Quasi-Experimental Design in E-Cigarette Policy Research:
Evidence from the U.S. and Canada

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Disclosure

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Electronic Nicotine Delivery Systems

- Electronic nicotine delivery systems (ENDS) are devices in which nicotine and other ingredients (e.g., flavors) are heated into a vapor and inhaled
  - First developed in China and entered US tobacco market in 2006

- Increased ENDS access could improve public health via harm reduction
  - Cigarette smoking is the leading cause of preventable death in US
    - Smoking responsible for 480,000 deaths each year, increase risk of a myriad of cancers, heart disease, stroke, and respiratory disease; annual cost $600B (CDC 2023)

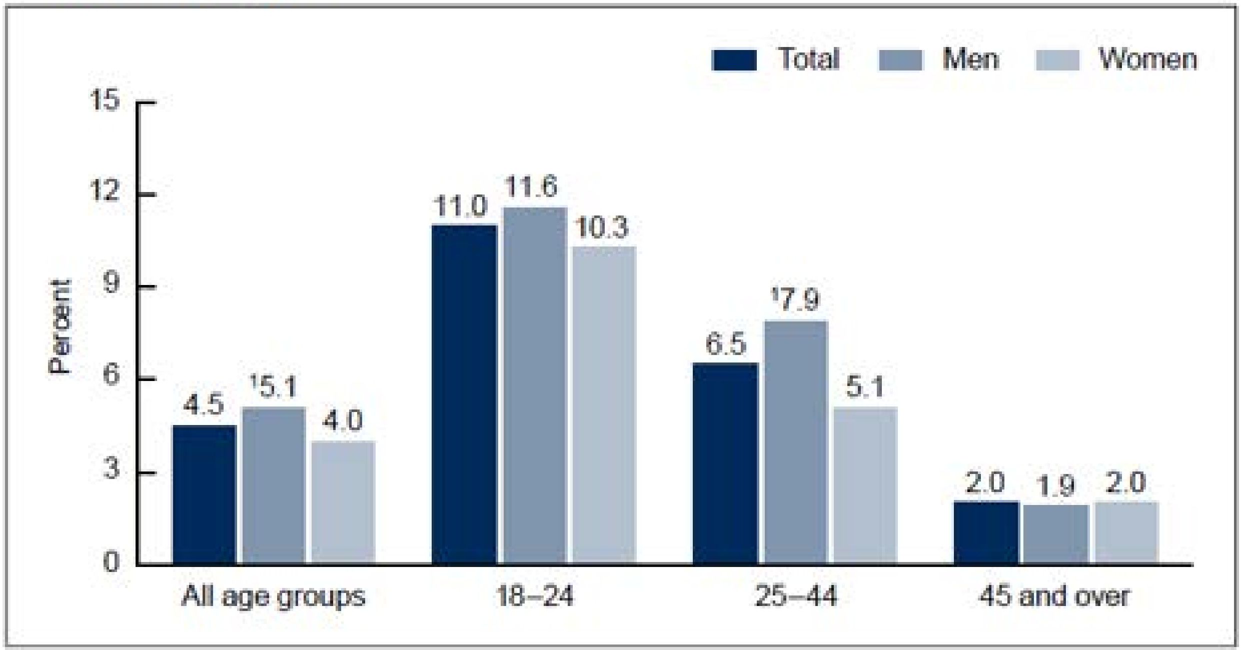
  - In sharp contrast, National Academies of Sciences (2018) concludes that while ENDS use appears to cause respiratory and heart-related health harm:

    "...e-cigarettes appear to pose less risk to an individual than combustible tobacco cigarettes ...e-cigarette aerosol contains fewer numbers and lower levels of toxicants than smoke from combustible tobacco cigarettes."

  - Expert reviews suggest that e-cigarettes carry 5-37% of the harm of cigarettes (Allcott and Rafkin 2022; Public Health England 2015)

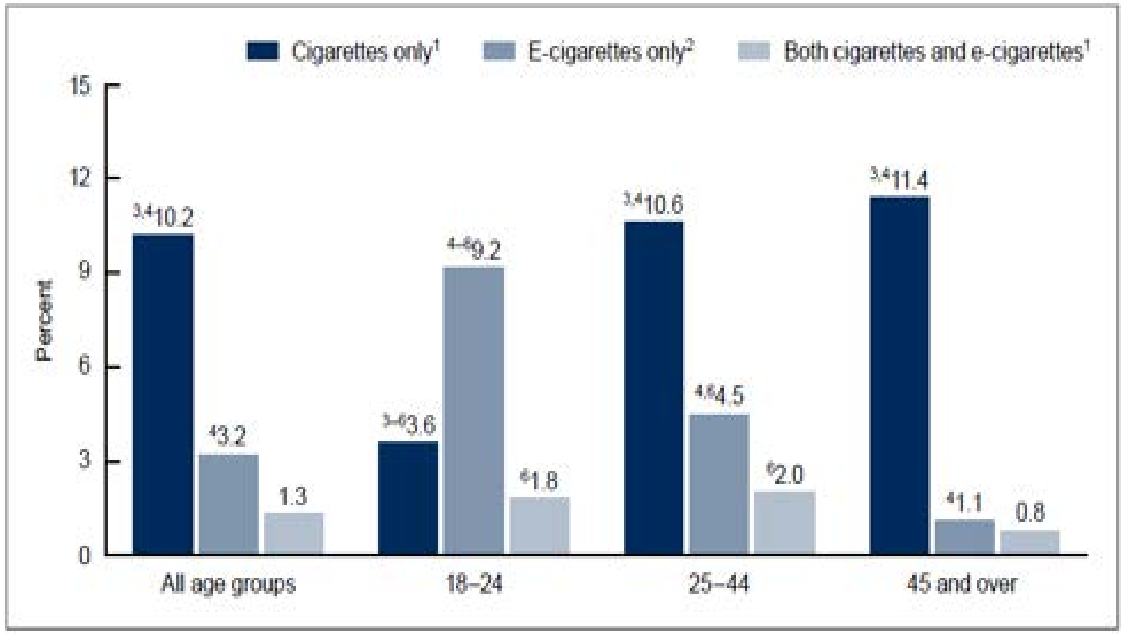
E-Cigarette Use Among U.S. Adults, by Age

Figure 1. Percentage of adults aged 18 and over who currently use e-cigarettes, by age group and sex: United States, 2021



[1]Significantly different from women ($p < 0.05$).
NOTES: Men, women, and total men and women had a significant linear trend by age ($p < 0.05$). Current e-cigarette use was based on responses of "every day" or "some days" to the question, "Do you now use e-cigarettes or other electronic vaping products every day, some days, or not at all?" This question was asked of adults who had ever tried an e-cigarette, even one time. Estimates are based on household interviews of a sample of the U.S. civilian noninstitutionalized population. Access data table for Figure 1 at: https://www.cdc.gov/nchs/data/databriefs/db475-tables.pdf#1.
SOURCE: National Center for Health Statistics, National Health Interview Survey, 2021.

Figure 4. Percentage of adults aged 18 and over who currently smoke cigarettes and use e-cigarettes, by age group: United States, 2021



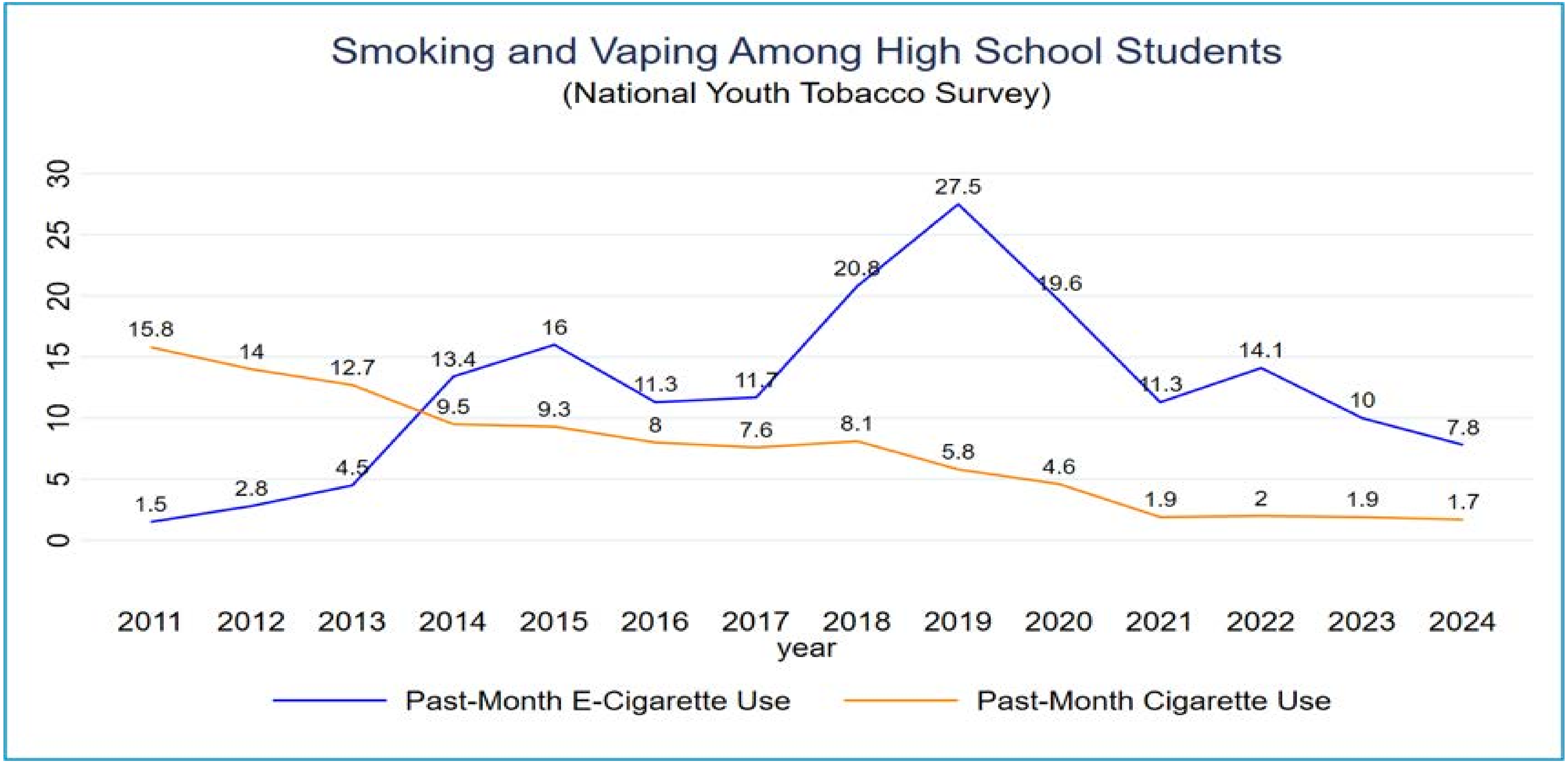
[1]Significant quadratic trend by age ($p < 0.05$).
[2]Significant linear trend by age ($p < 0.05$).
[3]Significantly different from e-cigarettes only ($p < 0.05$).
[4]Significantly different from both cigarettes and e-cigarettes ($p < 0.05$).
[5]Significantly different from adults aged 25–44 ($p < 0.05$).
[6]Significantly different from adults aged 45 and over ($p < 0.05$).
NOTES: Current e-cigarette use was based on responses of "every day" or "some days" to the question, "Do you now use e-cigarettes or other electronic vaping products every day, some days, or not at all?" This question was asked of adults who had ever tried an e-cigarette, even one time. Adults were asked if they had smoked at least 100 cigarettes in their lifetime and, if yes, whether they currently smoked cigarettes every day, some days, or not at all. Those who smoked every day or some days were classified as current cigarette smokers. The sum of e-cigarettes only and both cigarettes and e-cigarettes may not equal total e-cigarette use due to rounding. Estimates are based on household interviews of a sample of the U.S. civilian noninstitutionalized population. Access data table for Figure 4 at: https://www.cdc.gov/nchs/data/databriefs/db475-tables.pdf#4.
SOURCE: National Center for Health Statistics, National Health Interview Survey, 2021

Policymakers concerned about youths

- Could ENDS serve as a gateway to combustible tobacco for youth?
  - Tobacco control advocates worry that increased access to ENDS products, especially flavored ENDS, could “lure” teens into riskier health behaviors
  - Are e-cigarettes and combustible cigarettes economic complements or substitutes for teens?

- Youths may deserve special attention by policymakers for regulation
  - Asymmetric information
  - Prefrontal cortexes not fully developed, making “rational” decision-making more difficult and responses to negative emotional shocks less measured
  - Time-inconsistent preferences that could generate internalities

National Youth Tobacco Survey (U.S.)



Common Policy strategies to reduce ENDS use

- Minimum legal purchasing ages for e-cigarettes
  - Now Federal “Tobacco-to-21” Law
- Restricting sales of flavored ENDS products
- Extend clean indoor air laws to cover e-cigarette aerosol
- ENDS retail licensure laws
- Restricting the delivery of ENDS products purchased online
- ENDS taxes

Importance of Causal Inference in Policy Analysis

- In the absence of a randomized controlled trial (RTC), credible quasi-experimental research design is needed to establish causal effect of policy
  - Disentangle selection effects and reverse causality from causal impact
- We need credibly policy analysis to understand the intended and unintended effects of public policies (positive analysis)
  - These estimated policy parameters can then be used as part of a cost-benefit analysis (normative analysis)
- Concern with Observational Data: Policy adoption is not random
  - Jurisdictions that adopt stricter ENDS policies may have stronger anti-vaping sentiment or, alternatively, higher vaping rates than controls
- Credible quasi-experimental econometric methods are necessary to mimic conditions of a (localized) experiment

Common quasi-experimental methods used

- **Difference-in-differences (DiD)**
  - Exploit staggered adoption of local policies to identify their effects on health
    - Compare trends in vaping (smoking) before and after policy change in treatment jurisdictions vs counterfactual jurisdictions

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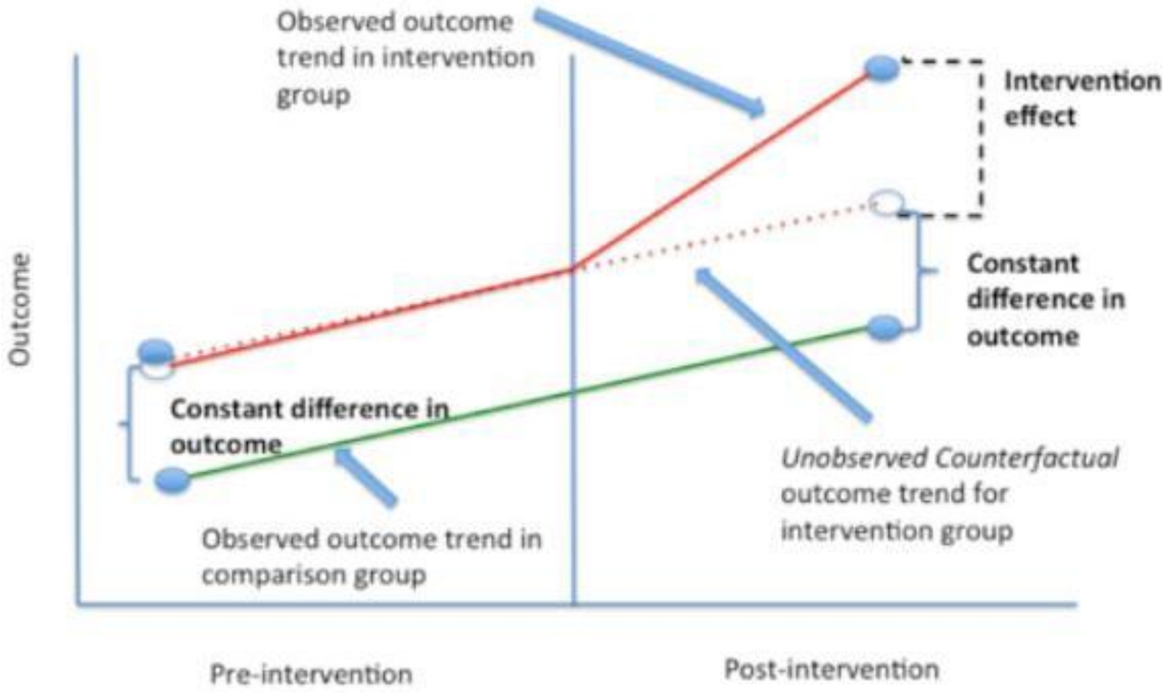

Source: https://www.publichealth.columbia.edu/research/population-health-methods/difference-difference-estimation

Common quasi-experimental methods used

- **Difference-in-differences (DiD)**
  - Exploit staggered adoption of local policies to identify their effects on health
    - Compare trends in vaping (smoking) before and after policy change in treatment jurisdictions vs counterfactual jurisdictions
  - Dynamic DiD (event-study analysis)
    - decompose the treatment effect over time
    - explore whether prior to policy adoption, vaping (smoking) in treatment and control states were trending similarly and any diversion happens post-treatment
  - Two-way fixed effects (TWFE) vs Alternate DiD Estimators
    - Stacked DiD (Cengiz et al. 2019); Sun and Abraham (2021); Callaway and Sant’Anna (2021); Gardner (2021); de Chaisemartin and D'Haultfoeuille (2020; 2023)

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- **Regression discontinuity design (RDD)**
  - Assignment variable (e.g. age) has discrete value where the treatment is felt by those on one side of a cutoff and not felt on the other side of the cutoff
  - For example, a minimum legal sales age for e-cigarettes of age 18
    - If you are 17.9 years-old, it is illegal, but if you are 18.1, it is legal

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Intended and unintended effects of e-cigarette taxes on youth tobacco use

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Abstract

Over the past decade, rising youth use of e-cigarettes and other electronic nicotine delivery systems (ENDS) has contributed to aggressive regulation by state and local governments. Between 2010 and mid-2019, ten states and two large counties adopted ENDS taxes. We use two large national surveys (Monitoring the Future and the Youth Risk Behavior Surveillance System) to estimate the impact of ENDS taxes on youth tobacco use.We find that ENDS taxes reduce youth ENDS consumption, with estimated ENDS tax elasticities of -0.06 to -0.21. However, we estimate sizable *positive* cigarette cross-tax effects, suggesting economic substitution between cigarettes and ENDS for youth. These substitution effects are particularly large for frequent cigarette smoking. We conclude that the unintended effects of ENDS taxation may considerably undercut or even outweigh any public health gains.

ENDS Taxes

- Popular policy tool in U.S. to restrict access to ENDS (via higher prices) is through the adoption of ENDS taxes
- As of December 2024, 32 states and the District of Columbia had adopted ENDS taxes
- The first such tax was adopted in 2010 in Minnesota, with an effective tax rate of $1.24 per mL of e-liquid (in 2023$)
- In 2023, the highest ENDS taxes were in Minnesota ($2.89 per mL of e-liquid) and Vermont ($2.79 per mL of e-liquid)

Why might ENDS taxes reduce ENDS use?

- Cotti et al (2022) find that 90% of e-cigarette taxes are passed along to consumer retail prices
  - IV approach finds e-cigarette own-price elasticity of -2.2

- ENDS taxes could serve as an informational signal about the risk of nicotine vaping
  - Or relative risk of vaping as compared to other tobacco products

- Heterogeneity in Tax Sensitivity for Youths vs Adults
  - Possible that youths are more price sensitive due to more limited disposable income
  - Very different reasons for consumption (adults more likely to use as smoking cessation aid)

Data

- **National and State Youth Risk Behavior Surveys** (2015-2019; 2015-2023)
  - Nationally representative (and in case of State YRBS, state representative as well) school-based survey of US high school students
  - Detailed information on health and health behaviors, including prior-month ENDS use and combustible tobacco product (cigarettes, cigars) use
  - Coordinated by the Centers for Disease Control and Prevention and administered by States Department of Health & Human Services and Education

- **Monitoring the Future** (2014-2019)
  - Nationally representative survey of 8th, 10th, 12th grade students
  - Information on ENDS use, combustible tobacco product use

- **Behavioral Risk Factor Surveillance Survey** (2016-2022)
  - Nationally representative phone-based survey (includes landlines and smartphones) of those aged 18 and older
  - Includes information on health and health behaviors, including past 30-day ENDS use and cigarette use

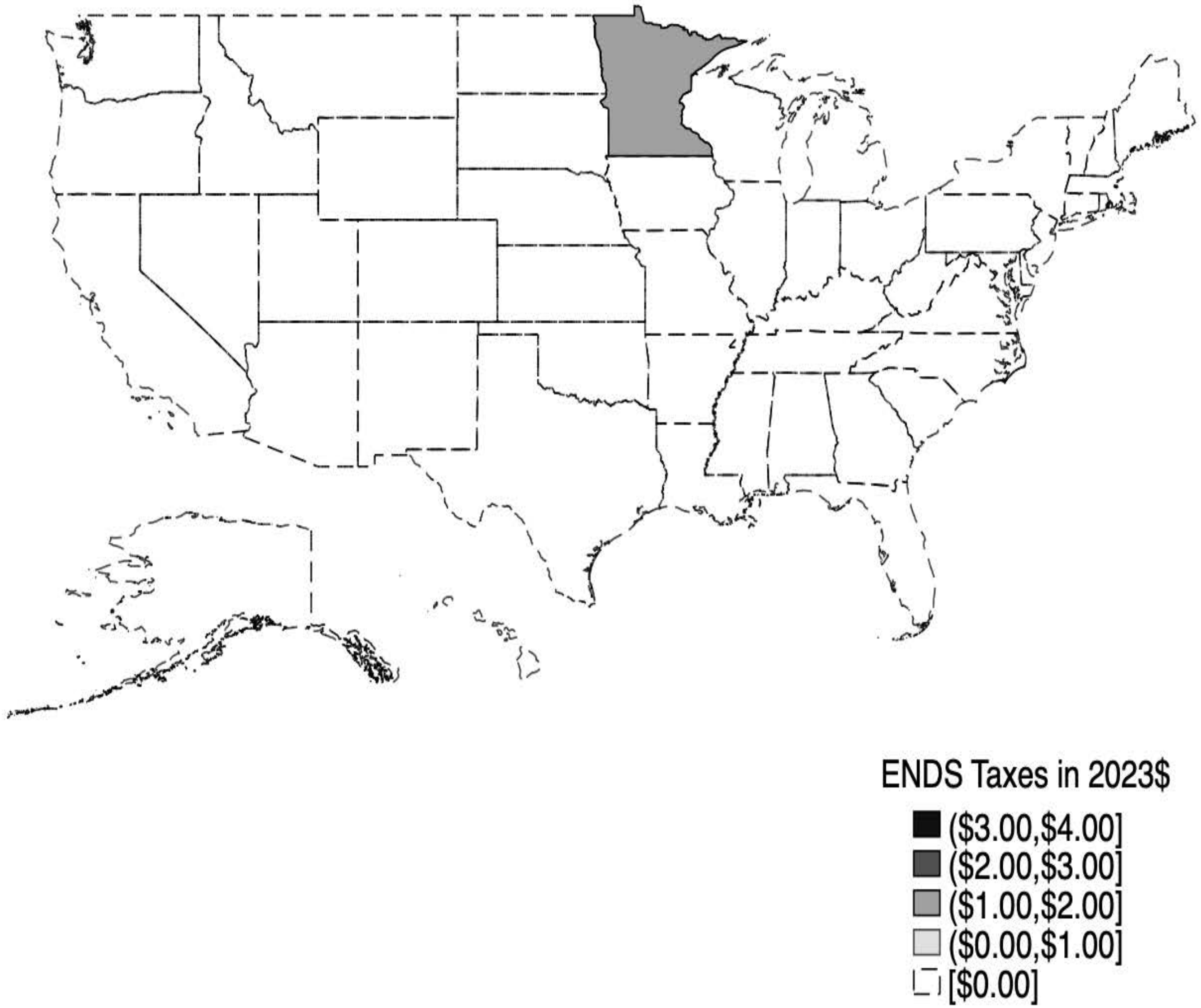
Empirical Approach

- Two-way fixed effects (TWFE) DiD Regression:

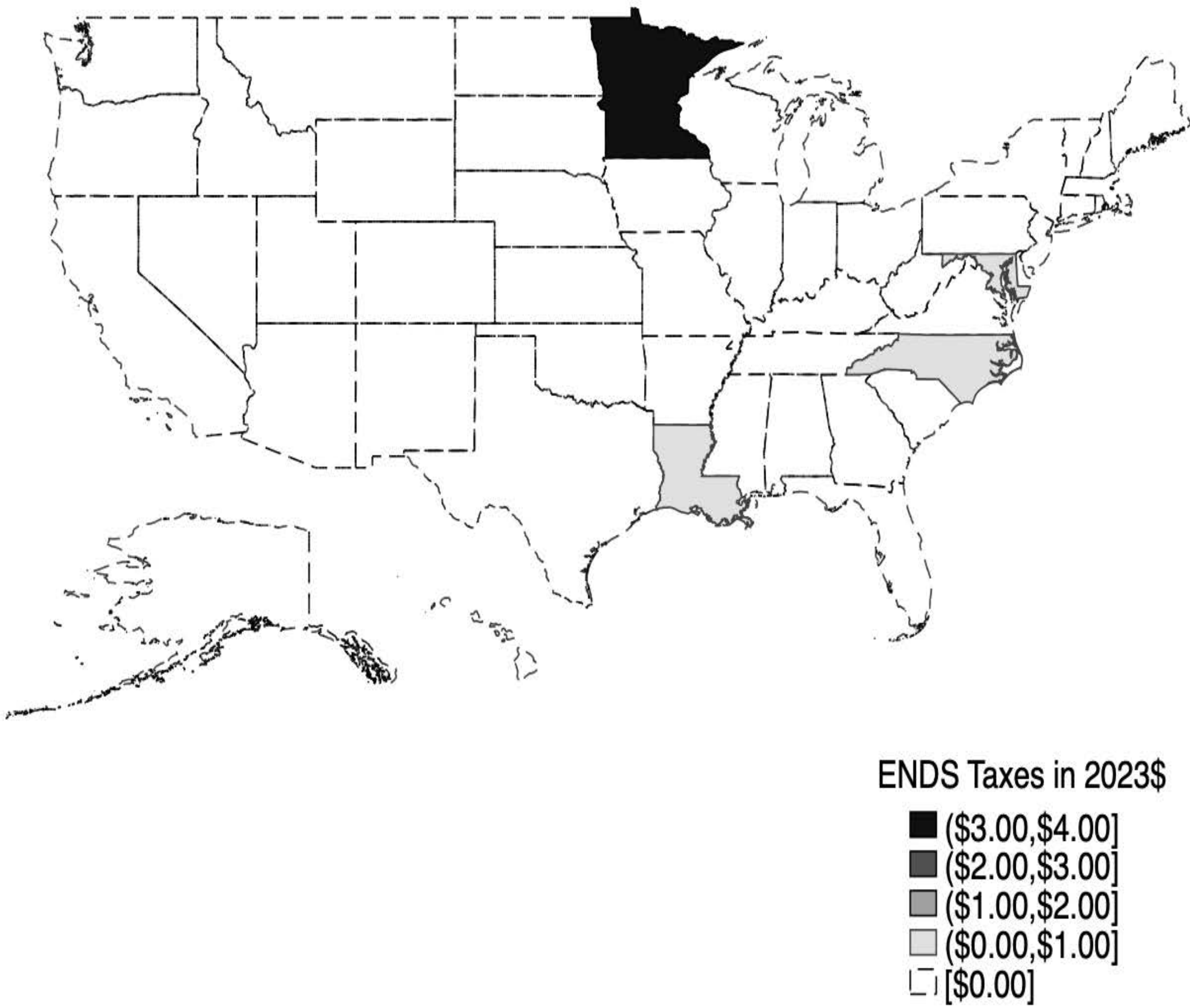
$$Y_{ist} = \gamma_0 + \gamma_1 ENDS\ Tax_{st} + \boldsymbol{X}_{st}\,\boldsymbol{\beta} + \boldsymbol{Z}_{it}\boldsymbol{\kappa} + \alpha_s + \theta_t + \varepsilon_{ist}$$

- Y_{ist} measures current ENDS use, combustible cigarette use
- **macroeconomic conditions** (unemployment rate, poverty rate)
- **tobacco control policies** (the presence of an ENDS MLSA, cigarette tax indoor ENDS use restriction in restaurants, bars, or workplaces, indoor smoking restriction in restaurants, bars, or workplaces, Tobacco-21 laws, vertical license laws, ENDS flavor bans, ENDS licensure laws)
- **alcohol and marijuana policies** (beer tax per, medical & recreational MJ laws)
- **individual demographic controls** (in the YRBS & MTF: gender, age, race/ethnicity, and grade; in the BRFSS: gender, age, educational attainment, race/ethnicity)

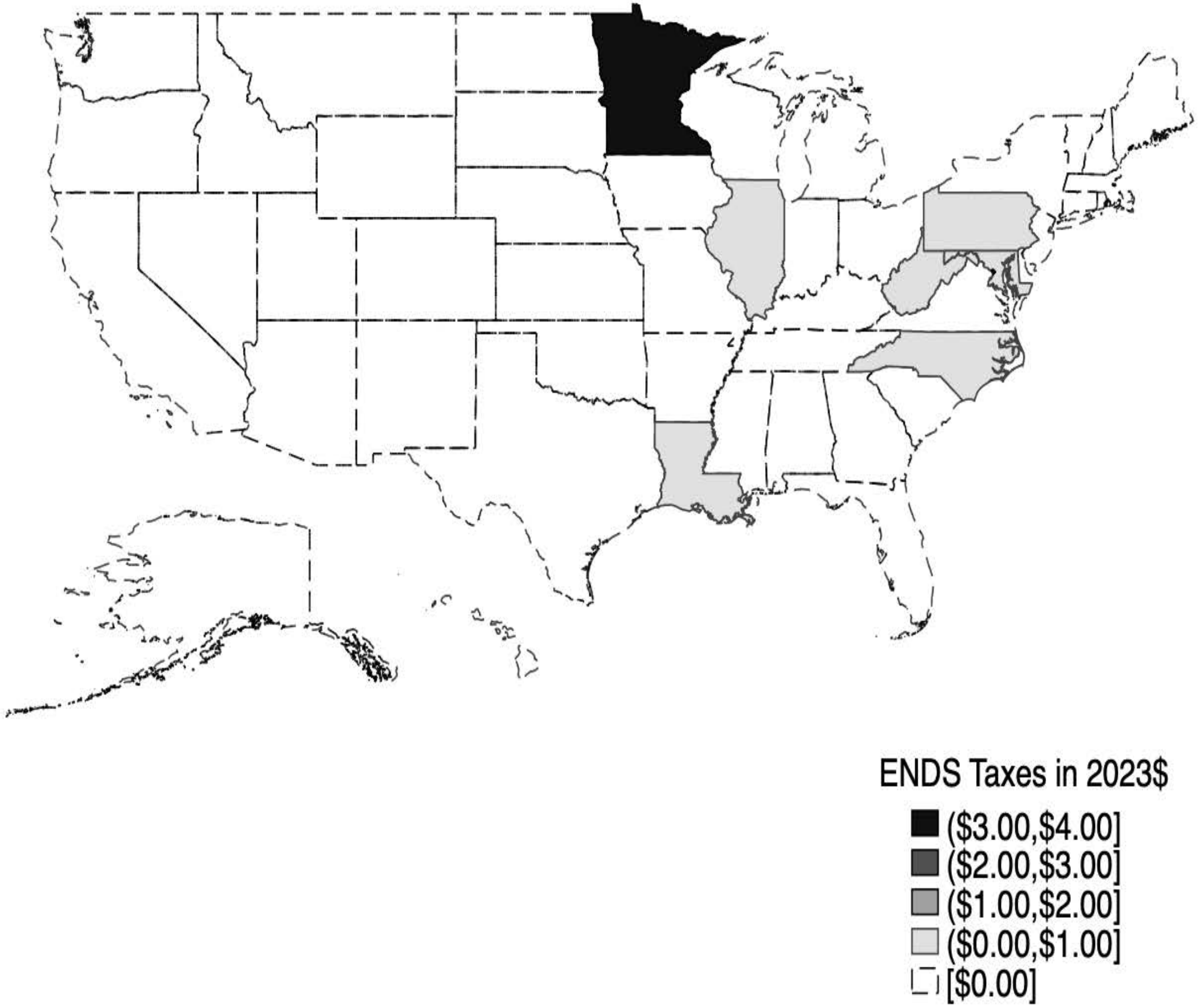
2010



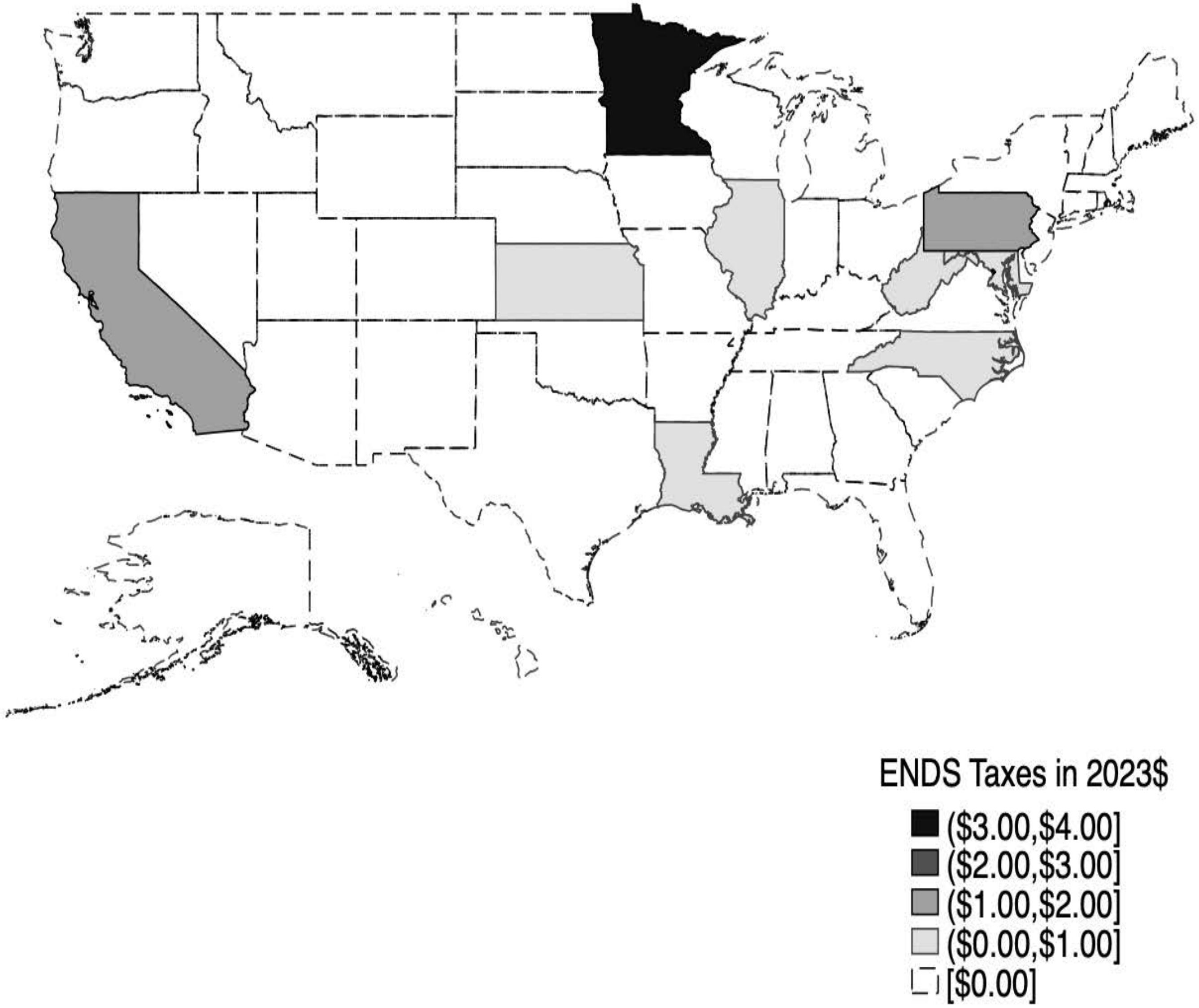
2015



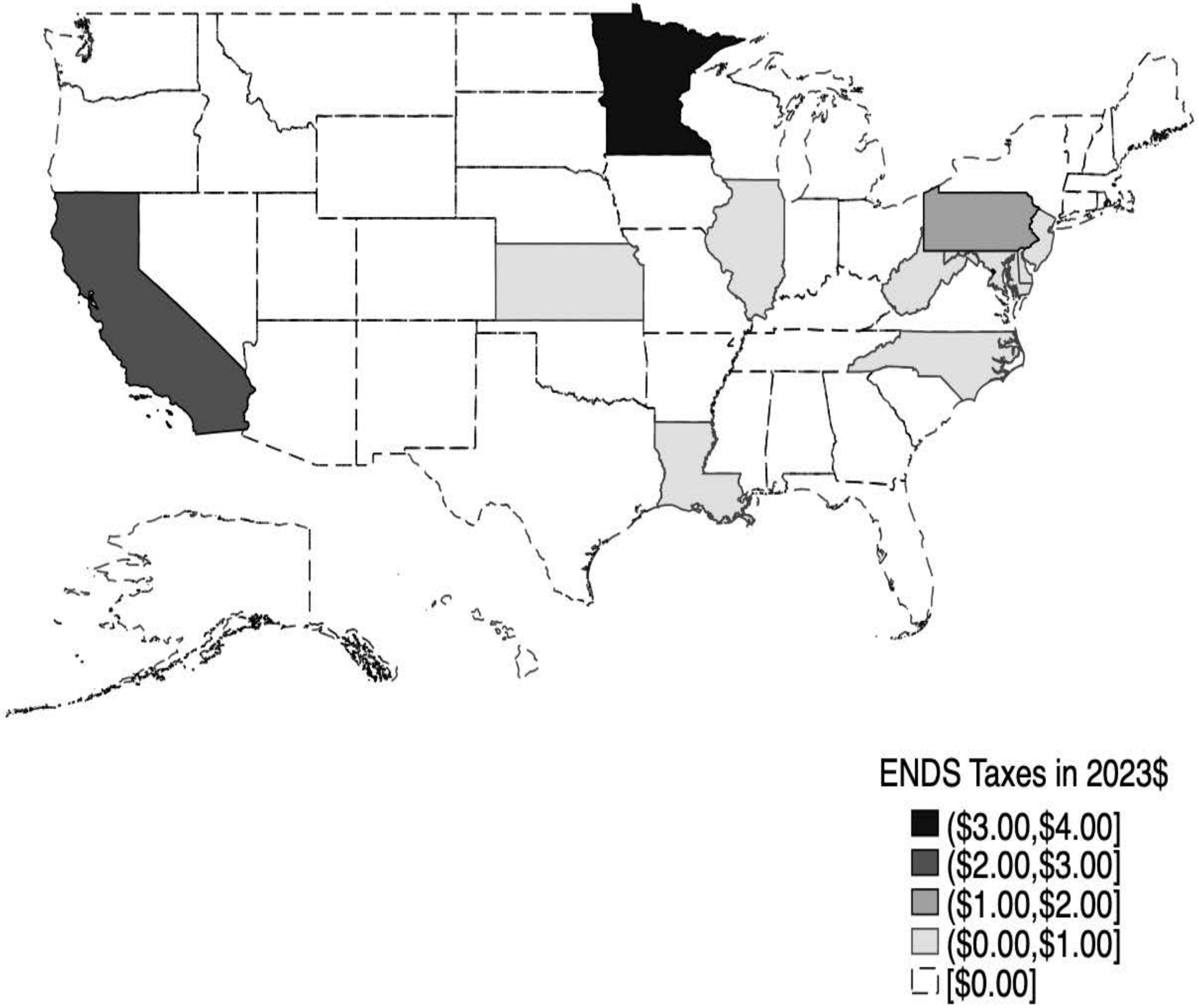
2016



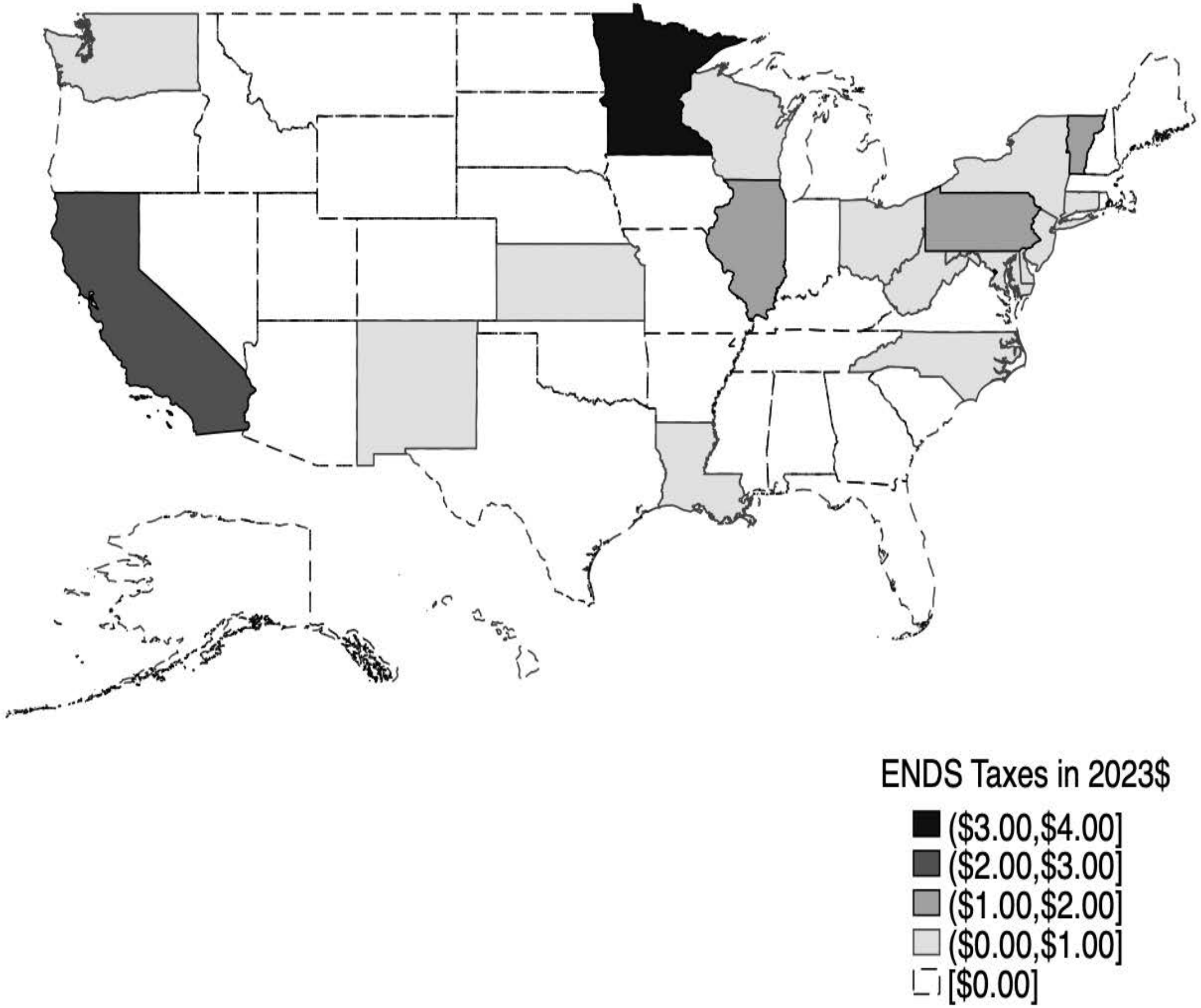
2017



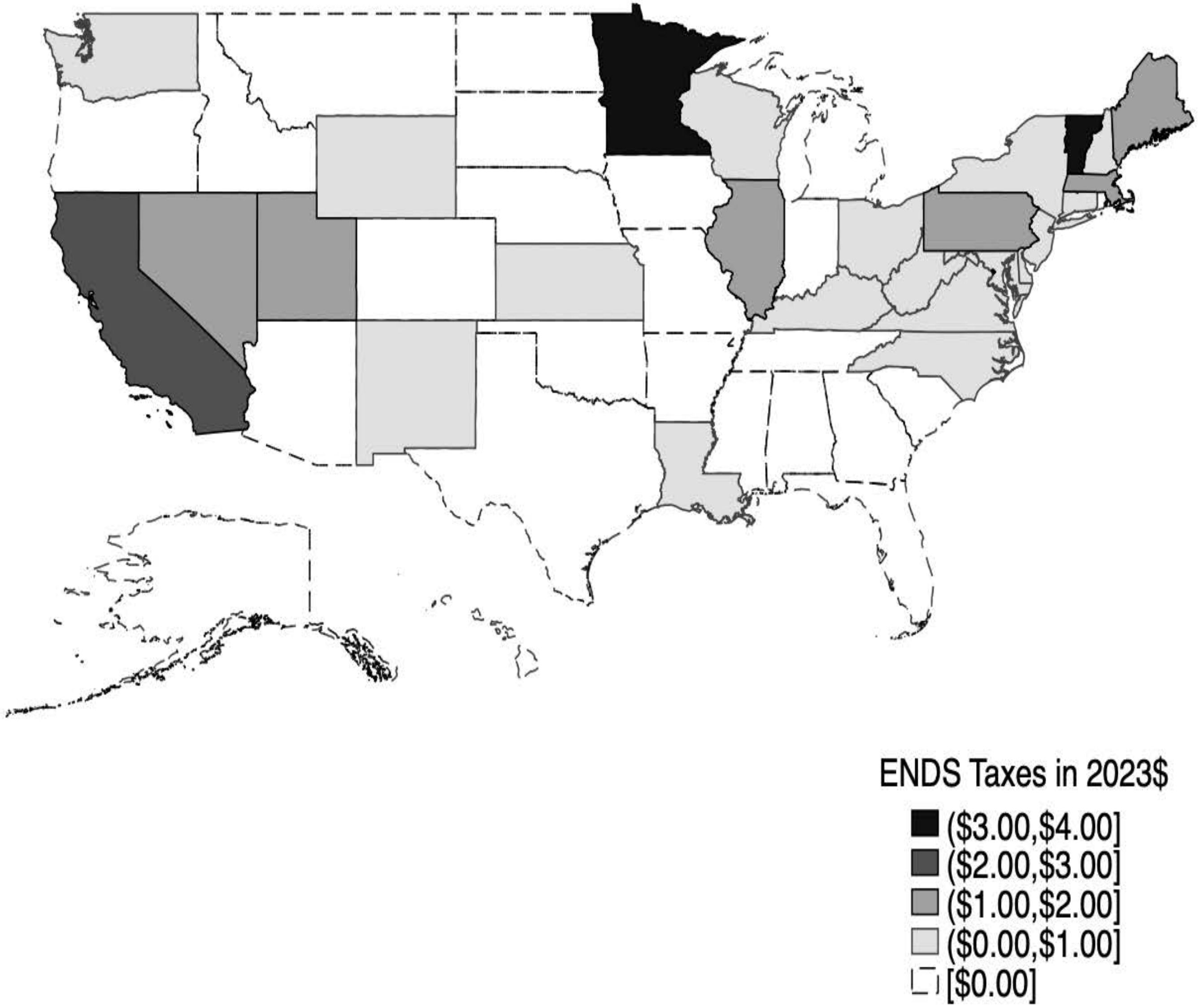
2018



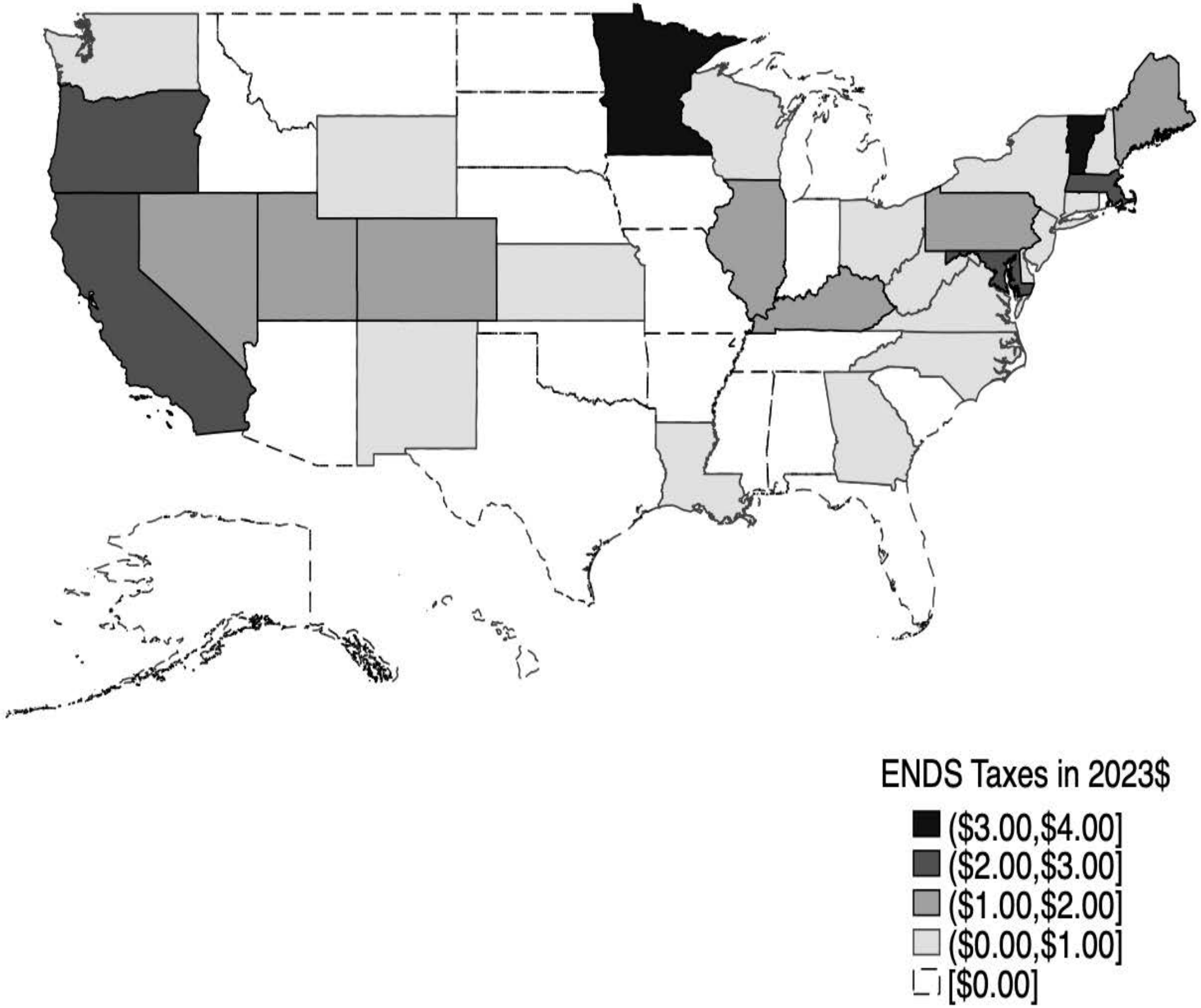
2019



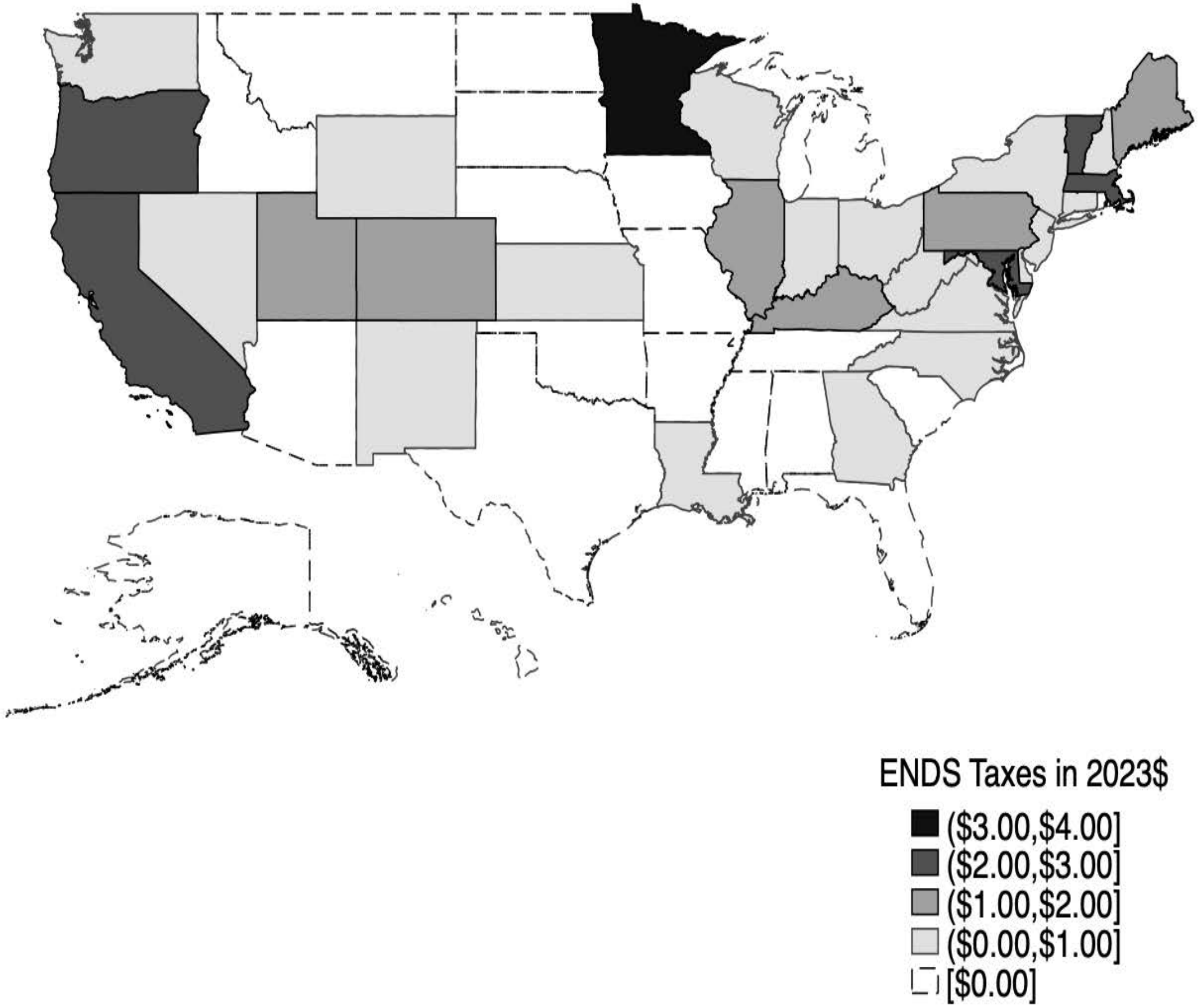
2020



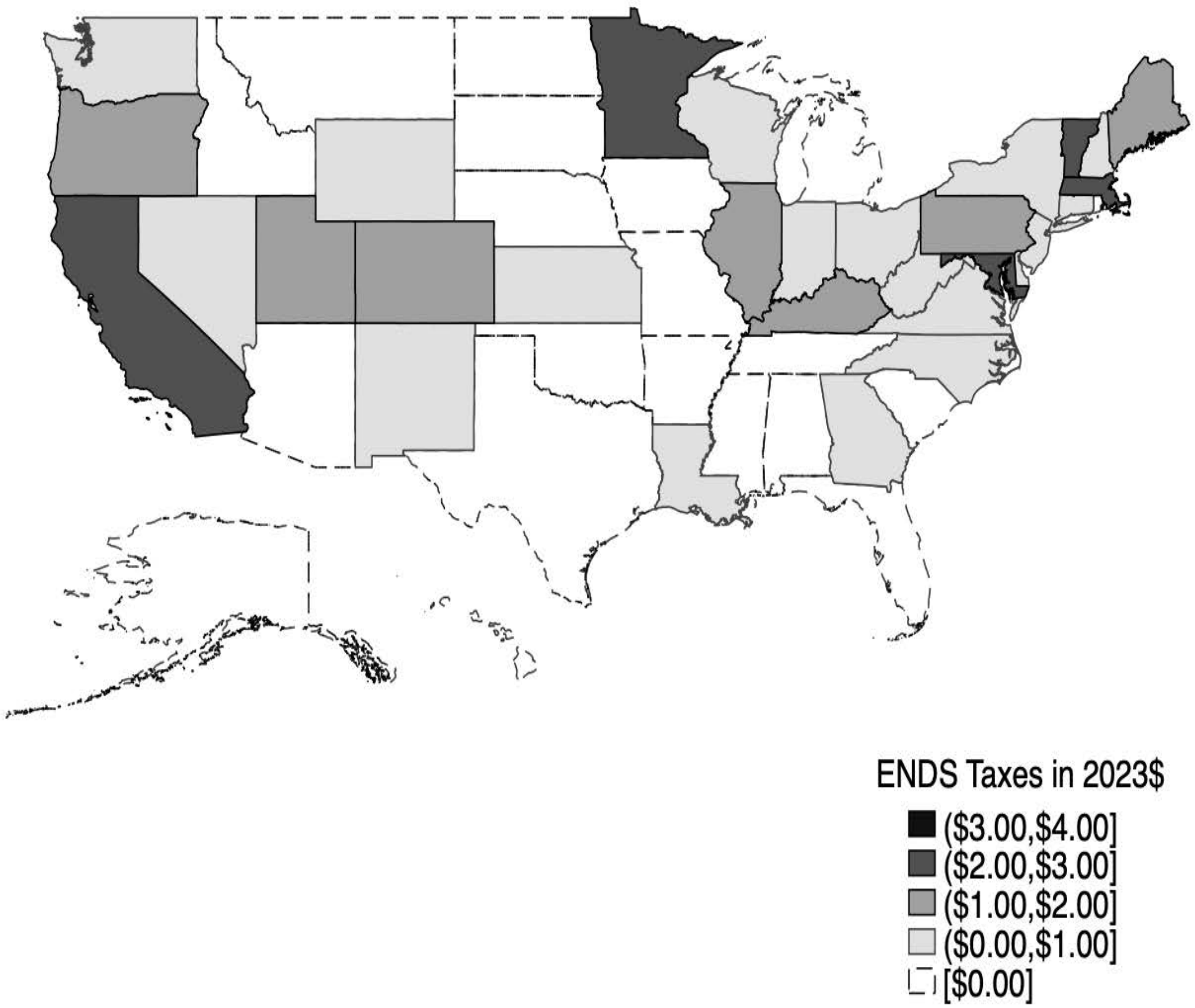
2021



2022



2023



Identification Assumptions of TWFE DiD

- Common Trends Assumption
    - In the absence of treatment, youth vaping trends in the treatment states would have evolved as the control states did

<u>This means</u>:

- No state-specific time-varying unobservables correlated with ENDS tax adoption and youth vaping (smoking)
- No reverse causality whereby youth vaping causes ENDS tax increases

<u>In addition, bias may arise through</u>:

- Negative weighting of treatment states due to timing of adoption
- Using earlier adopters as controls for later adopters in the presence of heterogeneous and dynamic treatment effects

Effects of ENDS Taxes on Youth ENDS Use, YRBS (2015-2019) and MTF (2014-2019)

	Current ENDS User	**Regular ENDS User**	**Ever Use ENDS**	**Current ENDS User**
ENDS Tax Rate per ml (2019 $)	-0.019*	-0.013*	-0.052***	-0.071***
	(0.010)	(0.007)	(0.010)	(0.025)
N	126,306	126,306	85,541	538,992
Dependent Variable Mean	0.152	0.038	0.287	0.213
Dataset	MTF	MTF	MTF	YRBS
ENDS Tax Elasticity	-0.095	-0.712	-0.127	0.568

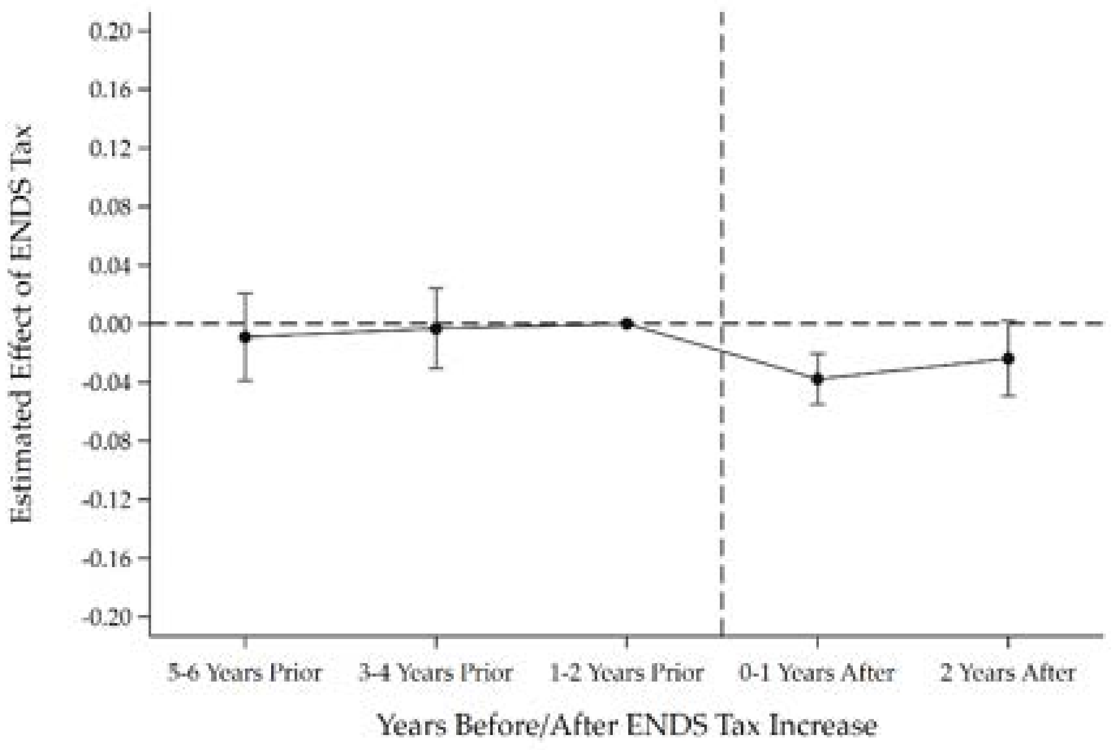
***p < .01 **p < .05 *p< .10

Intended Effects Persist in YRBS, 2015-2023

ENDS Tax (2023$)	-0.018***	-0.016***	-0.029**	-0.029**	-0.028**	-0.029**
	(0.004)	(0.005)	(0.012)	(0.012)	(0.011)	(0.011)
N	735109	735109	735109	735109	735109	735109
Pre-Treat Mean of Dep Var	0.179	0.179	0.179	0.179	0.179	0.179
State, Year, and Semester FE?	Yes	Yes	Yes	Yes	Yes	Yes
Demographic Controls?	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic Control?	No	Yes	Yes	Yes	Yes	Yes
Tobacco Policy Controls?	No	No	Yes	Yes	Yes	Yes
Alcohol Policy Control?	No	No	No	Yes	Yes	Yes
Marijuana Policy Controls?	No	No	No	No	Yes	Yes
Non-MJ Drug Policy Controls?	No	No	No	No	No	Yes

***p < .01 **p < .05 *p< .10

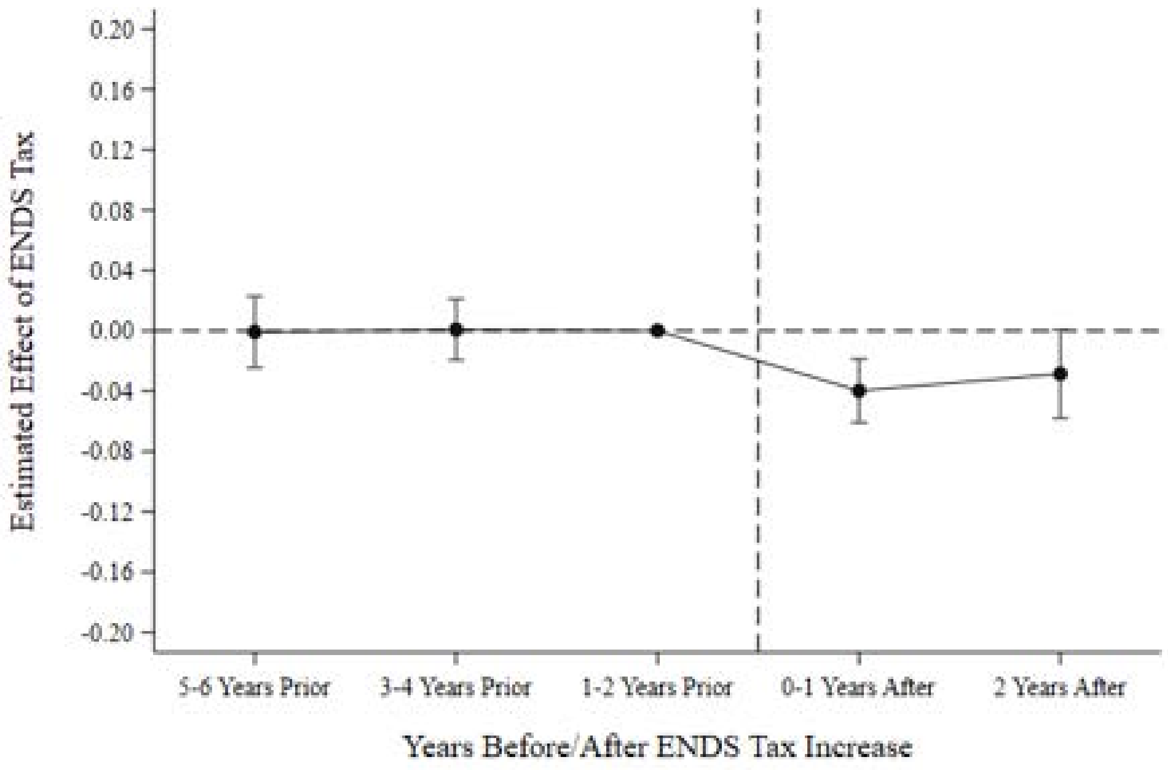
Event-Study Analysis, TWFE Estimates



95% CI reported on coefficients

Event-Study Analysis, Stacked DD Estimates

[Never and not-yet adopters as counterfactuals]



95% CI reported on coefficients

Intended Effects of ENDS Taxes for Adults, BRFSS

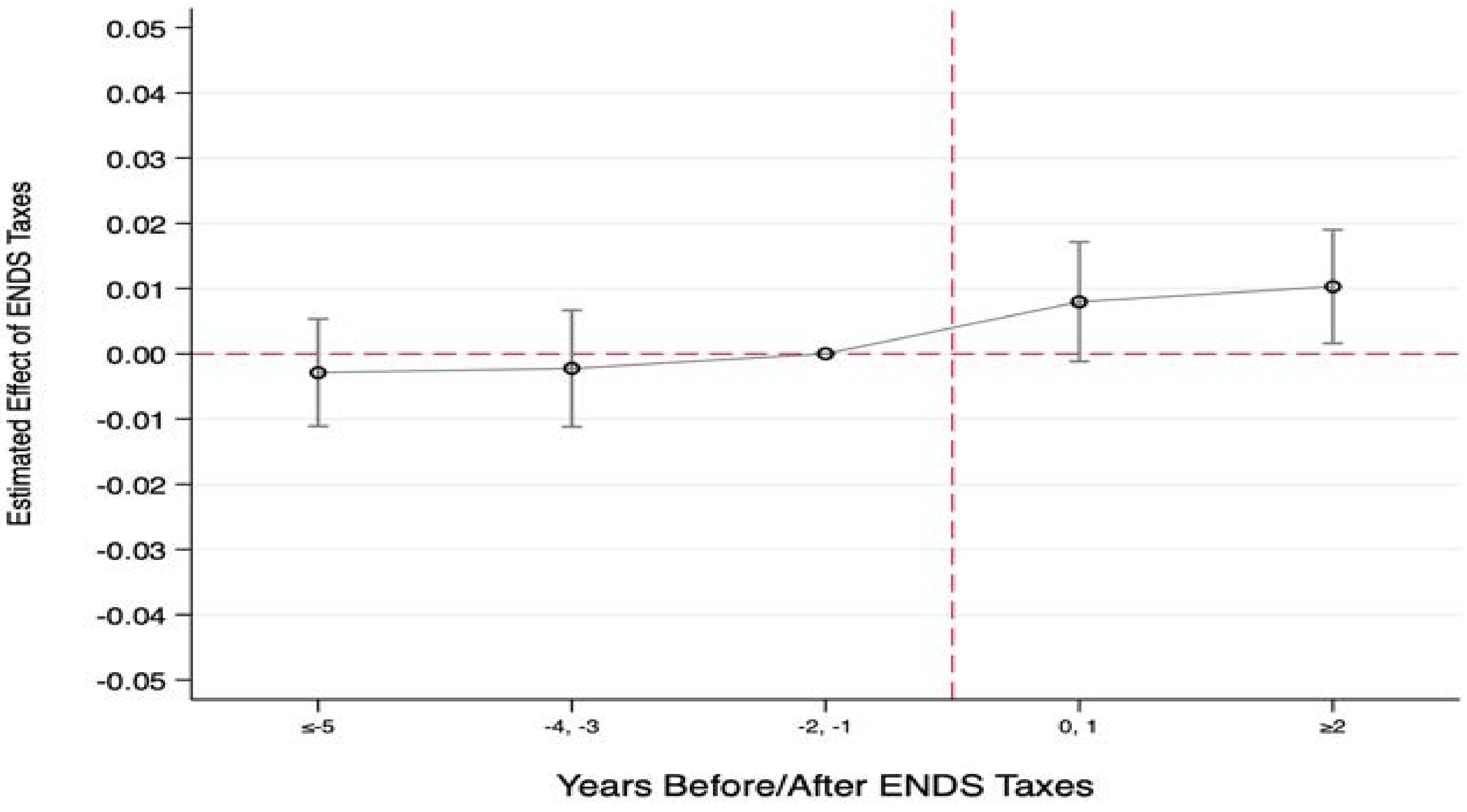
	Panel I: Ages 18-20					
ENDS Tax (2022$)	-0.0166***	-0.0162***	-0.0097*	-0.0104*	-0.0082	-0.0079
	(0.0043)	(0.0042)	(0.0057)	(0.0057)	(0.0060)	(0.0057)
N	47633	47633	47633	47633	47633	47633
Pre-Treatment Mean of DV	0.147	0.147	0.147	0.147	0.147	0.147
	Panel II: Ages 21-30					
ENDS Tax (2022$)	-0.0083***	-0.0075**	-0.0093**	-0.0078*	-0.0070*	-0.0089**
	(0.0030)	(0.0030)	(0.0041)	(0.0039)	(0.0041)	(0.0038)
N	193762	193762	193762	193762	193762	193762
Pre-Treatment Mean of DV	0.116	0.116	0.116	0.116	0.116	0.116
	Panel III: Ages 31 and older					
ENDS Tax 2022($)	0.0019	0.0021	0.0022	0.0019	0.0021	0.0015
	(0.0019)	(0.0017)	(0.0013)	(0.0020)	(0.0020)	(0.0022)
N	1,746,778	1,746,778	1,746,778	1,746,778	1,746,778	1,746,778
Pre-Treatment Mean of DV	0.0406	0.0406	0.0406	0.0406	0.0406	0.0406

Effect of ENDS Taxes on Teen Combustible Tobacco Use (2014-2019)

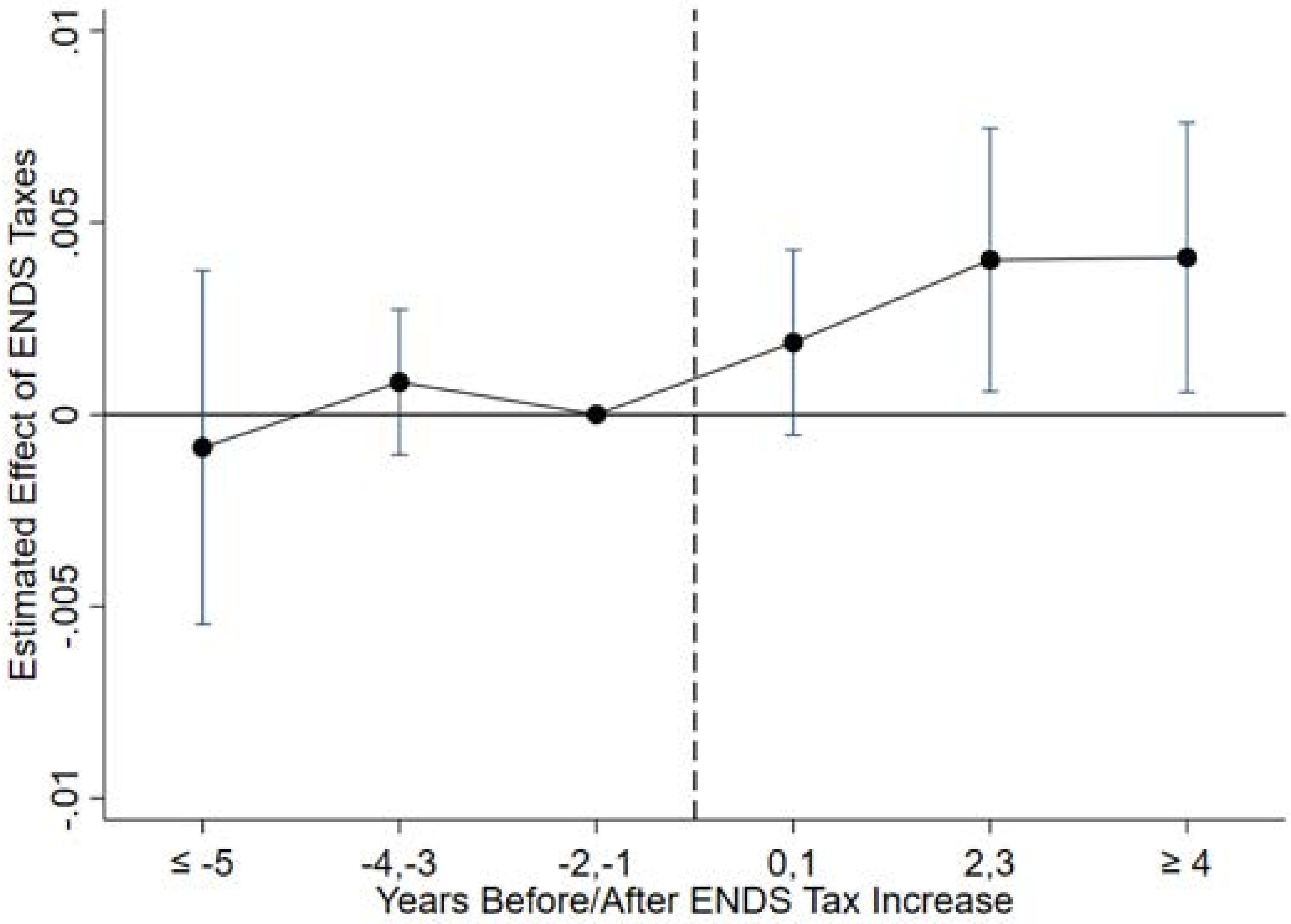
	Current Cigarette Use	Cigarette Half Pack a Day	Current Cigarette or Cigar	Current Cigarette Use	Regular Cigarette Use	Daily Cigarette Use	Current Cigarette or Cigar
ENDS Tax Rate per ml (2019$)	0.013** (0.006)	0.006** (0.002)	0.012* (0.006)	0.008 (0.013)	0.016 (0.014)	0.014 (0.012)	0.007 (0.016)
N	244,360	244.630	246,192	580,788	580,788	580,788	504,639
Dependent Var Mean	0.066	0.012	0.080	0.080	0.019	0.014	0.107
ENDS Tax Elasticity	0.123**	0.341**	0.089*	0.041	0.336	0.412	0.031
Dataset	MTF	MTF	MTF	YRBS	YRBS	YRBS	YRBS

***p < .01 **p < .05 *p< .10

Event-Study Analysis of ENDS Taxes and Teen Cigarette Smoking, 2015-2023



Event-Study Analysis of ENDS Taxes and Adult Everyday Cigarette Smoking, 2016-2023



Spillover Effects of ENDS Taxes:

Alcohol, Marijuana, Obesity, and Mental Health

Journal of Health Economics
Volume 102, August 2025, 103022

The Effect of E-Cigarette Taxes on Substance Use

Dhaval Dave, Yang Liang, Johanna Catherine Maclean, Caterina Muratori, Joseph J. Sabia

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Abstract

Public health advocates warn that the rapid growth of legal markets for electronic nicotine delivery systems (ENDS) may generate a "gateway" to marijuana and harder drug consumption, particularly among teenagers. This study explores the effects of ENDS taxes on substance use. Analyses are based on difference-in-differences and event-study methods applied to both survey (Youth Risk Behavior Surveillance System and Behavioral Risk Factor Surveillance System) and administrative (Treatment Episode Data Set) data. Our results imply that a one-dollar increase in ENDS taxes (2023$) is associated with a 1.0 to 1.5 percentage point decline in teen marijuana use and in co-use of ENDS and marijuana. This result is consistent with e-cigarettes and marijuana being economic complements. We also find that youth responses to ENDS taxes, in terms of their ENDS

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Do Vaping Taxes Tip the Scale? The Effect of E-Cigarette Taxation on Obesity

Charles J. Courtemanche, Tessie Krishna, Yang Liang, Joseph J. Sabia & Anthony Chuo

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Nicotine Vaping and Youth Mental Health: New Evidence from E-Cigarette Regulations

Chad D. Cotti, Tessie Krishna, Johanna Catherine Maclean, Erik T. Nesson & Joseph J. Sabia

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Can Anti-Vaping Policies Curb Drinking Externalities? Evidence from E-Cigarette Taxation and Traffic Fatalities

Dhaval M. Dave, Yang Liang, Johanna Catherine Maclean, Joseph J. Sabia & Matthew Braaksma

ELSEVIER

Journal of Health Economics

Volume 102, August 2025, 103013

The effect of e-cigarette flavor bans on tobacco use *

Chad Cotti [a], Charles Courtemanche [b], Yang Liang [c], Johanna Catherine Maclean [d], Erik Nesson [e], Joseph J. Sabia [f]

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https://doi.org/10.1016/j.jhealeco.2025.103013

Abstract

Advocates for sales restrictions on flavored e-cigarettes argue that flavors appeal to young people and lead them down a path to nicotine addiction. Using data from a variety of surveys (Youth Risk Behavior Surveys, Behavioral Risk Factor Surveillance Survey, and Population Assessment of Tobacco and Health), this study is among the first to examine the effect of state and local restrictions on the sale of flavored electronic nicotine delivery system (ENDS) products on youth and young adult tobacco use. We find robust evidence

Are flavors luring teenagers to vape nicotine?

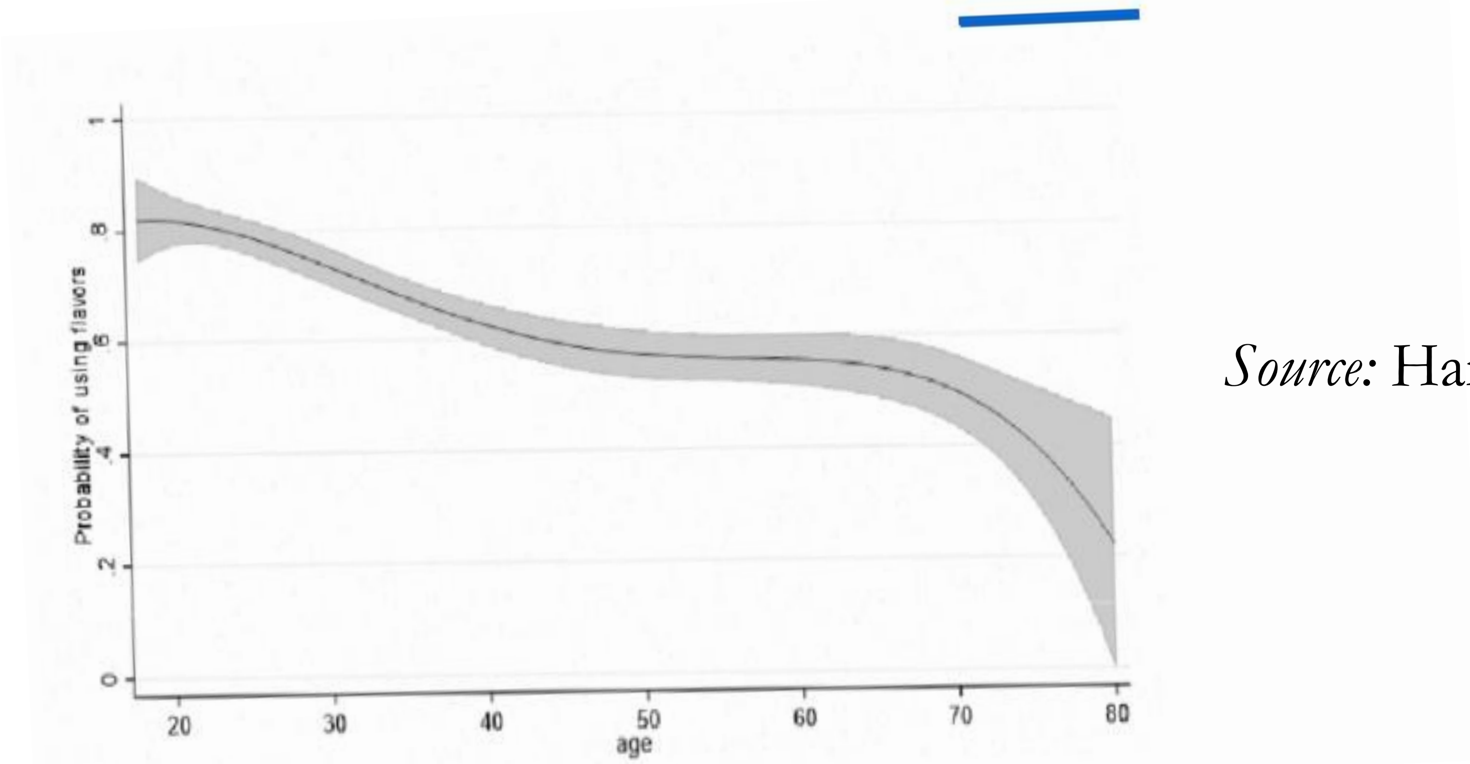
"The tobacco industry is well aware that flavors appeal to and attract kids, and that young people are uniquely vulnerable to nicotine addiction… [W]e all must work with even greater urgency to protect our nation's youth from all flavored e-cigarettes, including disposables."

-Truth Initiative (2023)

ENDS Flavor Restrictions

- According to the 2023 National Youth Tobacco Survey, 89% of youths who vape report using flavors
  - Most common are fruit (63%), candy, desserts, other sweets (35%), mint (28%), menthol (20%) (Birdsey et al., 2023)

BUT FLAVORS ARE NOT JUST FOR TEENS



Source: Hampsher-Monk et al (2024)

Data

- **National and State Youth Risk Behavior Surveys (YRBS)**
  - Biennial School-based surveys (2015 -2023) coordinated by CDC
  - Representative of tobacco use among high school students at state and national levels
  - Outcomes: prior-month e-cigarette and combustible tobacco use (any, frequent, everyday)

- **Behavioral Risk Factor Surveillance Survey (BRFSS)**
  - Telephone-based survey of adults aged 18 and older (2016-2023) coordinated by CDC
  - Nationally representative survey of adults (young adults 18-20 years and 21+ years)
  - Outcomes: prior-month e-cigarette and combustible cigarette use

- **Population Assessment of Tobacco and Health (PATH)**
  - Individual-level panel dataset of youths and adults
  - Detailed information on types of ENDS used

Empirical Approach

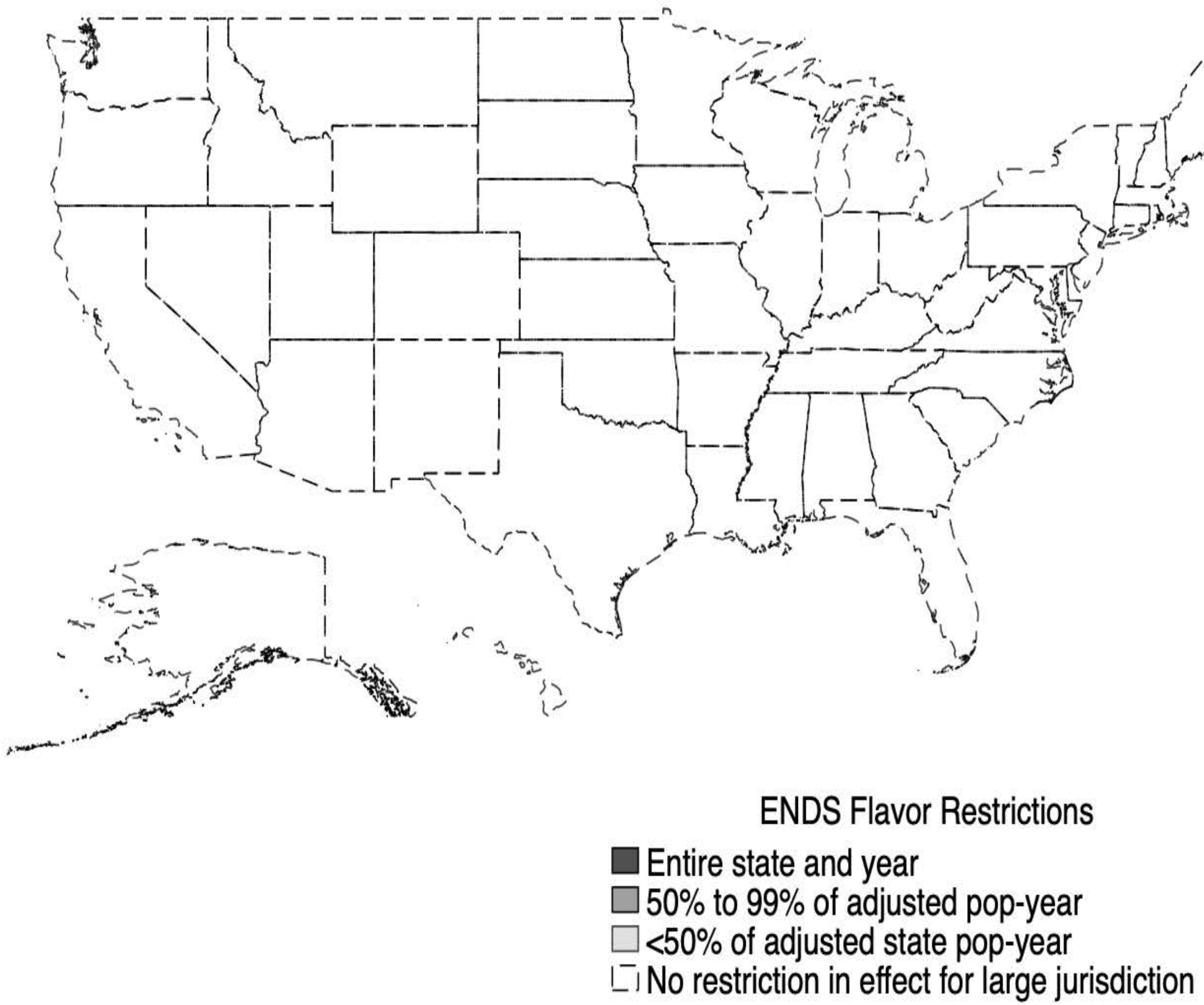
- Two-way fixed-effects model estimated via logit and OLS:

$$\mathbf{Y}_{ist} = \beta_0 + \beta_1\ \mathbf{FlavorBan}_{st} + \mathbf{X'}_{ist}\beta_2 + \mathbf{P'}_{st}\beta_3 + \alpha_s + \lambda_p + \varepsilon_{ist}$$

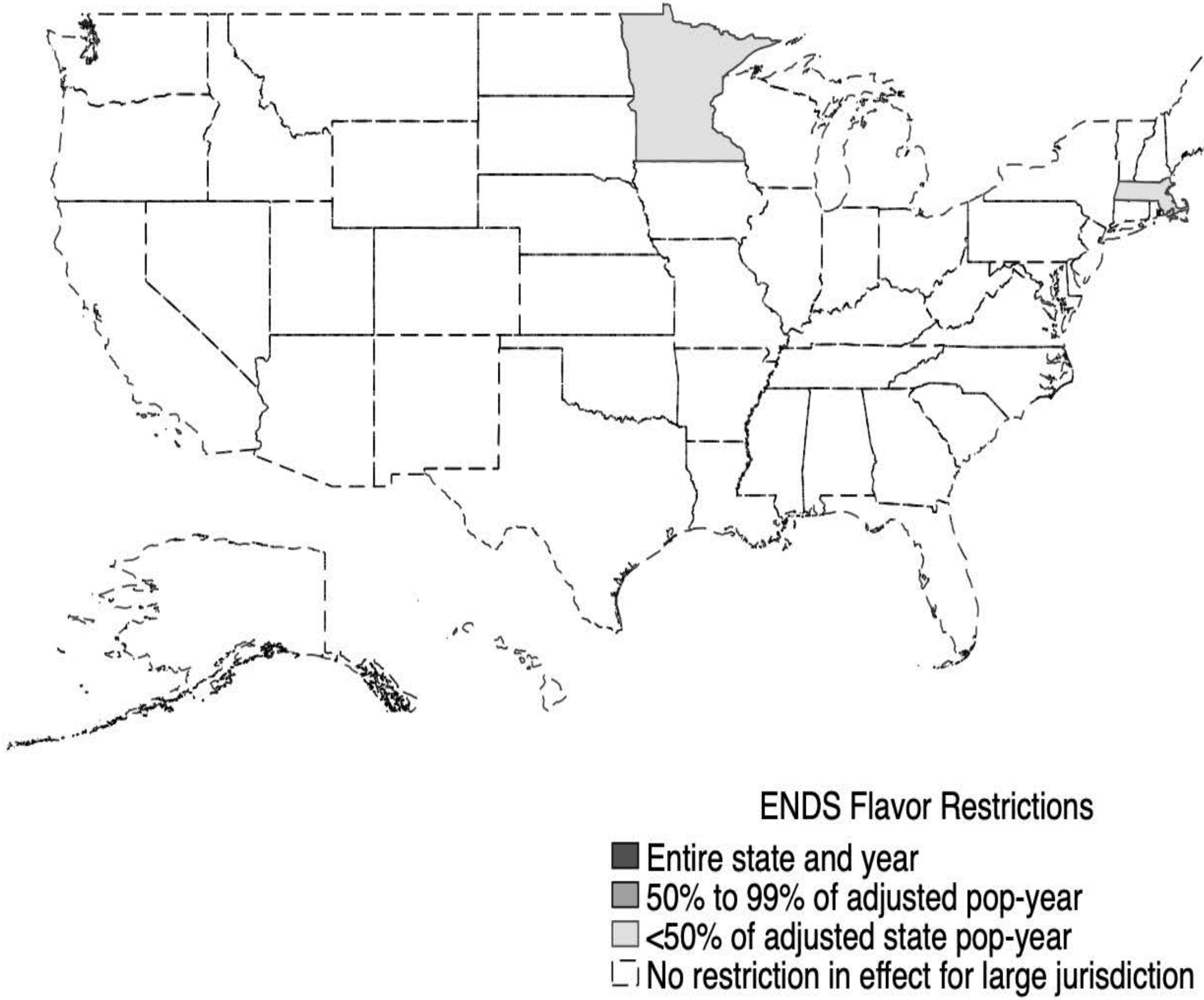
- $\mathbf{Y}_{ist}$: tobacco use (prior-month e-cigarette use, combustible cigarette smoking)
- $\mathbf{FlavorBan}_{st}$: ENDS Flavor Restriction
- $\mathbf{X}_{ist}$: Individual characteristics (e.g., gender, age, race, ethnicity, grade)
- $\mathbf{P}_{st}$: State Combustible tobacco and ENDS policy controls (Tobacco-21 Laws, ENDS Tax, Cigarette Tax, Menthol Cigarette Ban, ENDS Licensure Laws, ENDS Online Sales Delivery Ban, Clean Indoor Air Laws, MLPAs), Unemployment Rate, COVID-19 Death Rate, Beer Taxes, Medical and Recreational MJ Laws
- $\boldsymbol{\alpha}_s$: State fixed effects
- $\boldsymbol{\tau}_t$**:** Year-semester fixed effects
- Standard errors clustered at state level and regressions are weighted

- Machine learning (LASSO) approach to select controls

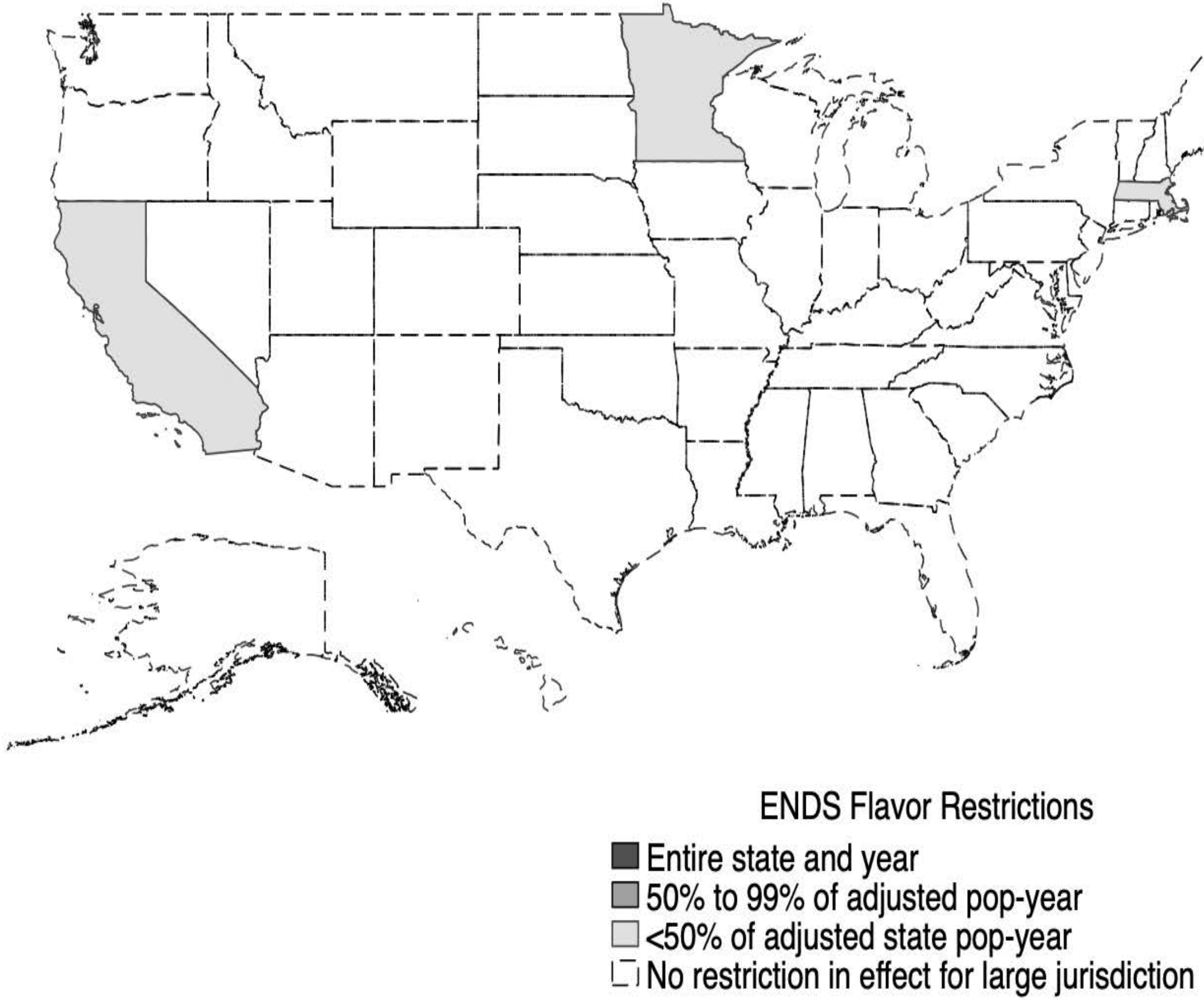
2015


ENDS Flavor Restrictions
Entire state and year
50% to 99% of adjusted pop-year
<50% of adjusted state pop-year
No restriction in effect for large jurisdiction

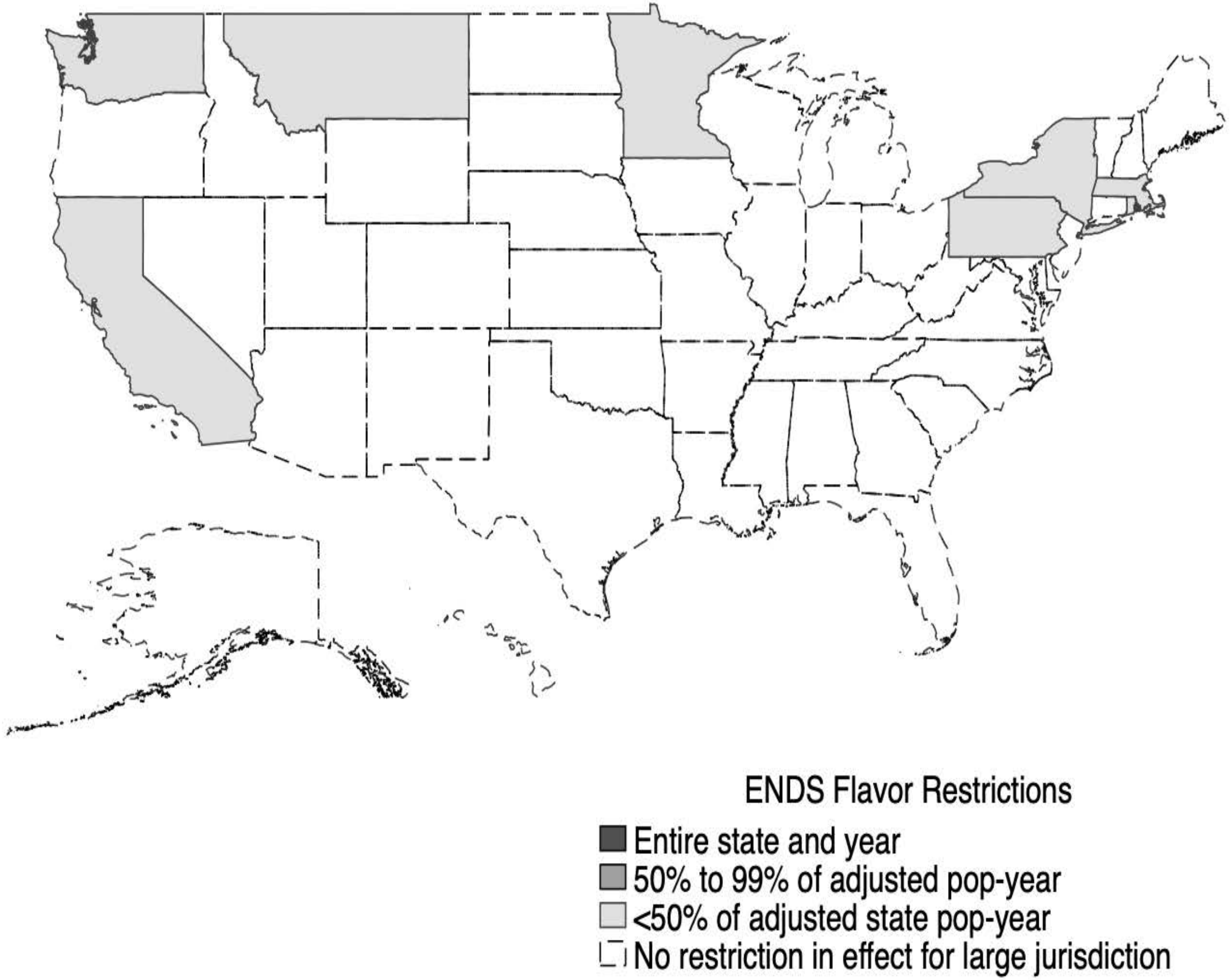
2017


ENDS Flavor Restrictions
Entire state and year
50% to 99% of adjusted pop-year
<50% of adjusted state pop-year
No restriction in effect for large jurisdiction

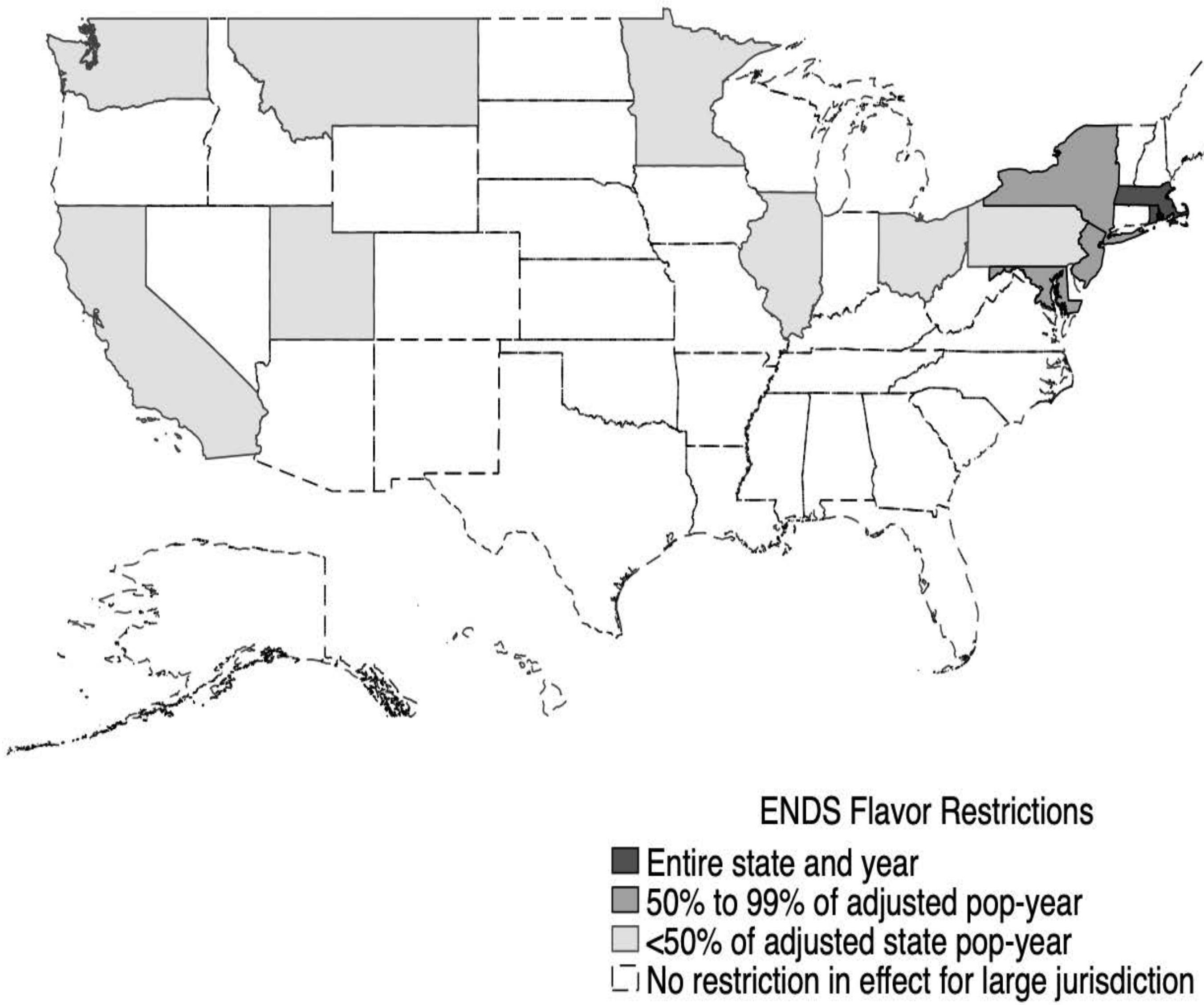
2018


ENDS Flavor Restrictions
Entire state and year
50% to 99% of adjusted pop-year
<50% of adjusted state pop-year
No restriction in effect for large jurisdiction

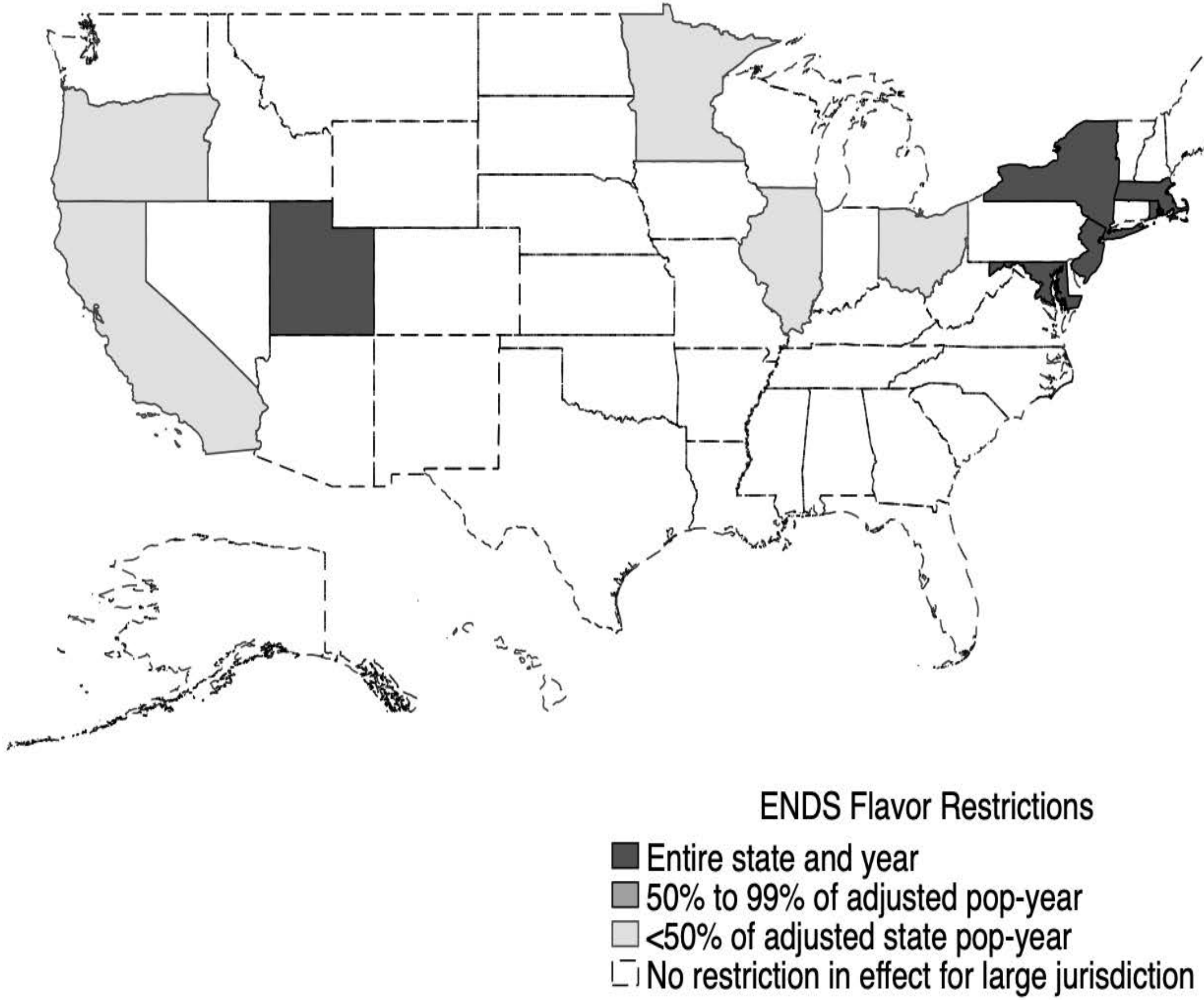
2019


ENDS Flavor Restrictions
Entire state and year
50% to 99% of adjusted pop-year
<50% of adjusted state pop-year
No restriction in effect for large jurisdiction

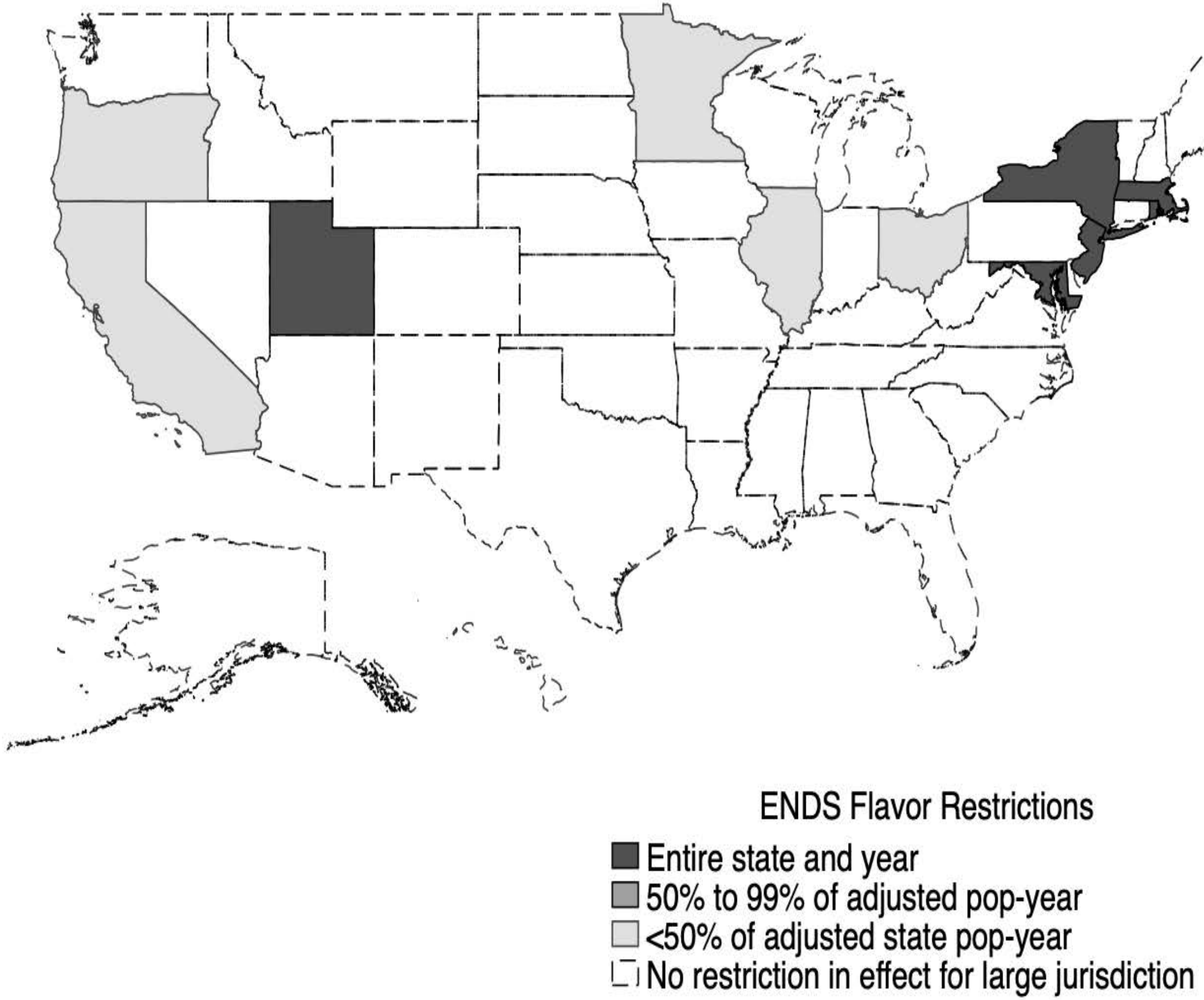
2020


ENDS Flavor Restrictions
Entire state and year
50% to 99% of adjusted pop-year
<50% of adjusted state pop-year
No restriction in effect for large jurisdiction

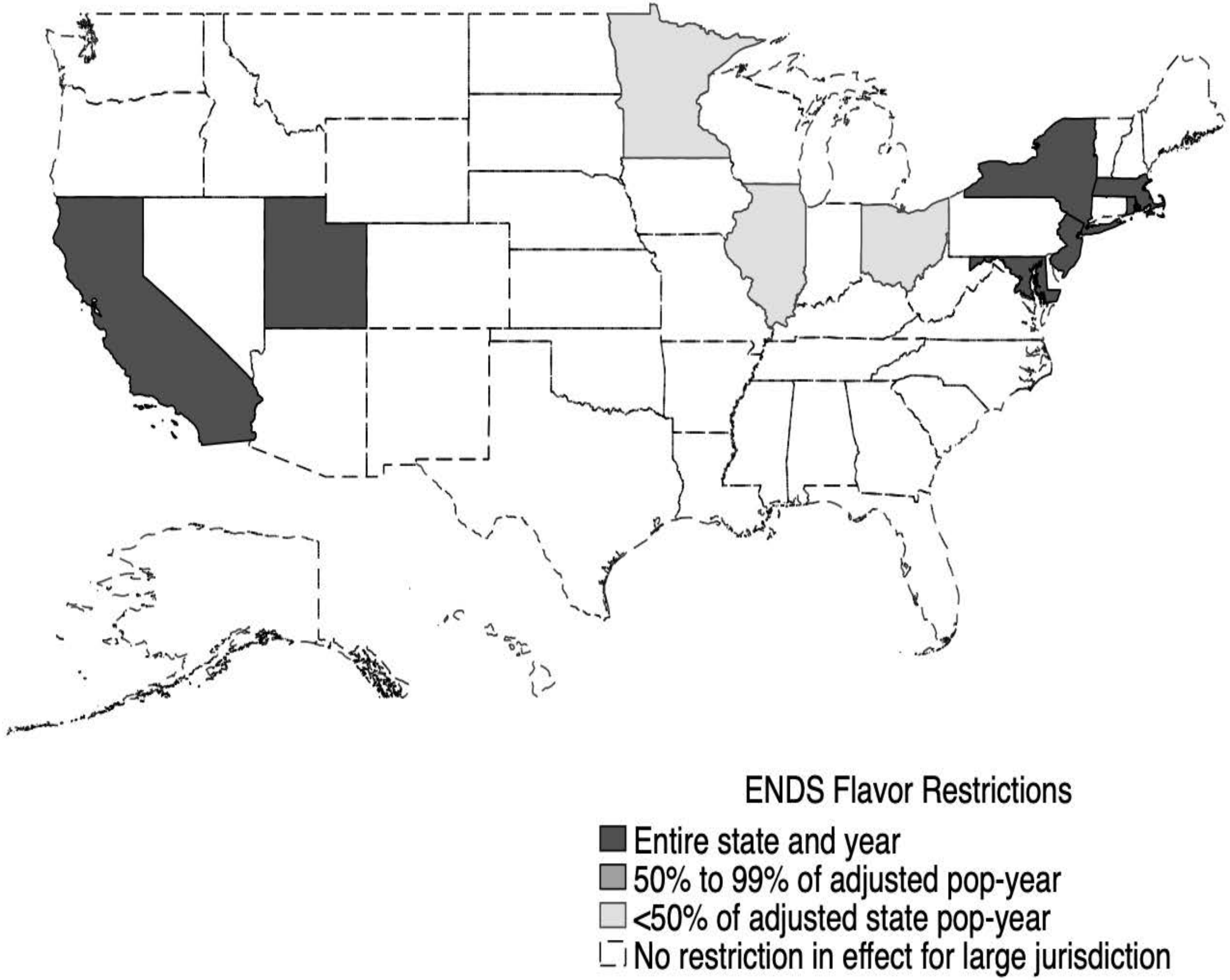
2021


ENDS Flavor Restrictions
Entire state and year
50% to 99% of adjusted pop-year
<50% of adjusted state pop-year
No restriction in effect for large jurisdiction

2022


ENDS Flavor Restrictions
Entire state and year
50% to 99% of adjusted pop-year
<50% of adjusted state pop-year
No restriction in effect for large jurisdiction

2023



ENDS Flavor Restrictions
Entire state and year
50% to 99% of adjusted pop-year
<50% of adjusted state pop-year
No restriction in effect for large jurisdiction

Effect of Flavor Bans on Current ENDS Use

	(1)	(2)	(3)
	Panel I: Overall Treatment Effect		
ENDS Flavor Restriction	-0.0094	0.0058	0.0064
	(0.0097)	(0.0189)	(0.0188)
	Panel II: Lagged Effects		
0-1 Years After ENDS Flavor Restriction	-0.0077	-0.0037	-0.0028
	(0.0140)	(0.0226)	(0.0226)
2+ Years After ENDS Flavor Restriction	-0.0102	0.0114	0.0119
	(0.0109)	(0.0200)	(0.0200)
Pre-Treatment Mean DV	0.2164	0.2164	0.2164
N	789921	789921	789921
Control Variables:			
Baseline Controls?	Yes	Yes	Yes
Extended Controls?	No	Yes	Yes
Double-selection LASSO	No	No	Yes

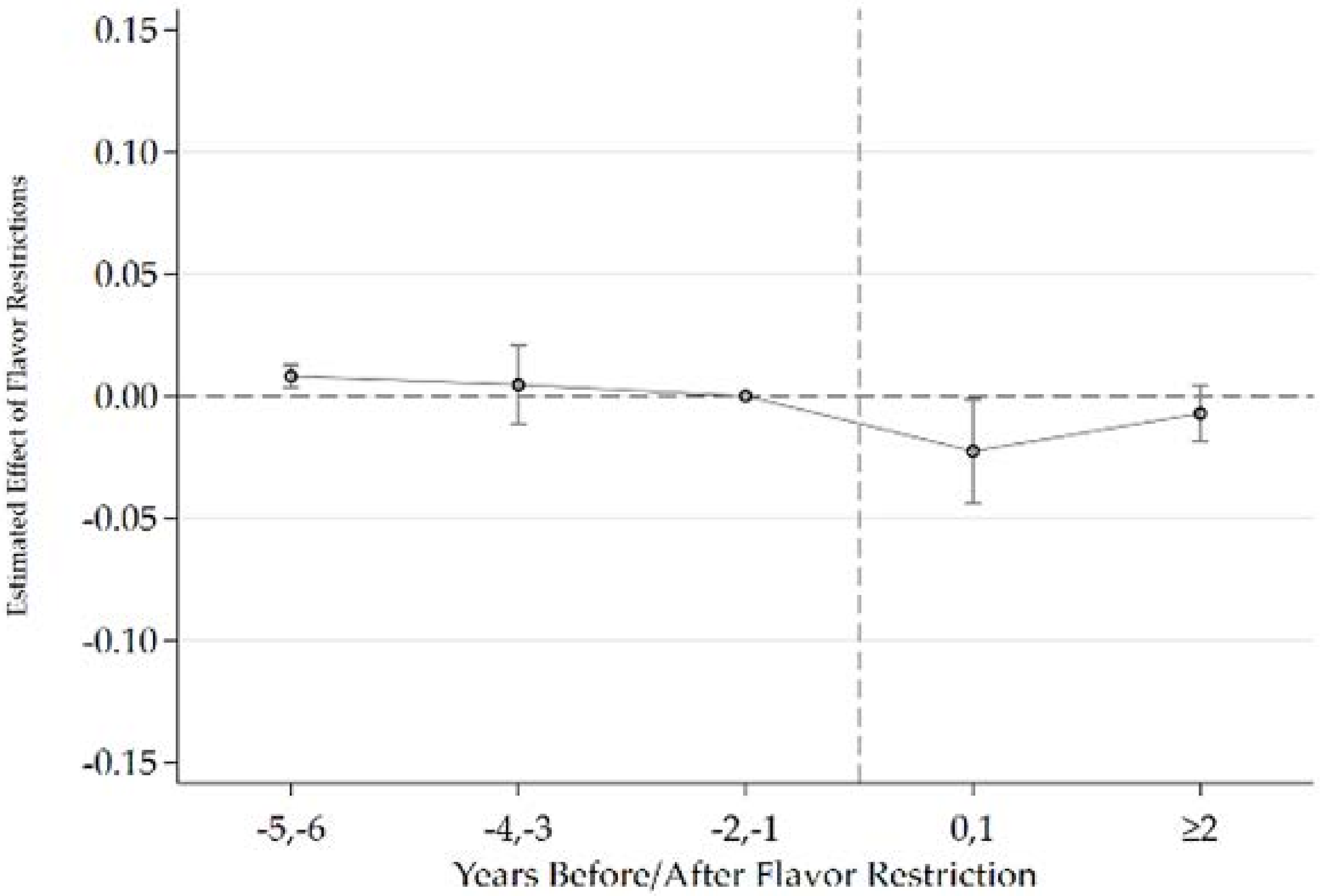
** p<.1, ** p<.05, *** p<.01*

Effect of Flavor Bans on Everyday ENDS Use

	(1)	(2)	(3)
		Panel I: Overall Treatment Effect	
ENDS Flavor Restriction	-0.0137**	-0.0110	-0.0101
	(0.0057)	(0.0076)	(0.0074)
		Panel II: Lagged Effects	
0-1 Years After ENDS Flavor Restriction	-0.0220**	-0.0240**	-0.0225**
	(0.0088)	(0.0111)	(0.0107)
2+ Years After ENDS Flavor Restriction	-0.0095	-0.0035	-0.0027
	(0.0062)	(0.0083)	(0.0083)
Pre-Treatment Mean DV	0.0292	0.0292	0.0292
N	789921	789921	789921
Control Variables:			
Baseline Controls?	Yes	Yes	Yes
Extended Controls?	No	Yes	Yes
Double-selection LASSO	No	No	Yes

* $p<.1$, ** $p<.05$, *** $p<.01$

Dynamic DiD Estimates on Everyday Use



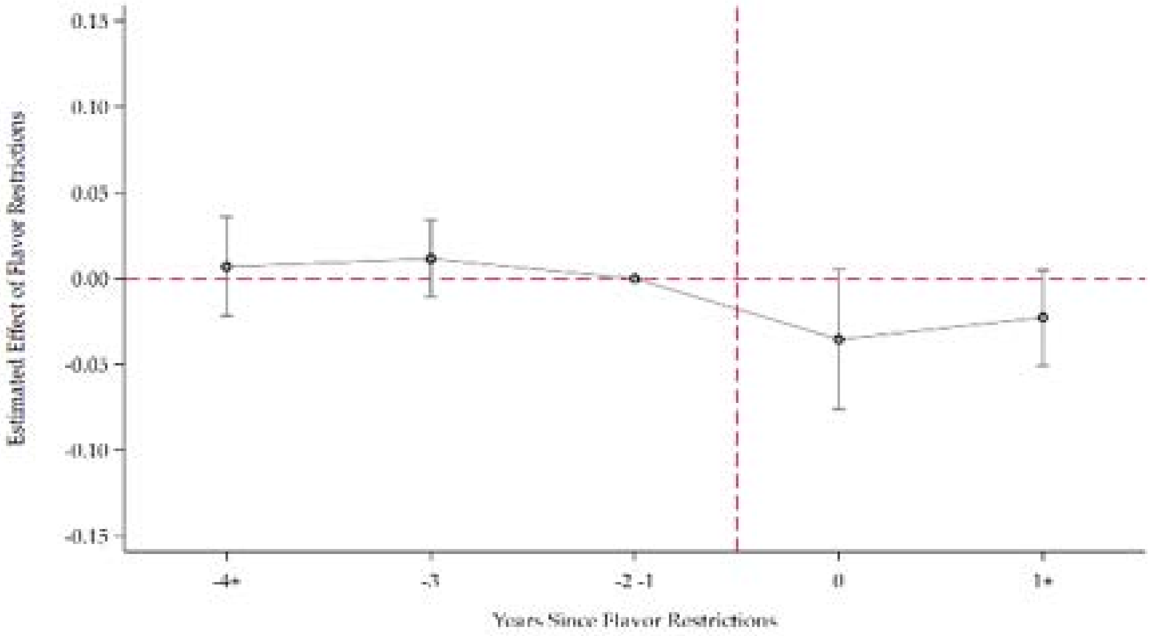
Why might effects (especially on extensive margin) be a muted?

Population Assessment of Tobacco & Health

	Current ENDS Use	Everyday ENDS Use	Flavored ENDS	Unflavored ENDS
Panel A. Current Treatment Effect				
ENDS Flavor Restriction	-0.009	-0.023**	-0.014	0.021***
	(0.021)	(0.011)	(0.020)	(0.006)
Panel B. Lagged Treatment Effect				
0-1 Years After ENDS Flavor Restriction	-0.001	-0.017*	-0.004	0.020***
	(0.020)	(0.010)	(0.019)	(0.006)
2+ Years After ENDS Flavor Restriction	-0.026	-0.035**	-0.034	0.022***
	(0.029)	(0.014)	(0.027)	(0.007)
Pre-Treatment Mean DV	0.143	0.037	0.128	0.013

Event-Study Analysis, 18-20-Year Olds

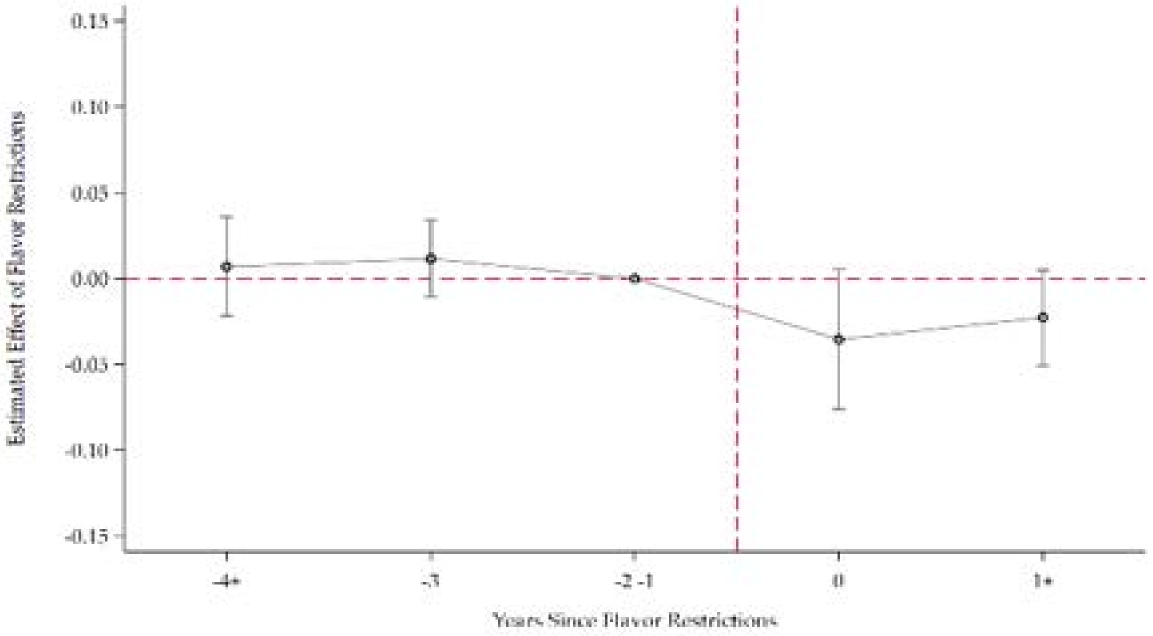
ENDS Use



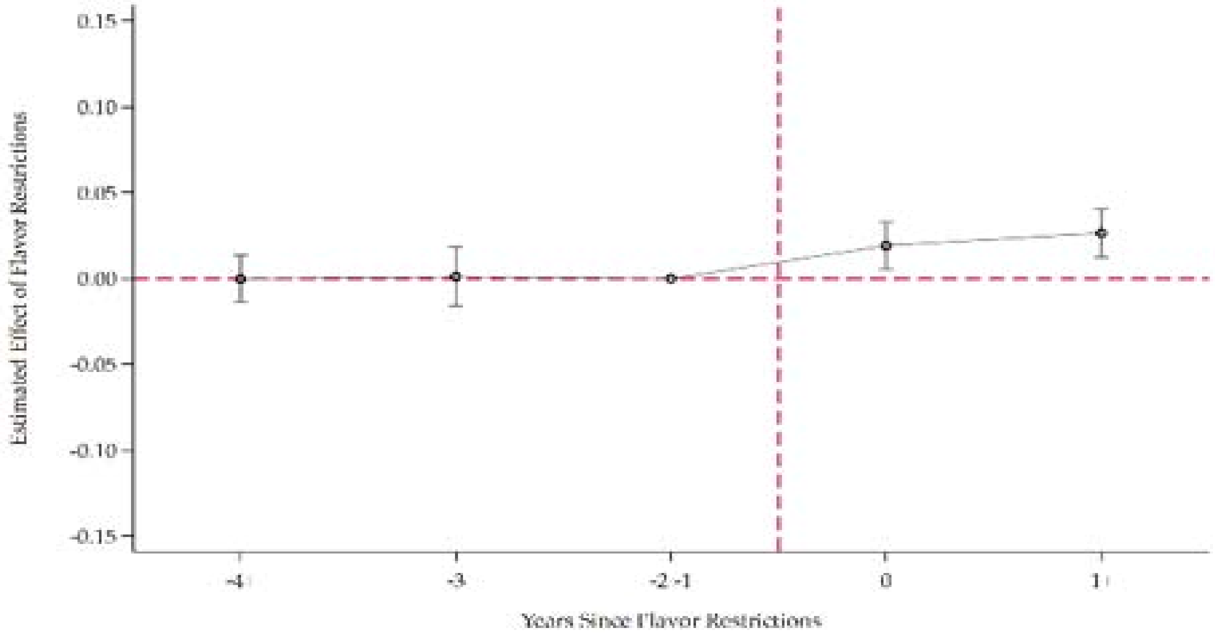
Adoption of an ENDS flavor restriction is associated with a 3 percentage-point reduction in young adult ENDS use

Event-Study Analysis, 18-20-Year Olds

ENDS Use



Cigarette Smoking



Adoption of an ENDS flavor restriction is associated with a 3 percentage-point reduction in young adult ENDS use, but a **1 percentage-point increase in cigarette smoking**

ELSEVIER

Journal of Health Economics

Volume 98, December 2024, 102919

Do e-cigarette retail licensure laws reduce youth tobacco use?

Charles Courtemanche [a], Yang Liang [b], Johanna Catherine Maclean [c], Caterina Muratori [d], Joseph J. Sabia [e]

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Abstract

E-cigarette licensure laws (ELLs) require retailers to obtain a state license to sell e-cigarettes over the counter. This study is the first to comprehensively explore the effect of ELL adoption on youth tobacco product use. Using data from the State Youth Risk

E-Cigarette Retail Licensure Laws

- While many policies designed to curb youth ENDS use have focused on demand-side approaches — such as using taxes to raise prices faced by consumers — this study explores the impact of a prominent supply-side policy strategy: e-cigarette licensure laws (ELLs)

- Since 2011, 33 states and the District of Columbia have adopted ELLs, which require tobacco sellers to obtain a state license to sell e-cigarettes over the counter (Public Health Law Center, 2023)

- Minimum license fees range from trivial amounts (e.g., $5 in Montana) to more substantial fees (e.g., $800 in Connecticut), and penalties for noncompliance include suspension or revocation of a firm's license to sell e-cigarettes, license, fines up to $25,000, even criminal sanctions

What are ELLs designed to do?

- ELLs are designed to regulate sales, increase compliance with state tobacco regulations (i.e., minimum legal purchasing ages, scanner ID laws), and reduce the supply of e-cigarettes available to local consumers, in particular youth

- ELLs also offer “support” to retailers, with some ELLs encouraging vendors to meet with onsite inspectors to ask questions about selling e-cigarettes and ensuring proper signage

- Many public health advocates see ELLs as a vital anti-vaping policy tool (Tobacco Control Legal Consortium, 2016)
    - In 2018, the U.S. Surgeon General issued an advisory recommending that states and localities adopt ELLs as part of a comprehensive approach to curbing youth vaping (U.S. Surgeon General, 2018)

Datasets

- Main: 2015-2021 State Youth Risk Behavior Survey (State YRBS)
  - State representative surveys of 9th through 12th grade high school students
  - Can be made nationally representative of 14-18-year-olds
  - Information from 2015-2021 on prior-month ENDS use (including number of days of nicotine vaping)
  - Also includes information on combustible cigarette or cigar smoking
  - Supplement analysis using National YRBS

- Auxiliary: 2016-2021 Behavioral Risk Factor Surveillance System Survey (BRFSS)
  - Includes information on ENDS and combustible cigarette use among adults
  - Explore effects for teens ages 18-20 and 21+ (at or above MLPA)

Estimation Strategy

- Begin with TWFE Estimation

$$Y_{ist} = \gamma_0 + \gamma_1 E\,L\,L_{st} + X_{ist}\,\beta + Z_{st}\,\delta + \alpha_s + \Theta_t + \epsilon_{ist}$$

Y_{ist}: ENDS use

$E\,L\,L_{st}$: ENDS licensure law

X_{imt}: Vector of individual demographic controls: gender, age, grade and race dummies

Z_{smt}: Vector of state-level covariates

Macroeconomic conditions & COVID-19: unemployment rate, per capita income, COVID-19 cumulative death rate (experimented with Oxford COVID-19 indexes)

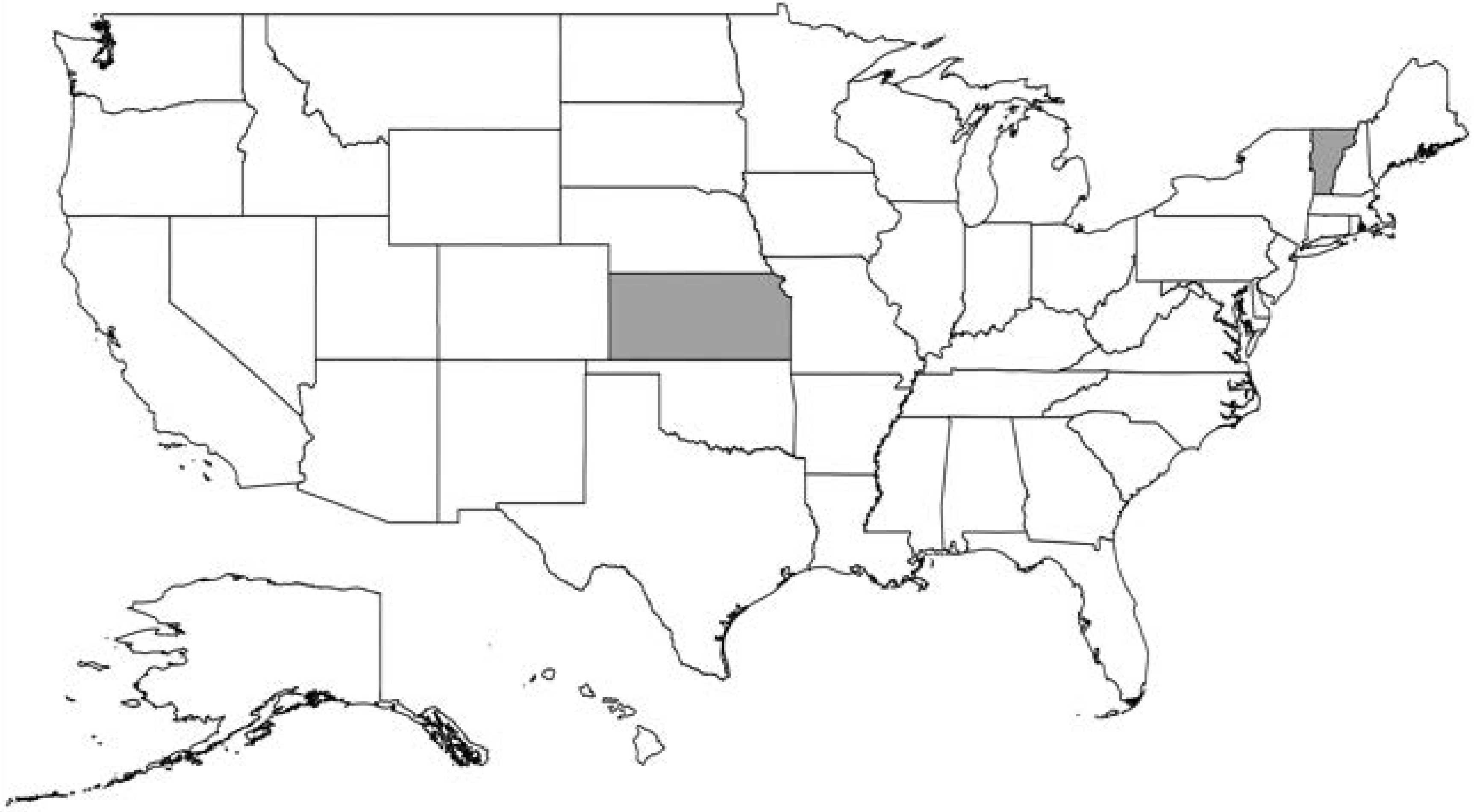
Tobacco policies: Tobacco-21 law, cigarette tax, e-cigarette tax, ENDS MLPA, indoor smoking/ENDS restrictions, combustible tobacco licensure law, ENDS flavor restrictions, menthol cigarette ban, online sales delivery ban

Substance use policies: recreational marijuana law, medical marijuana law, beer tax

2011

ENDS Licensure Laws

2013

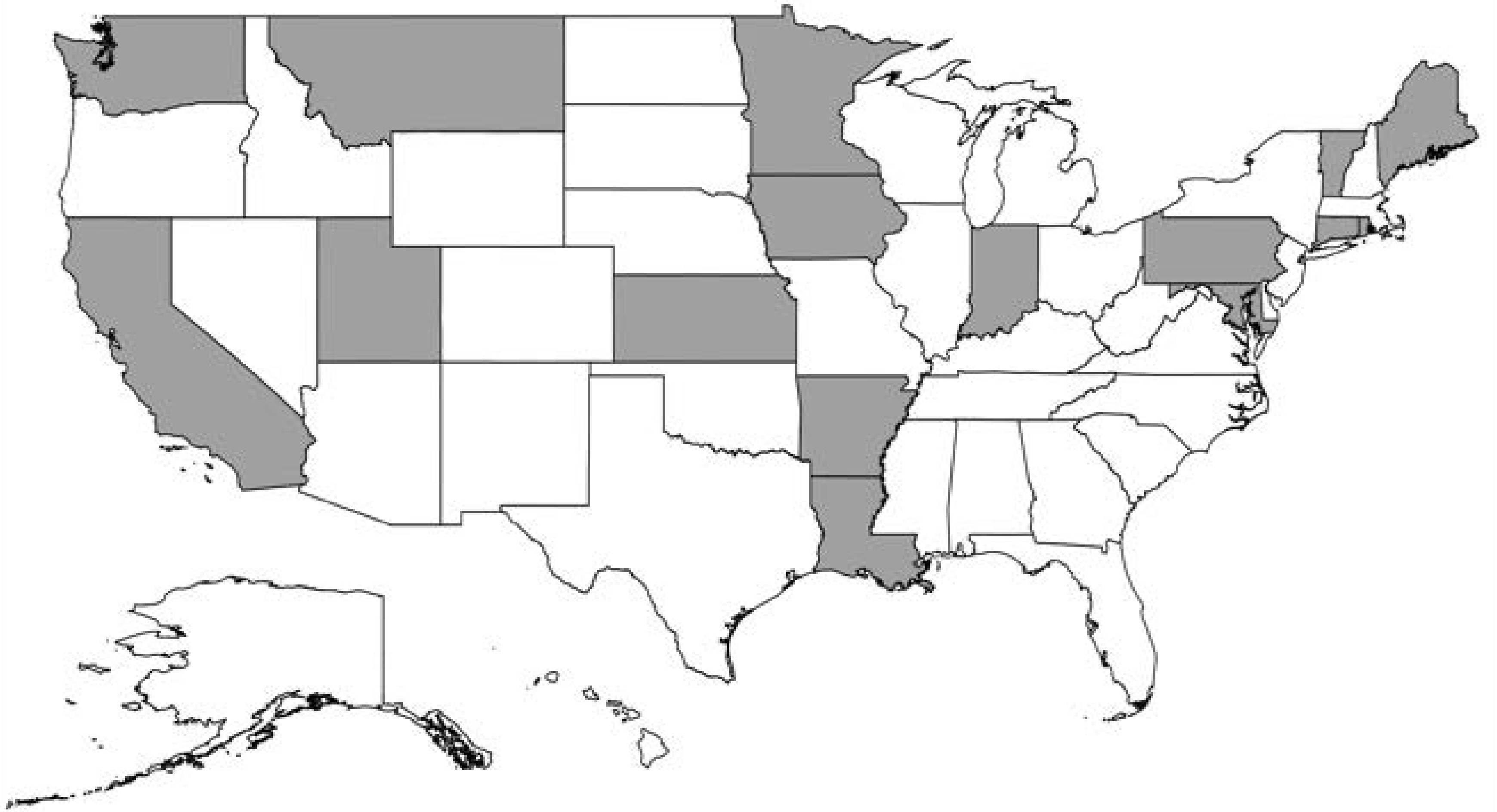


ENDS Licensure Laws

2015

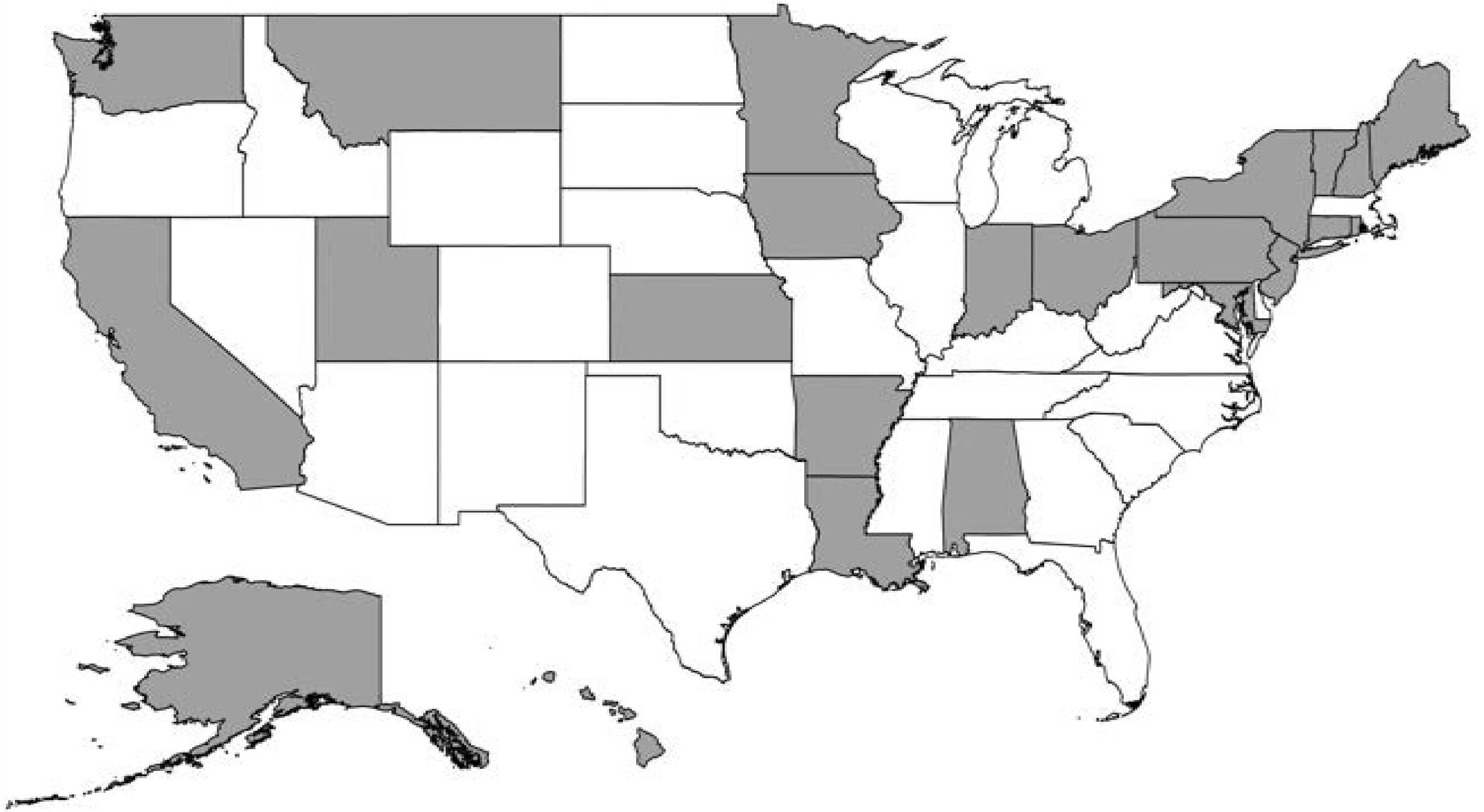
ENDS Licensure Laws

2017



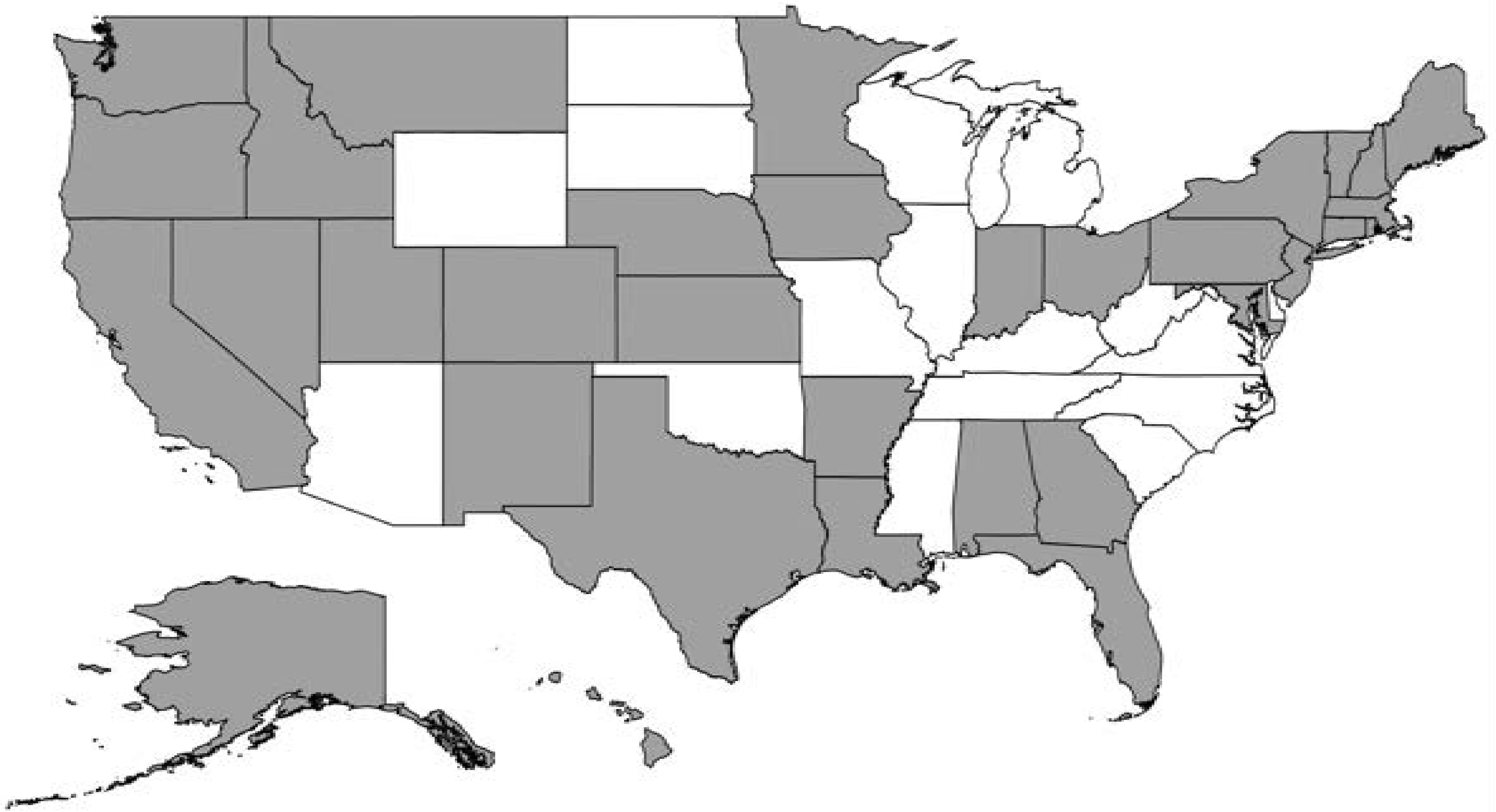
ENDS Licensure Laws

2019



ENDS Licensure Laws

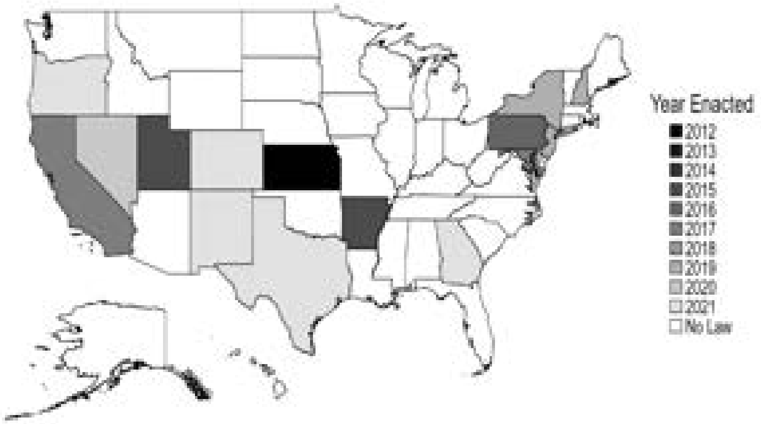
2021



ENDS Licensure Laws

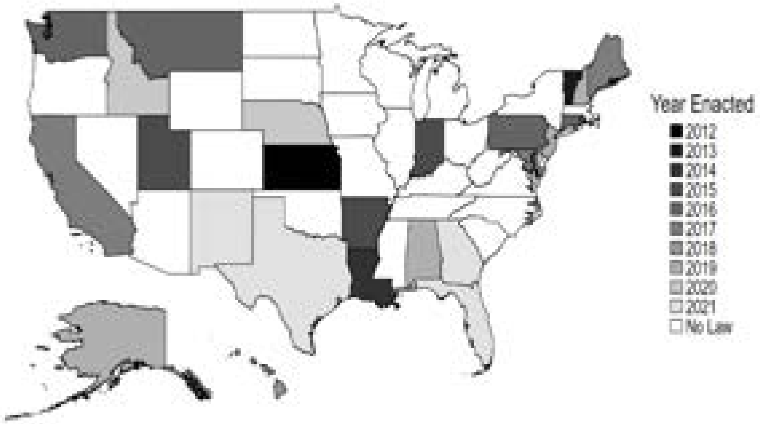
Heterogeneity by Law Intensity

Higher Fines



Higher Renewable Fees

Criminal Penalty



Effects of ENDS Taxes (2021$) on Youth ENDS Use, YRBS

Panel II: Current ENDS Use	.009	.014	.014	.013
	(.011)	(.011)	(.011)	(.010)
Pre-Treat. Mean of DV	*0.198*	*0.198*	*0.198*	*0.198*
Panel II: Frequent ENDS Use	-.001	.002	.008	.007
	(.006)	(.005)	(.005)	(.005)
Pre-Treat. Mean of DV	*0.040*	*0.040*	*0.040*	*0.040*
Panel III: Daily ENDS Use	-.002	.001	.005	.004
	(.004)	(.004)	(.004)	(.004)
Pre-Treat. Mean of DV	*0.028*	*0.028*	*0.028*	*0.028*
N	622122	622122	622122	622122
Controls:				
State and Wave FE & Demographics?	Yes	Yes	Yes	Yes
Region-by-wave FE, Macro & COVID?	No	Yes	Yes	Yes
Tobacco Policy Controls?	No	No	Yes	Yes
Other Substances Policy Controls?	No	No	No	Yes

0 is a number too!

Editorial Statement on Negative Findings

The Editors of the health economics journals named below believe that well-designed, *well-executed empirical studies that address interesting and important problems in health economics, utilize appropriate data in a sound and creative manner, and deploy innovative conceptual and methodological approaches compatible with each journal's distinctive emphasis and scope* have potential scientific and publication merit regardless of whether such studies' empirical findings do or do not reject null hypotheses that may be specified. As such, the Editors wish to articulate clearly that the submission to our journals of studies that meet these standards is encouraged.

We believe that publication of such studies provides properly balanced perspectives on the empirical issues at hand. Moreover, we believe that this should reduce the incentives to engage in two forms of behavior that we feel ought to be discouraged in the spirit of scientific advancement:

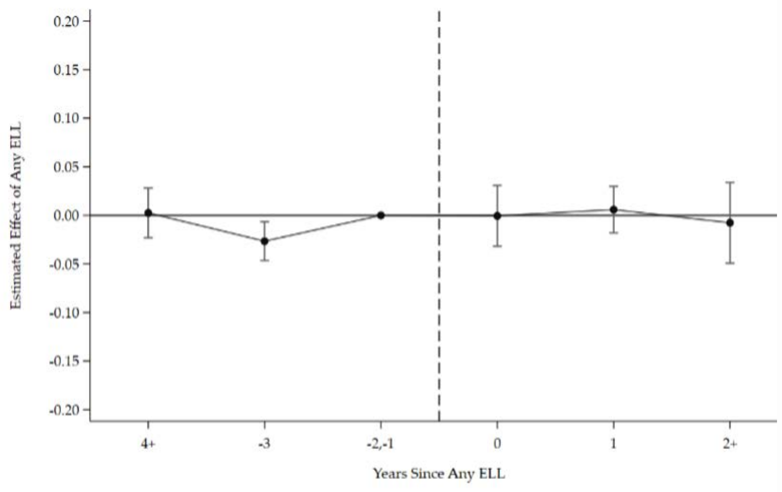
1. Authors withholding from submission such studies that are otherwise meritorious but whose main empirical findings are highly likely "negative" (e.g. null hypotheses not rejected).
2. Authors engaging in "data mining," "specification searching," and other such empirical strategies with the goal of producing results that are ostensibly "positive" (e.g. null hypotheses reported as rejected).

Henceforth we will remind our referees of this editorial philosophy at the time they are invited to review papers. As always, the ultimate responsibility for acceptance or rejection of a submission rests with each journal's Editors.

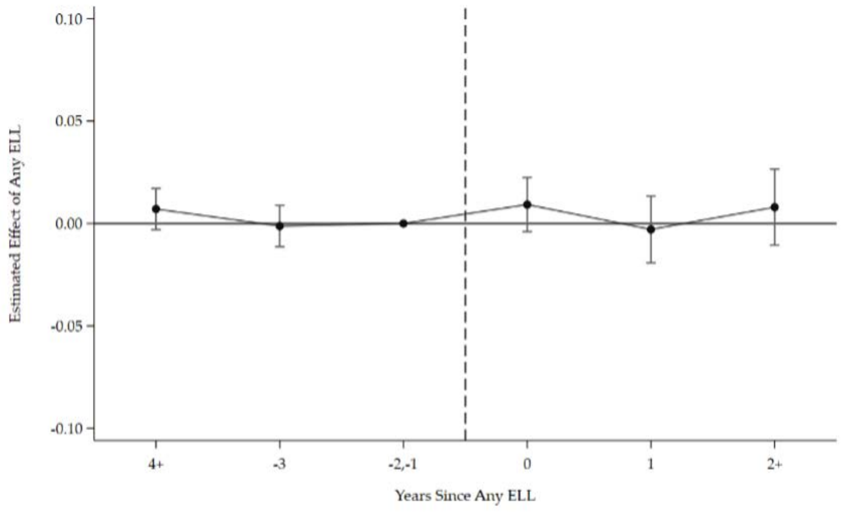
American Journal of Health Economics
European Journal of Health Economics
Forum for Health Economics & Policy
Health Economics Policy and Law
Health Economics Review
Health Economics
International Journal of Health Economics and Management
Journal of Health Economics

Event-Study Analysis, TWFE Estimates

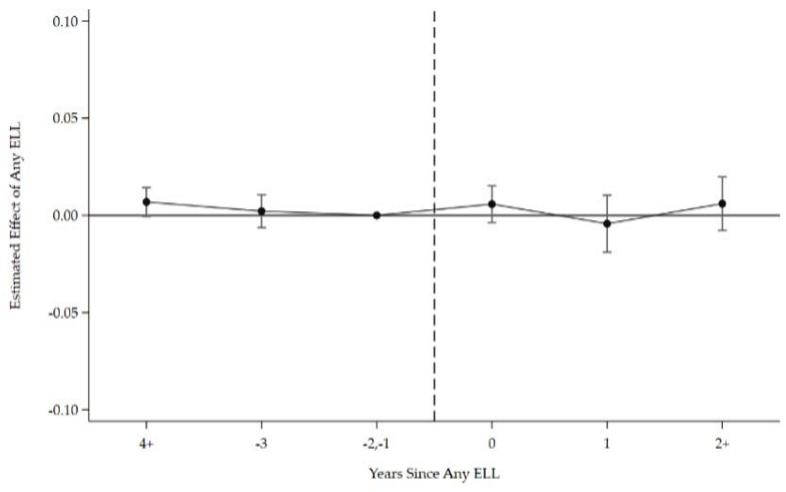
Current ENDS Use



Frequent ENDS Use

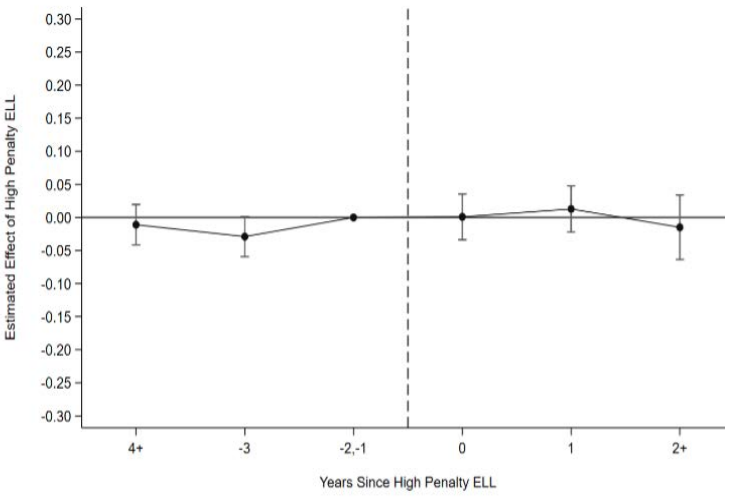


Everyday ENDS Use

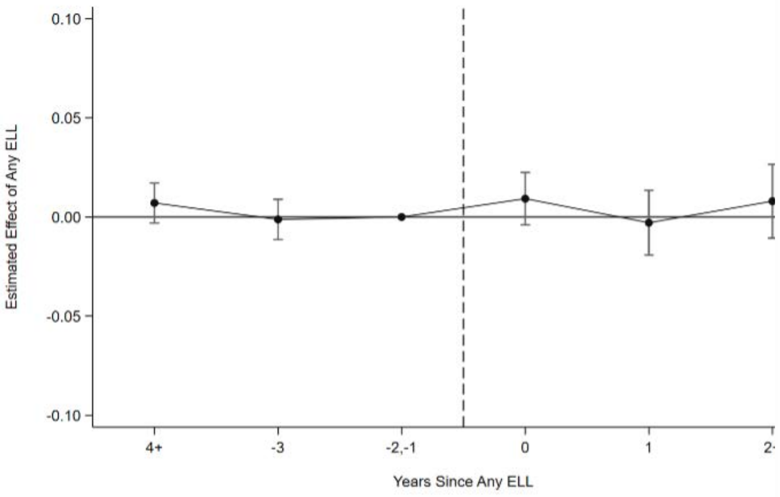


Higher Penalty Licensure Laws

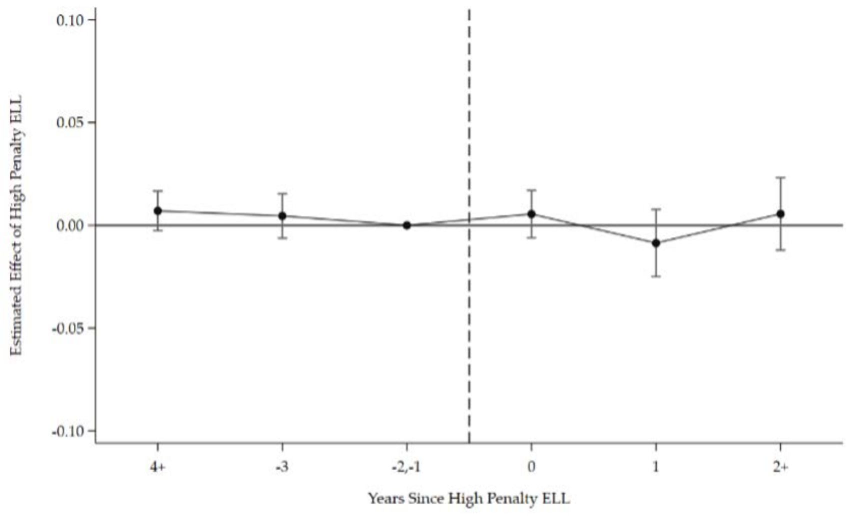
Current ENDS Use



Frequent ENDS Use



Everyday ENDS Use



Auxiliary Findings on Adults (BRFSS)

	(1)	(2)	(3)	(4)
	Aged 18-20	Aged 21+	Aged 18-20	Aged 21+
	Any ENDS Use		Daily ENDS Use	
ELL	.021	-.002	-.005	-.0003
	(.021)	(.002)	(.007)	(.001)
Pre-Treat. Mean of DV	*0.135*	*0.048*	0.043	*0.019*
N	38086	1548893	38086	1548891

American Journal of Health Economics > Volume 9, Number 3

< PREVIOUS ARTICLE

Regression Discontinuity Evidence on the Effectiveness of the Minimum Legal E-cigarette Purchasing Age

Jeff DeSimone, Daniel Grossman, and Nicolas Ziebarth

PDF | PDF PLUS | Abstract | Full Text | Supplemental Material

Abstract

Increases in youth vaping rates and concerns of a new generation of nicotine addicts recently prompted an increase in the federal minimum legal purchase age (MLPA) for tobacco products, including e-cigarettes, to 21 years. This study presents the first regression discontinuity evidence on the effectiveness of e-cigarette MLPA laws. Using data on 12th graders from Monitoring the Future, we obtain robust evidence that federal and state age 18 MLPAs decreased underage e-cigarette use by 15–20 percent and frequent use by 20–40 percent. These findings suggest that the age 21 federal MLPA could meaningfully reduce e-cigarette use among 18- to 20-year-olds.

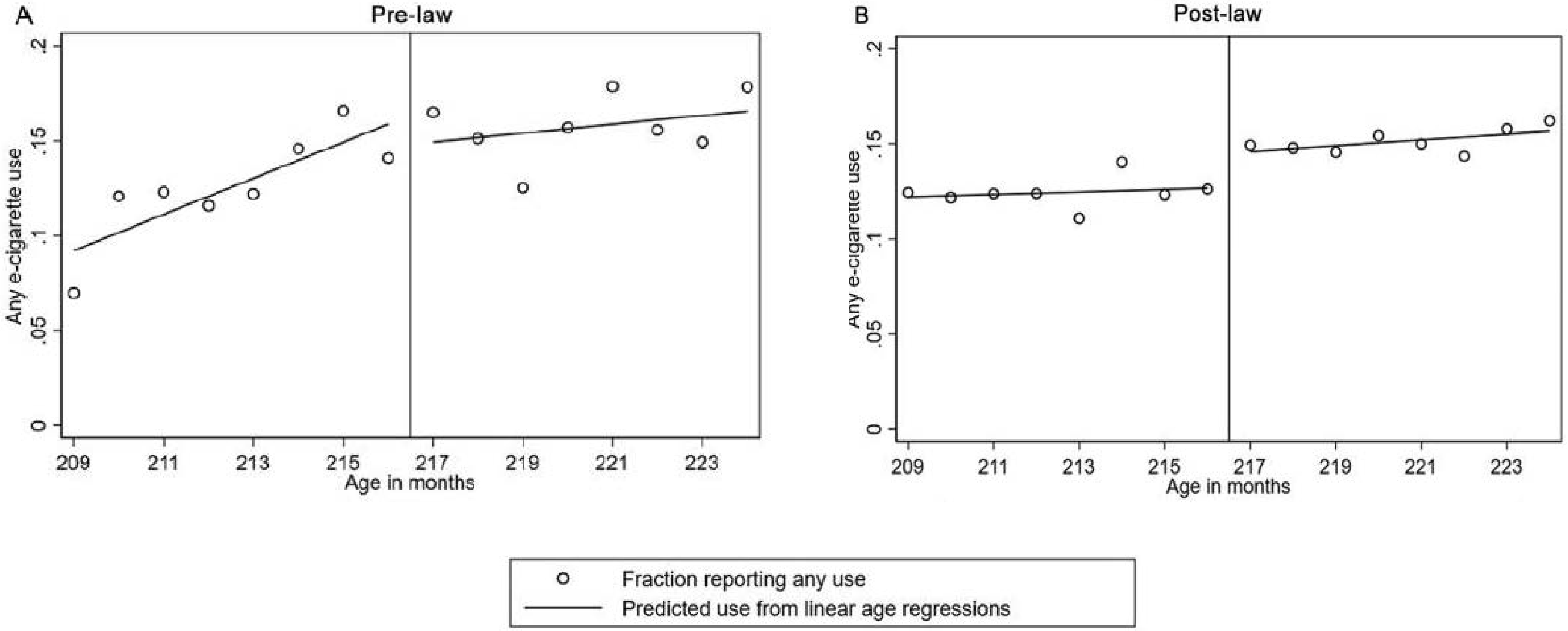
Details | Figures | References | Cited by

American Journal of Health Economics
Volume 9, Number 3
Summer 2023

Identification with RDD

- Continuity of Potential Outcomes
  - In absence of treatment, the estimated treatment effect around the cutoff of the assignment variable would be 0
- Discontinuity in Treatment Assignment
  - Sharp vs Fuzzy RDD
- No Manipulation of Treatment Variable
- Other Covariates Should Trend Smoothly around Assignment Cutoff

Do E-Cigarette MLPA Laws Work?



JAMA Pediatrics

Association of Canada's Provincial Bans on Electronic Cigarette Sales to Minors With Electronic Cigarette Use Among Youths

Hai V. Nguyen, PhD[1]

Author Affiliations | Article Information

RELATED ARTICLES FIGURES SUPPLEMENTAL CONTENT

Key Points

Question To what extent and through what channels did Canada's provincial bans on electronic cigarette (e-cigarette) sales to minors reduce their e-cigarette use?

Findings This quasi-experimental difference-in-differences and triple-differences study found that, between 2013 and 2017, e-cigarette use by youths increased in all provinces but less rapidly in provinces with a ban on e-cigarette sales to minors. Youths in provinces with a ban on e-cigarette sales to minors had better perception of harm from e-cigarette use and greater difficulty obtaining e-cigarettes but also higher use of social sources for e-cigarettes.

Difference-in-difference-in-differences (DiDiD)

- Can add a third difference to DiD models if there is, for instance, a within-state control group

- Studies of MLPA-18 laws could evaluate 15-17-year-olds in a DiD framework
  - Then, can estimate the effect of MLPA-18 laws on 18-25-year-olds

- DiDiD is the difference in DiD for treatment and control ages

- Advantages
  - Nets out incidental vaping trend difference among 18-25-yo in treated vs control states
  - Controls for unmeasured state-specific shocks commonly affecting 15-17- and 18-25-yo

- Identifying Assumptions
  - No youth specific, state shocks correlated with MLPA-18 and youth vaping
  - No reverse causality

Table 1. Dates of Bans on e-Cigarette Sales to Minors Across Canada

Province	Date in Effect	Target Age, y
Nova Scotia	May 31, 2015	19
New Brunswick	July 1, 2015	19
Prince Edward Island	October 1, 2015	19
Quebec	November 26, 2015	18
Ontario	January 1, 2016	19
Newfoundland and Labrador	June 7, 2016	19
British Columbia	September 1, 2016	19
Manitoba	October 1, 2017	18
Alberta	No ban	NA
Saskatchewan	No ban	NA
Canada-wide	May 23, 2018	18

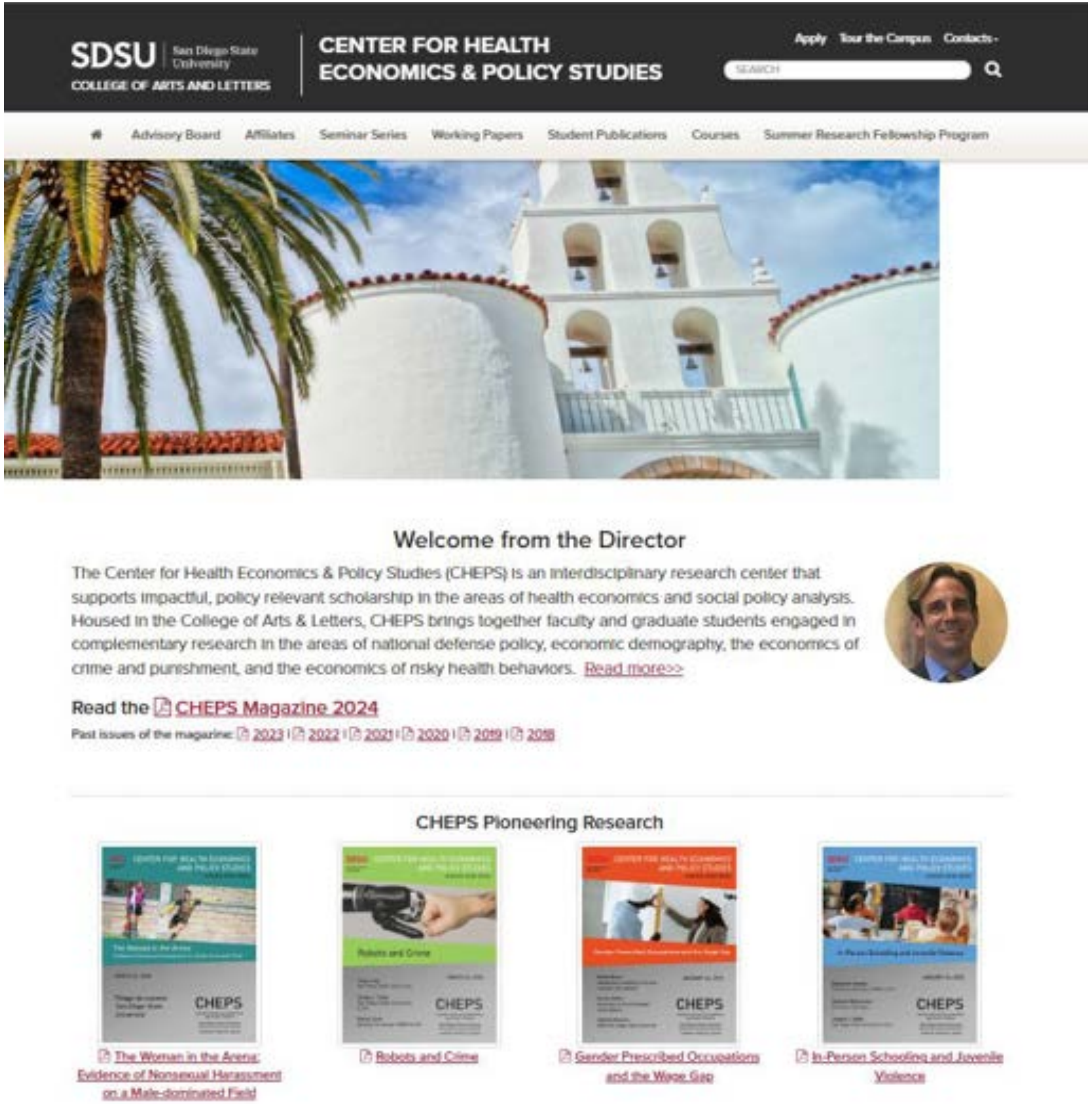
Abbreviations: e-Cigarette, electronic cigarette; NA, not applicable.

Table 4. Changes in Past 30-Day e-Cigarette Use, Use of Social Source, Harm Perception, and Access Difficulty After Ban[a]

Outcome	Percentage Point Change After Ban (95% CI)	*P* Value	Data Source	Study Sample Age, y
Base Case Analysis				
Past 30-d e-cigarette use				
DD (n = 8212)	−4.3 (−6.8 to −1.7)	.004	CTADS 2013-2017	15-17 or 18
DDD (n = 20 934)	−3.1 (−6.0 to −0.2)	.04	CTADS 2013-2017	15-25
Obtain e-cigarettes through social sources: DD (n = 2798)	17.3 (5.2 to 29.4)	.01	CTADS 2017	15-25 (e-cigarette users)
No harm in regular e-cigarette use: DD (n = 78 650)	−2.6 (−3.7 to −1.5)	.001	CSTADS 2014-2017	15-17 or 18
Difficult to access e-cigarettes: DD (n = 74 894)	6.2 (1.1 to 11.4)	.02	CSTADS 2014-2017	15-17 or 18

Conclusions

- In order to (1) evaluate the intended and unintended impacts of public policies, and (2) assess the broader social welfare effects of public policies, credible quasi-experimental design is needed
- In the U.S. and Canada, the most common methods used to estimate the economic impact of e-cigarette regulations are difference-in-differences (DiD) and regression discontinuity design (RDD)
- In a presentation later today from Yang Liang, we will discuss how these and other methods are being and/or can be used in low- and middle-income counties to evaluate impacts of e-cigarette regulations



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jsabia@sdsu.edu

<u>Office Hours:</u>

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5:30PM-6:45PM PT

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