VARIABLES	(1) Started Ever	(2) Max 10 per day	(3) Max 20 per day
Ages 17–19 in 1917 × Ban State 1917	0.0197	0.0241	0.0147
	(0.0215)	(0.0287)	(0.0180)
Ages 20–24 in 1917 × Ban State 1917	0.00710	0.0105	0.00123
	(0.0211)	(0.0236)	(0.0164)
Ages 25–29 in 1917 × Ban State 1917	0.0135	0.0114	0.00547
	(0.0152)	(0.0214)	(0.0159)
Observations	170,204	153,553	153,553
Ban State Pre-WWI Mean	0.585	0.354	0.0920

Notes: Standard errors clustered at the state level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Back

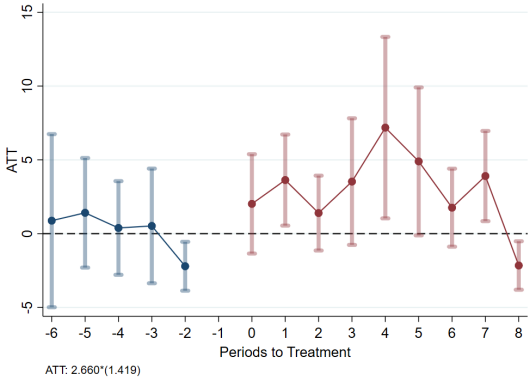
Event studies



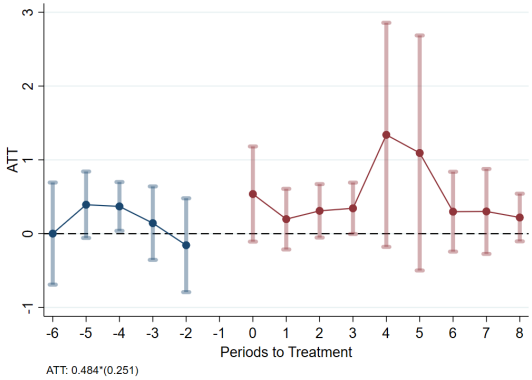
Back

Event studies for repeals with Callaway-Sant'Anna DID

(a) Cigarettes–



(b) Cigarette Ads



Back

Measurement Error and Selective Migration

- Since we observe state of residence at survey, exposure to treatment may be mismeasured if individuals migrated
  - Under classical measurement error, our estimates will be biased towards zero
  - However we may have non-classical measurement error if migration is correlated with ban status or smoking propensity
- Test for selective migration using Census data
  - About 65% of men live in their state of birth
  - Estimate CSDID with migration as the outcome
- No evidence of selective migration
  - No differential in-migration rates by treatment status
  - No differential in-migration rates from states without bans by treatment status

Back

Measurement Error and Selective Migration

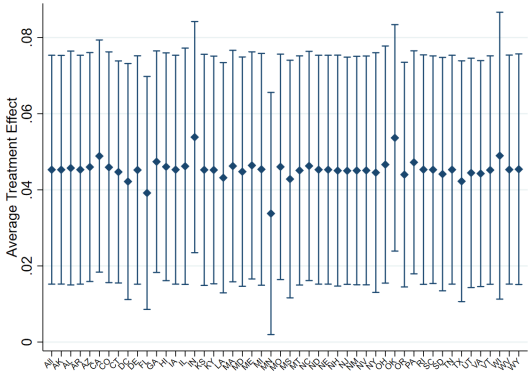
VARIABLES	(1) Migrated	(2) Migrated from non-ban state
Panel A: Repeal by Age 19		
Repeal	-0.0176	-0.0179
	(0.0162)	(0.0156)
Observations	477,496	477,496
Panel A: Repeal by Age 24		
Repeal	-0.0256	-0.0309
	(0.0221)	(0.0231)
Observations	321,054	321,054

Notes: Table reports ATEs from estimating Equation 15 using Callaway-Sant'Anna difference-in-differences. The outcome variables are indicator variables for an individual being born in a different place than his state of residence, and an individual being born in a different place than his state of residence and his state of birth not having had a cigarette ban. Regressions control for state-level alcohol prohibition. The estimation sample includes men born in the U.S. between 1873–1911. Standard errors clustered at the state level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

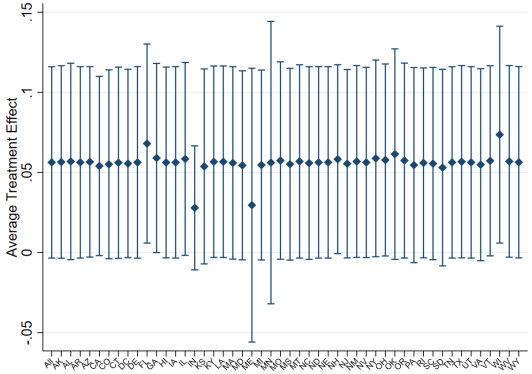
Back

Leave-One-Out

(a) Repeal by 19



(b) Repeal by 24



Back