Tobacco 21 Laws, Prenatal Smoking, and Birth Outcomes

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Disclosure Slide

- This work has not received any outside funding.
- I have not received any funding from tobacco-related sources in the past 10 years.

Compare and Contrast with Bersak et al (2025)

- Similarities:
  1. Same data source
  2. Both drop municipal T21 laws
  3. Both drop T19 states
  4. Both drop states missing significant #s of observations
- Differences:
  1. I focus on state laws
  2. I include mothers 18-21 vs 18-20
  3. I include births conceived in 2020
  4. This means more treated states (SUTVA concern)
  5. Model specification
  6. I also look at the strength of various laws
  7. Also look at effects by education
- Findings:
  1. We both find that the effect of T21 on smoking among pregnant mothers is much smaller than among 18-20 year old smokers overall.

Main Findings

- No significant reduction in prenatal smoking
- I can rule out reductions larger than:
  - Extensive margin: 6% reduction
  - Intensive margin: 5% reduction
- No significant reductions even when focusing on:
  - Mothers without a HS degree
  - States with the strictest laws
- No improvements in birth outcomes either

State vs. National T21 Law

- On December 20, 2019, President Trump signed a bill which make T21 the law of the land.
- Not enforceable for 90 days after FDA publishes 'final rule'
- This did not take place until September 30, 2024
- In the meantime, 26 states passed T21 laws despite national law
- There is meaningful variation in state laws
- Unclear whether state vs. national laws matter

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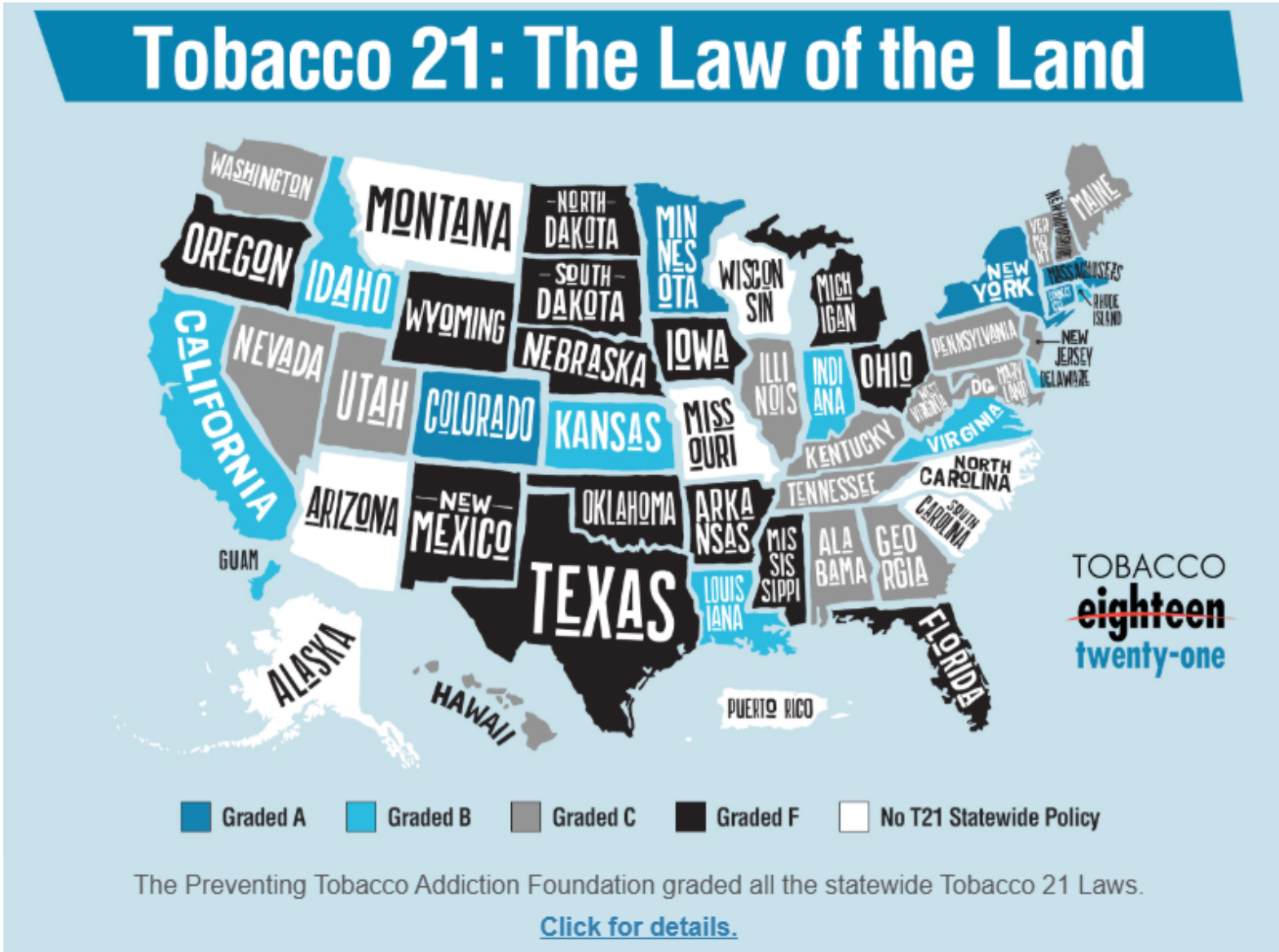
Preventing Tobacco Addiction Foundation Grades



Where do these grades come from?

PTAF website says that a strong T21 law will (non-exhaustive list):

- Include current and future products, including e-cigarettes
- Require retailers to verify age prior to sale
- Require retailers to post signs saying underage sales are prohibited
- Designate an enforcement agency with clear protocol
- Create a retail licensing program
- Dedicate funding to cover enforcement costs
- Provide authority to inspect retailers for compliance
- Providers penalties to the retailers for failure to comply

Effects of T21 Laws

- Studies find T21 laws reduced self-reported smoking in multiple surveys:
  - BRFSS and YRBS (Hansen et al, 2023)
  - MTF (Abouk et al, 2024)
  - PATH (Friedman and Pesko, 2024)
- Still, concerns remain about self-reporting bias
- Abouk et al, 2024 ad Nielsen Scanner data and find large reductions in purchases, concentrated in areas with higher young populations
- Relatively strong evidence overall that T21 laws reduce smoking...

Cotti, DeCicca, and Nesson, 2024

- This paper supplements survey findings with scanner data and analysis of underlying biomarkers from PATH data
  - Confirm other studies findings that T21 laws reduce self-reported smoking
  - Treated non-users who 'age out' of T21 are less likely to initiate smoking
  - Treated smokers get cigarettes by:
    - Having others purchase them
    - Crossing state borders
  - Biomarker evidence is mixed:
    - Find some evidence of reduced nicotine exposure
    - Do not find evidence of reduced tobacco exposure
  - Find that T21 laws cause smokers to self-report *not* smoking
- This paper raises some concerns about how to interpret other self-reported survey findings

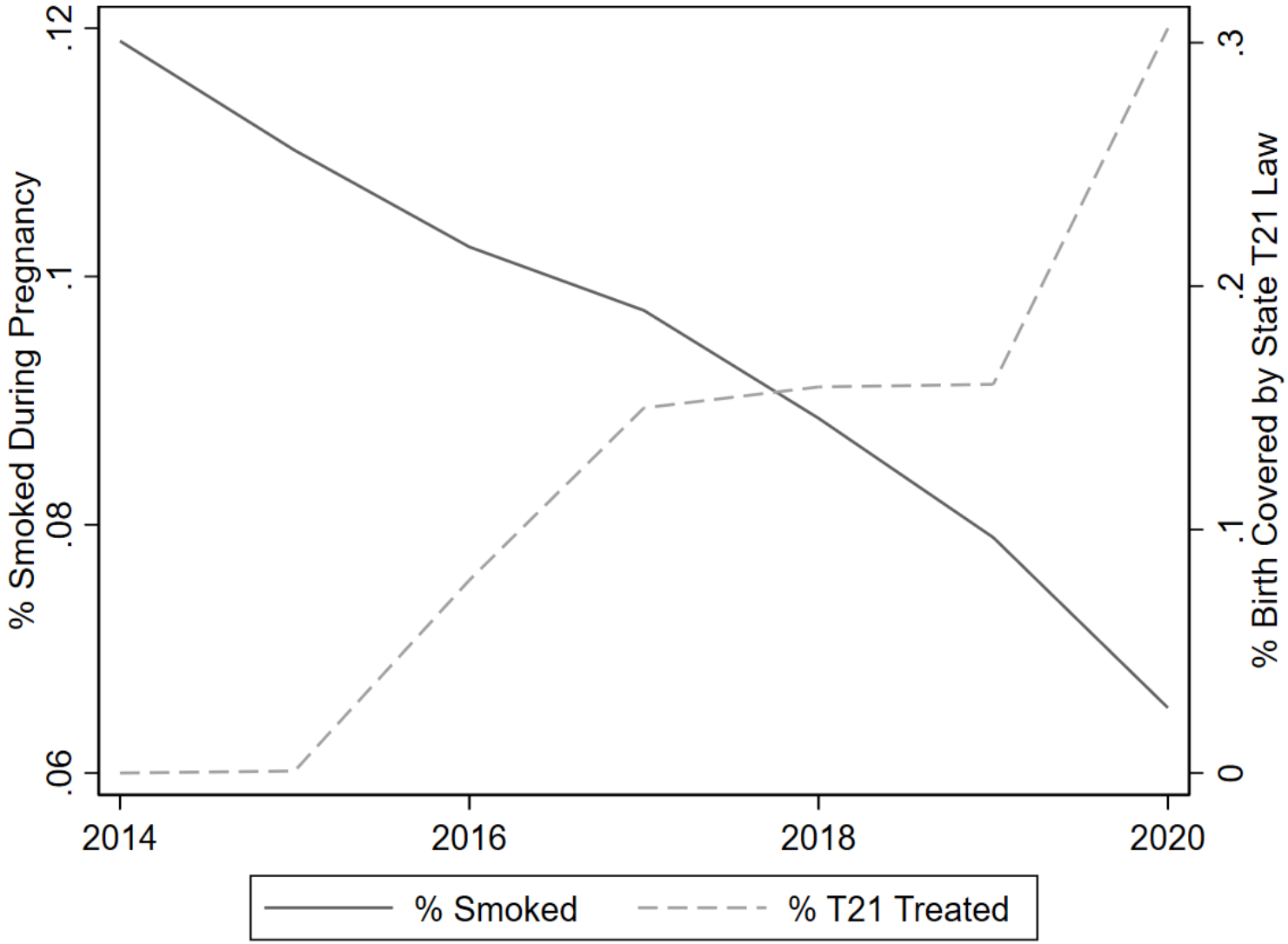
This Paper

- I build on Cotti et al, 2024 by analyzing another setting with both self-reported and biological evidence of smoking
- Birth records include responses about smoking while pregnant
- We also know how prenatal smoking impacts developing fetuses
- Reduced self-reported smoking should also show up in birth weight, gestational length, etc.

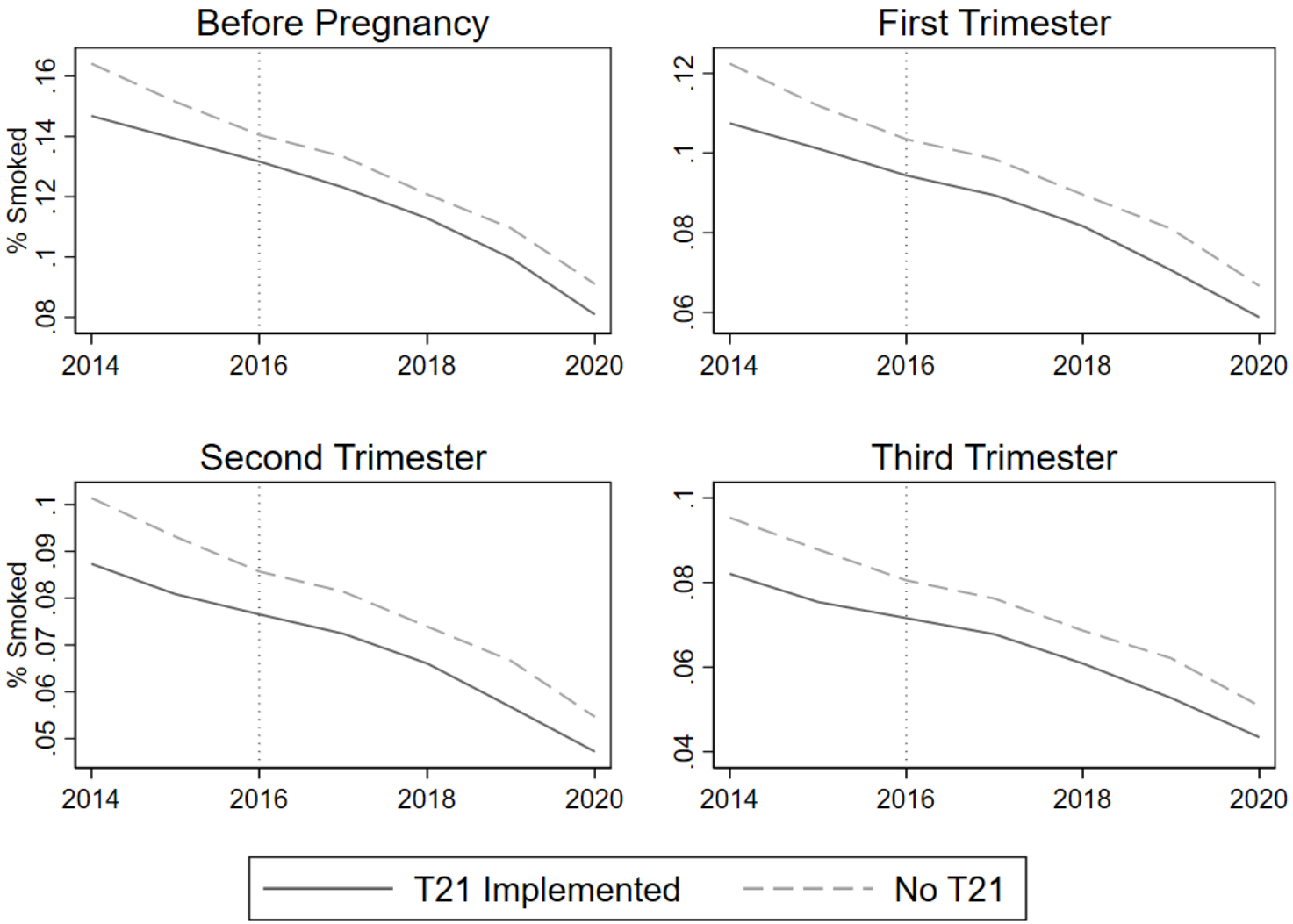
Data

- National Vital Statistics System birth records (2014-2021)
  - Interested in smoking around conception, not birth
  - Use gestational length to calculate month of conception
  - Keep births conceived in 2014-2020 to 18-21 year old mothers
  - Split by maternal education (HS or less)
- Grades from Preventing Tobacco Addiction Foundation
- Combine with tobacco policy controls
  - E-cig MLSA
  - Cigarette excise tax
  - E-cigarette excise tax
  - Indoor smoking ban

Prenatal Smoking and T21 Coverage - 2014-2020



Prenatal Smoking in T21 vs. non-T21 States - 2014-2020



▸▸ # of Cigs

Empirical Strategy

Both of my empirical strategies are versions of the basic DiD setup:

$$Smoking_{sq} = \hat{\beta}_{did} * Treat_{sq} + \delta_s + \gamma_q \quad (1)$$

- $Smoking_{sq}$ gives the rate of smoking among mothers in state s who conceived in quarter q
- $Treat_{sq}$ indicates that state s had a T21 law in effect during quarter q
- δ_s and γ_q are state and quarter fixed effects respectively

Empirical Strategy

My main empirical strategy estimates Synthetic Difference-in-Differences approach of Arkhangelsky et al (2021):

- Creates a weighted average of all possible control states
- Unit weights - match on pre-treated outcome
- Time weights - emphasizes pre-treatment periods that are most predictive of the posttreatment outcome (minimizes outliers)
- Returns single DiD coefficient that is a combination of individual 2x2s
- Benefits - more appropriate counterfactual
- Drawback - state-level observations mean states are weighted equally (CA=VT)

Alternative approach

I also implement the 'Stacked DiD' approach of Cengiz et al (2019):

$$Smoking_{icqs} = \hat{\beta}_{did} * Treat_{cqs} + \delta_{cs} + \gamma_{qs} \quad (2)$$

- Creates a separate dataset or 'stack' for each treatment period using individual observations
- This allows me to estimate at the county-level
- Each stack includes five quarters before implementation and six after
- Reference quarter is the quarter prior to implementation
- Each stack includes treated unit and 'clean' controls
- Stacks are appended on top of each other and estimated using county-stack and quarter-stack FEs
- Also estimate this in event-study form

SDID Results - Rate of Smoking

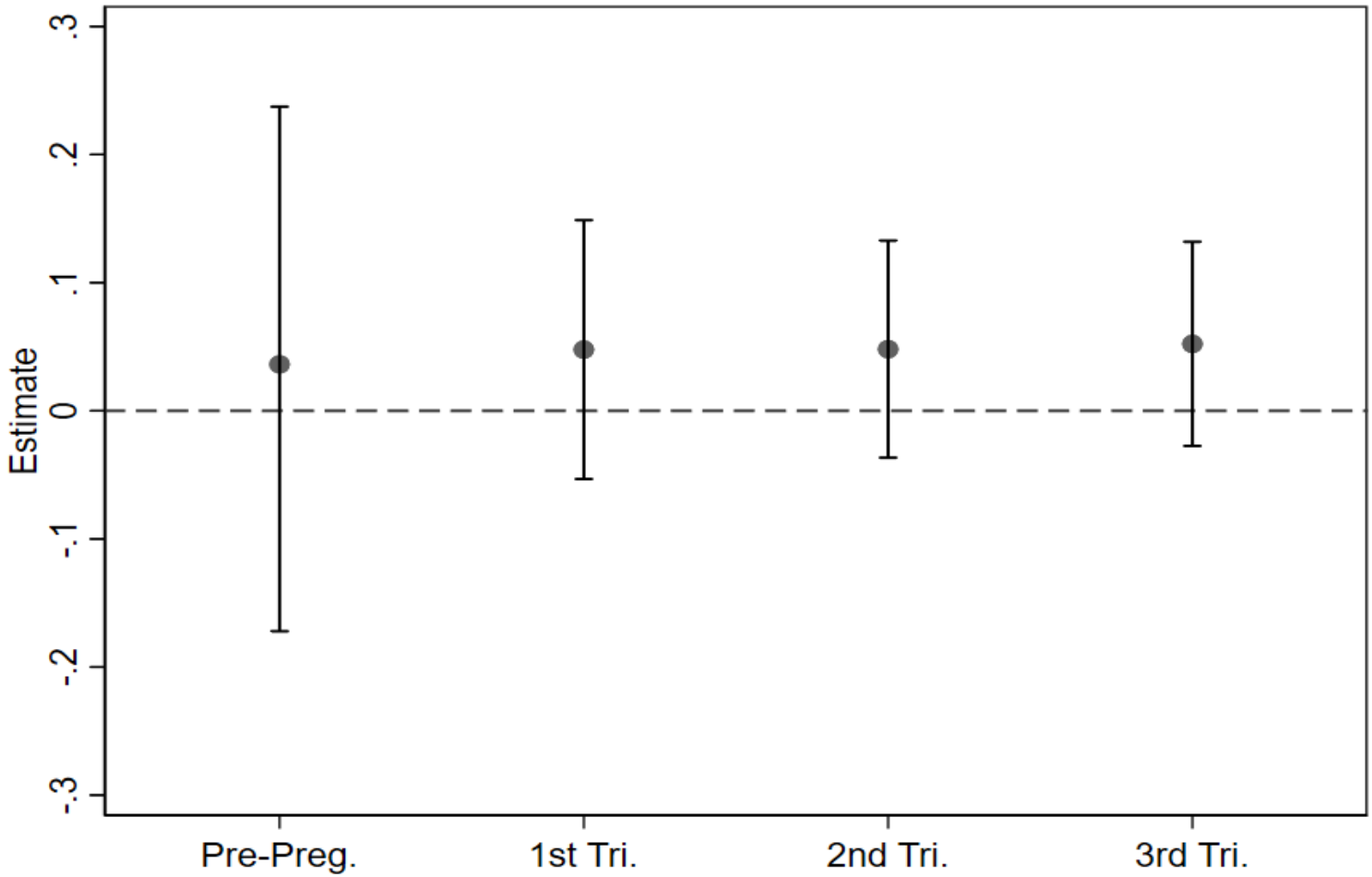
Table 1 — Synthetic Difference-in-Differences Estimates of the Effect of Tobacco 21 Laws on Prenatal Smoking During Various Stages of Pregnancy for 18-21 Year Old Mothers, 2014-2020

	(1) Pre-Preg.	(2) 1st Tri.	(3) 2nd Tri.	(4) 3rd Tri.	(5) # of Tris
Treat x Post	0.00325	0.00437	0.00361	0.00328	0.00993
	(0.00626)	(0.00409)	(0.00416)	(0.00439)	(0.0110)
Base Rate (2014)	14.9%	10.9%	8.8%	8.3%	.280
% Change	2.2%	4.0%	4.1%	3.9%	3.5%
Observations	1,064	1,064	1,064	1,064	1,064

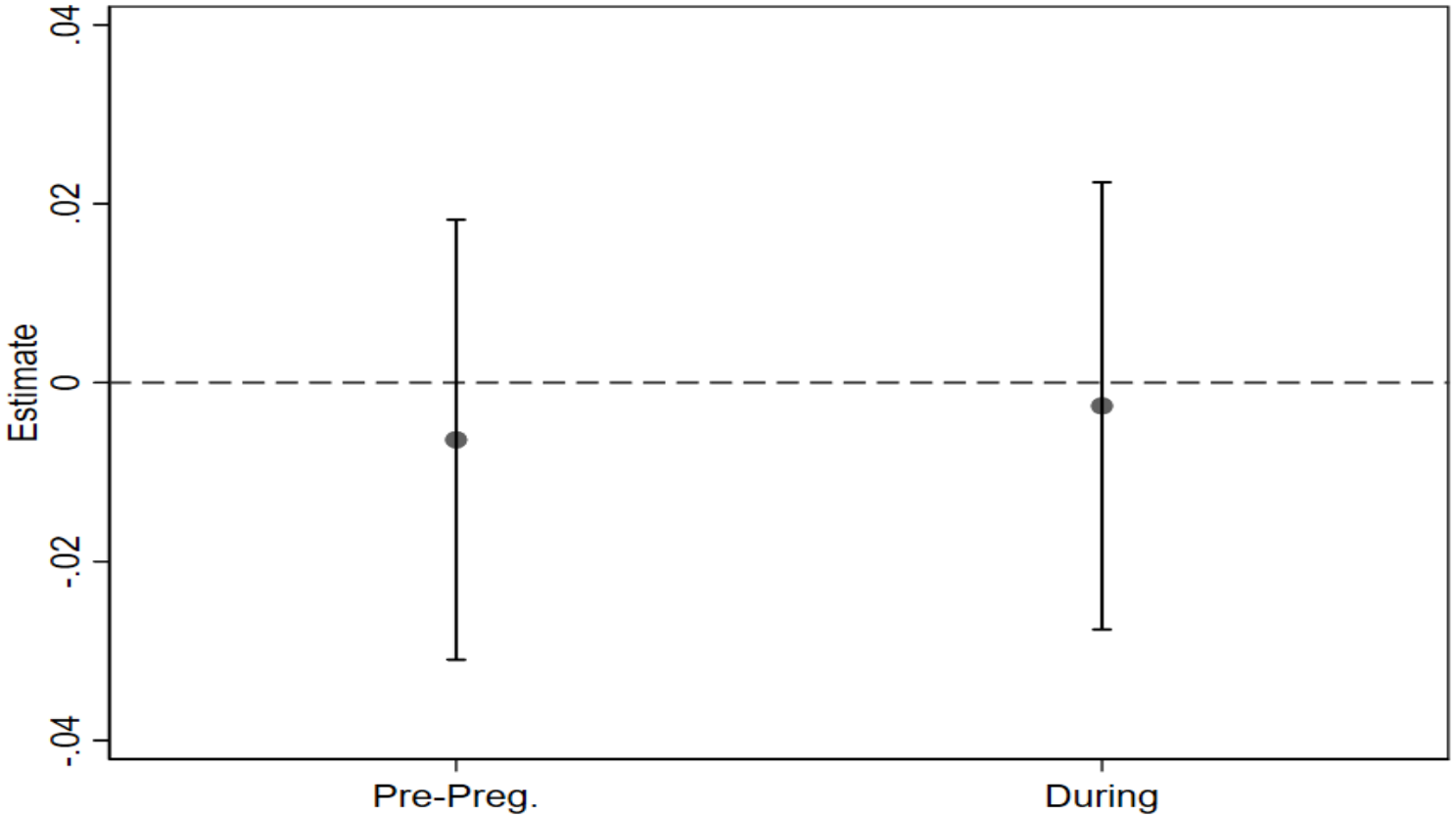
Note: This table displays synthetic difference-in-differences estimates of the effect of Tobacco 21 laws on smoking behavior of pregnant women between the ages of 18 and 21, before and during their pregnancy. The first column estimates the effect of these laws on the percent of births which occur to a mother who smoked prior to pregnancy, while the second through fourth columns iteratively estimate the effect on percent of births to a mother who smoked in the first, second, and third trimesters, respectively. The fifth column estimates the effect on the total number of trimesters in which mothers smoke any cigarettes. $^{*}\ p < .05$, $^{**}\ p < .01$, $^{***}\ p < .001$.

▸▸ SDID Graph ▸▸ Coef Plot

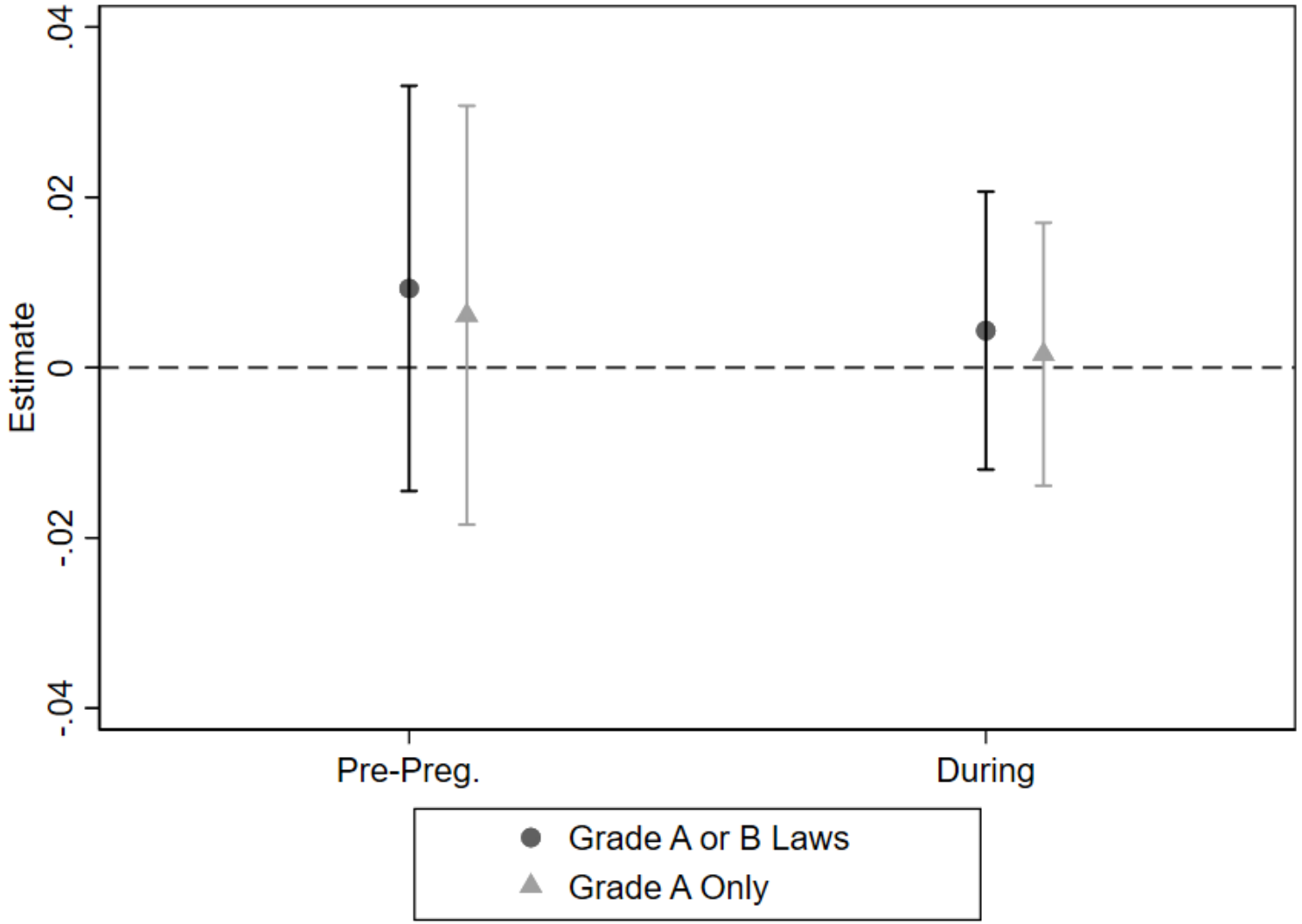
SDID Results - Number of Daily Cigarettes



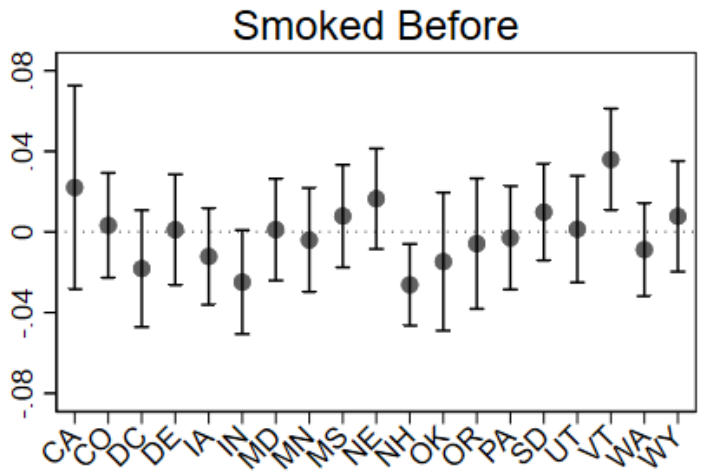
SDID Results - Only Non-HS Grads

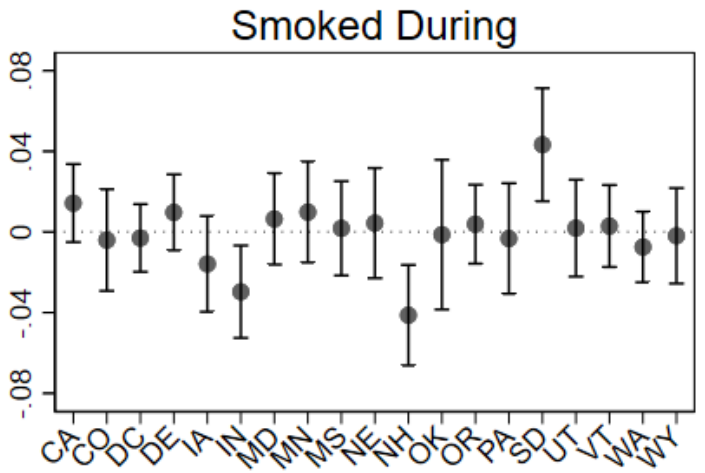


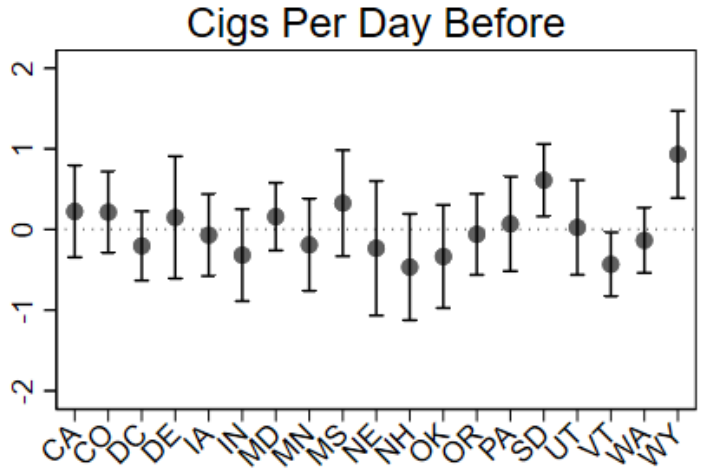
SDID Results - Only Stronger Laws

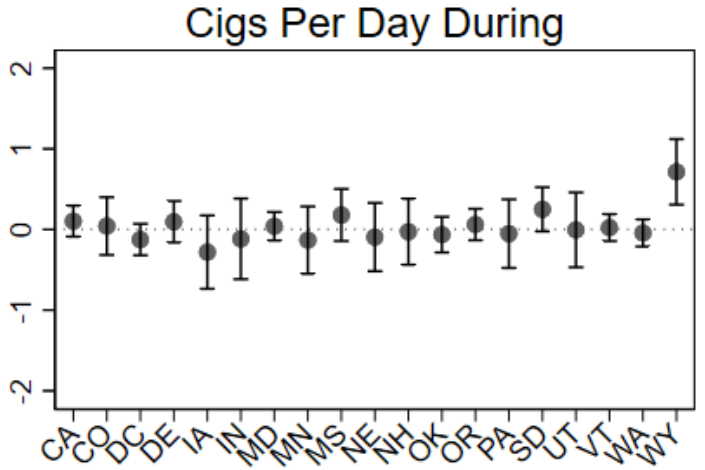


SDID Results - Individual State SDID Coefficients

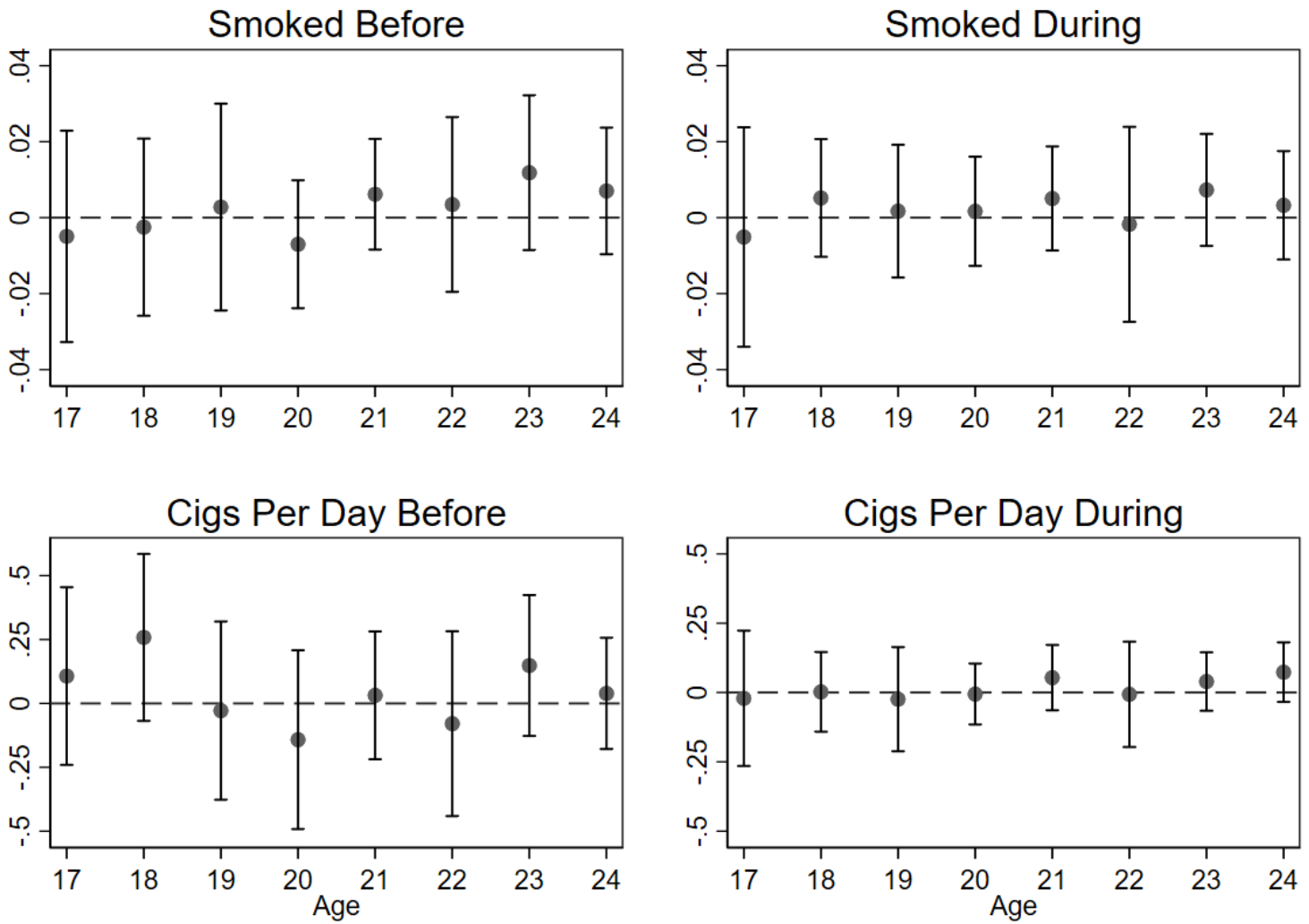








SDID Results - Single Year of Age



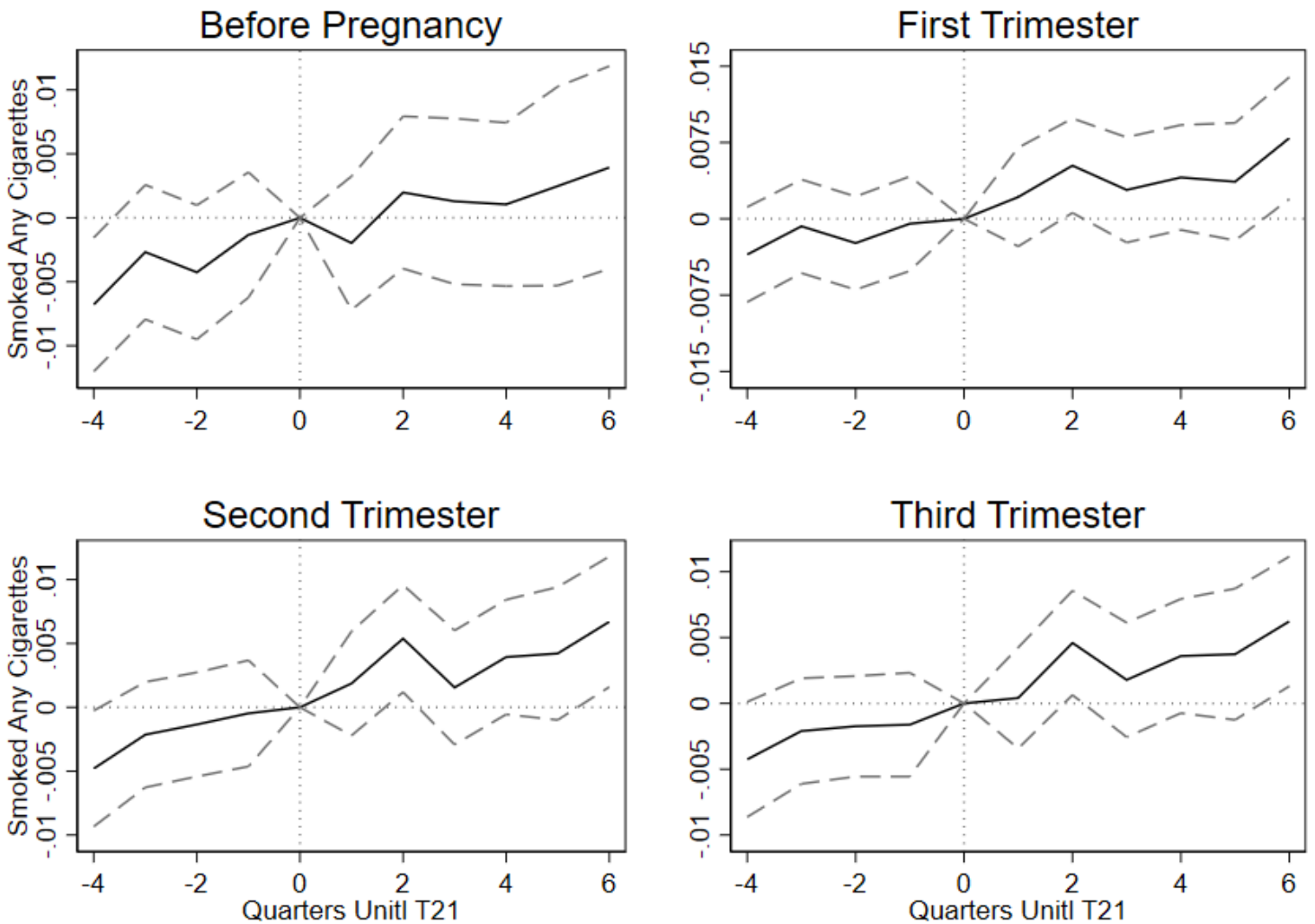
SDID Results - Birth Outcomes

Table 3 — Synthetic Difference-in-Differences Estimates of the Effect of Tobacco 21 Laws on Smoking Behavior of 18-21 Year Non-High School Graduate Mothers, 2014-2020

	(1) Birthweight	(2) Low BW	(3) Gestation	(4) Preterm
Treat x Post	4.009	-0.000704	-0.00518	0.00179
	(5.813)	(0.00330)	(0.0225)	(0.00318)
Baseline Rate (2014)	3,211	8.33%	38.62	8.95%
Percentage Change	0.1%	0.8%	0.00%	2.0%
Observations	1,064	1,064	1,064	1,064

Note: This table displays synthetic difference-in-differences estimates of the effect of Tobacco 21 laws on birth outcomes to women between the ages of 18 and 21, before and during their pregnancy. The first columns estimate the effect of these laws on whether the mother smoked at all before and during pregnancy, while the third and fourth columns iteratively estimate the effect on average daily cigarette consumption before and during pregnancy. $^{*}\ p < .05$, $^{**}\ p < .01$, $^{***}\ p < .001$.

Stacked Event-Study



Robustness

Results are qualitatively unchanged if I:

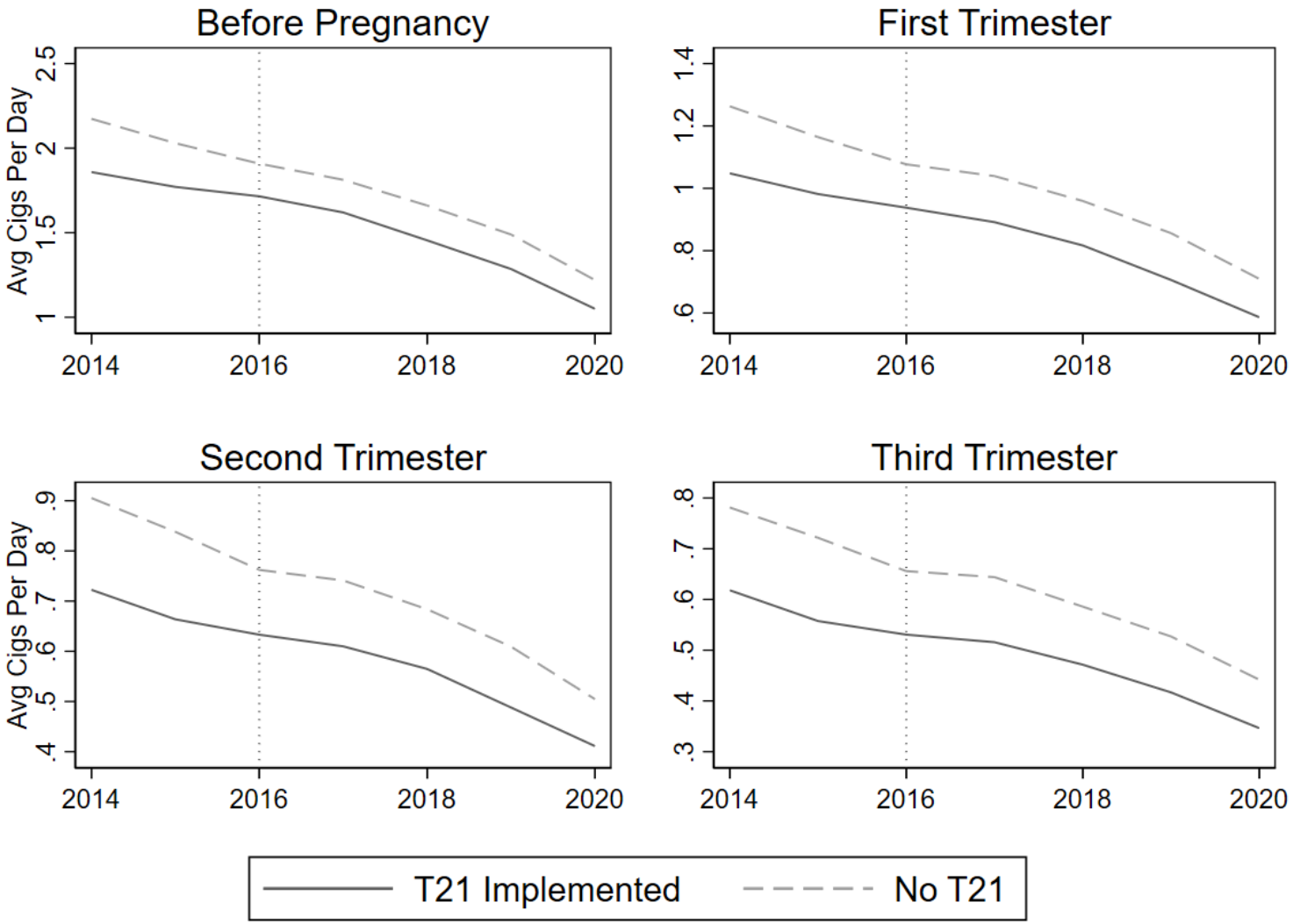
- Drop California (misspecified as rate or LPM)
- Restrict to pre-2020 data (loses precision)
- Change DV to log-odds (becomes positive)

I was able to basically replicate the other paper's findings

Conclusion

- CA law does appear to have impacted prenatal smoking, subsequent laws do not appear to have had as much impact
- Partially attributable to noise from national law in 12/2019
- Other state laws not able to be assessed for multiple years
- Still, even in California, effect is *much* smaller than reduction in self-reported smoking from other sources
- Open research question - following 2019, do individual state law matter for consumption in other data sources?

Daily Cigarettes in T21 vs. non-T21 States - 2014-2020



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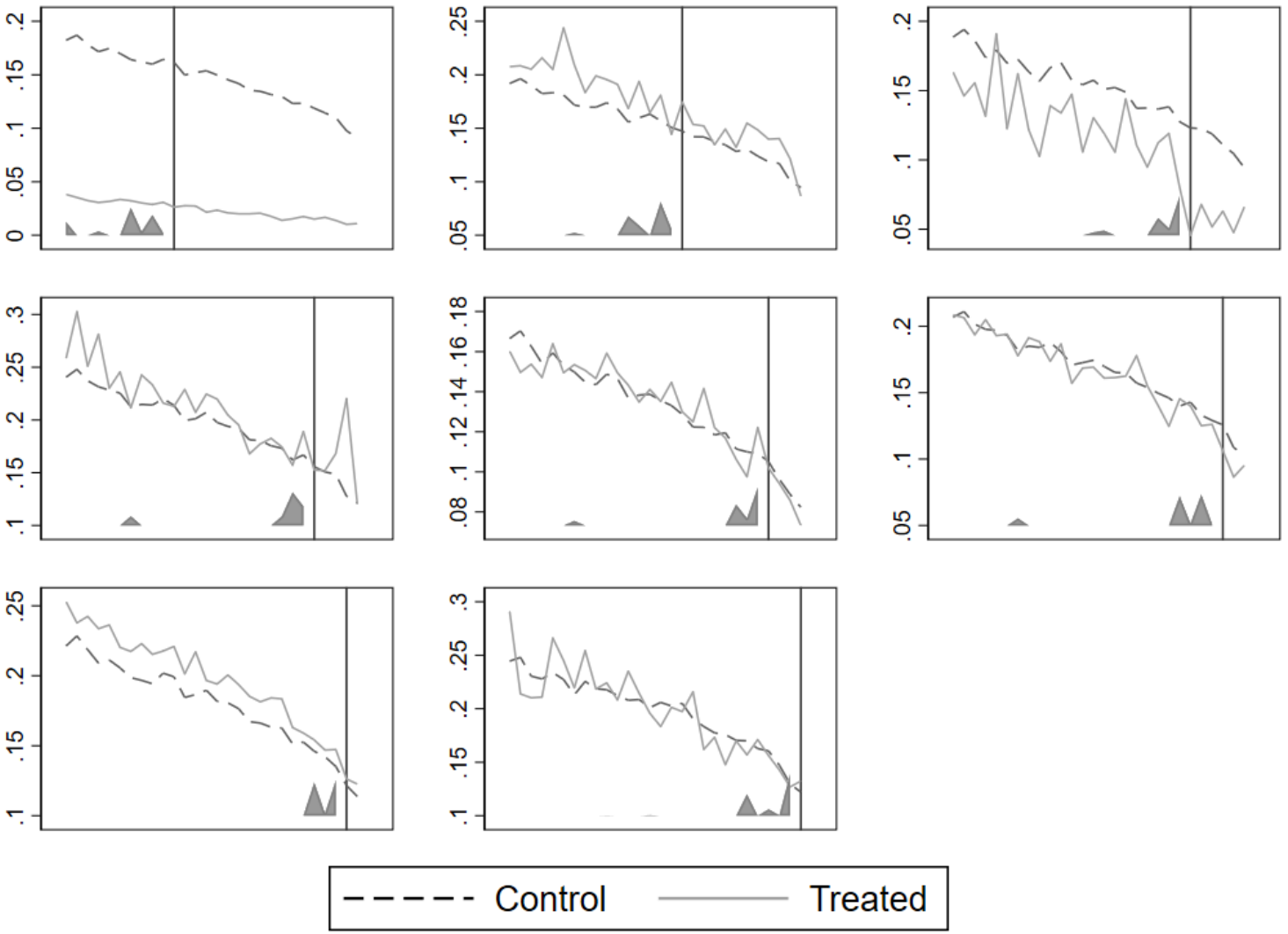
SDID Graphs - Rate of Smoking Prior to Pregnancy



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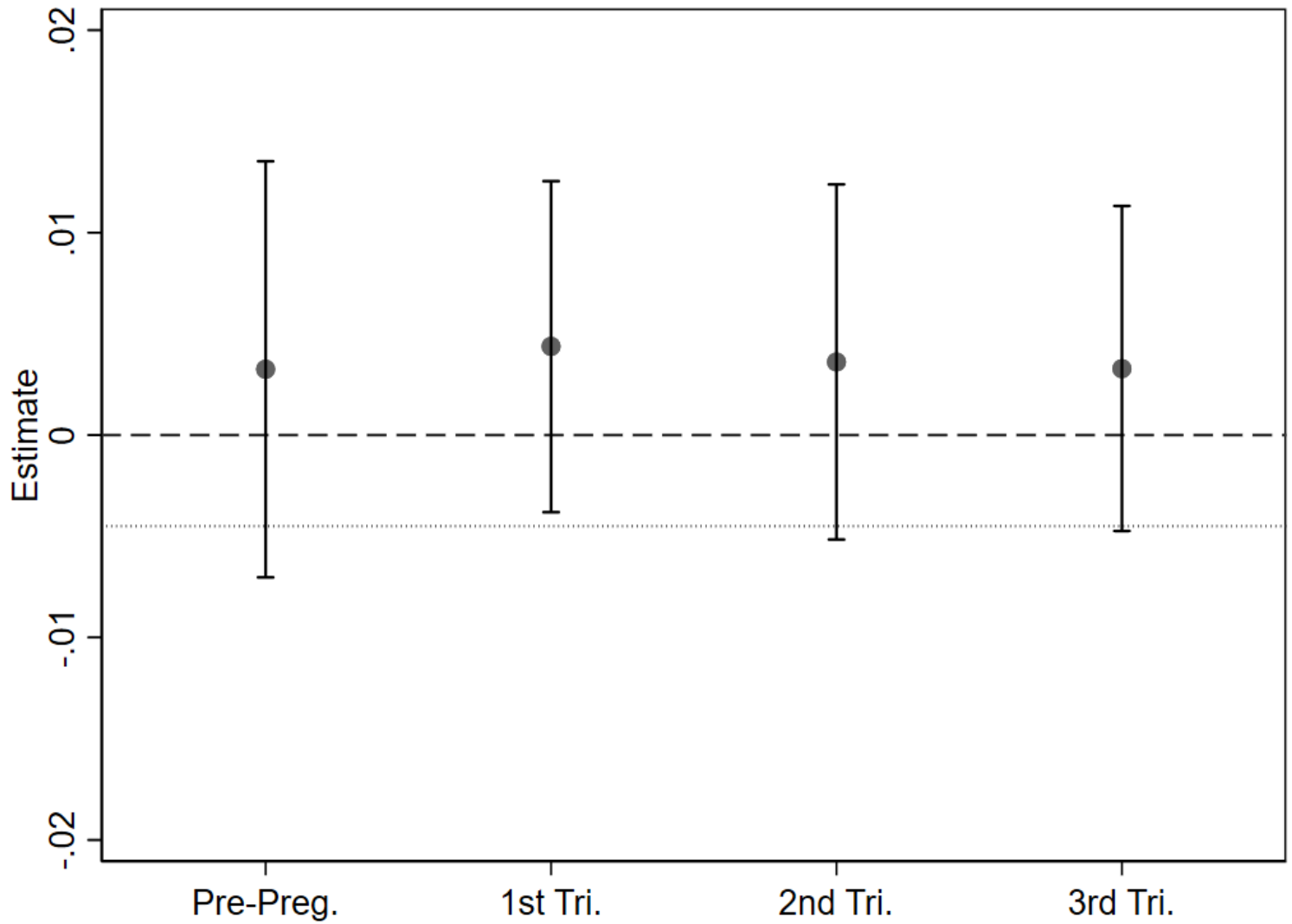
SDID Coefficients - Rate of Smoking Prior to Pregnancy



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