Alcohol, Pregnancy, and Health Outcomes

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November 2024†

Abstract

Alcohol negatively impacts health outcomes at every stage of pregnancy, from conception timing to childhood development. Fetal alcohol spectrum disorder alone is estimated to cost $1.29-10 billion annually in the U.S. Despite this, few public policies have been shown to affect alcohol consumption by women of reproductive age. In this study, I explore two policies endorsed by public health authorities, state-level alcohol excise taxes and laws mandating the placement of signs at the point-of-sale warning of the dangers of drinking during pregnancy. I study these policies across six data sources covering thirty years, using contemporary difference-in-difference methods. I also use a novel approach for standardizing alcohol taxes that vary across different products and in their administration. Contrary to earlier research, I find that neither policy leads to significant changes in drinking behavior or fetal health outcomes.

JEL Classifications: I12, I18, J13, J18

Keywords: Alcohol, Pregnancy, FASD, Excise Tax, PRAMS

*I wish to thank Carlos Dobkin, Lauren Hoehn-Velasco, Ian Jung, James Marton, Michael Pesko, Sam Sturm, and Keith Teltser for their assistance and suggestions. I also thank the seminar audiences at GSU for their feedback and comments. In addition, I thank the PRAMS Working Group, which includes the PRAMS Team, Division of Reproductive Health, CDC and the state PRAMS sites for their role in conducting PRAMS surveillance and allowing the use of their data.

†The most recent version of this document can be found at: https://rbhebert.github.io/files/hebert_jmp.pdf

1 Introduction

In 2014 the Centers for Disease Control (CDC) released guidance indicating: "The best choice is not to drink alcohol at all when you are pregnant or trying to get pregnant" (National Center on Birth Defects and Developmental Disabilities (CDC), 2014). This restrictive suggestion from a major health authority generated controversy among the public, but its message was evidentially well-founded (Seiler, 2016). Alcohol consumption negatively impacts a broad set of pregnancy-related health outcomes. First, impaired judgement can lead to unintended pregnancy, which may impact abortion rates and related abortion access concerns (Naimi et al., 2003). Second, women may experience a higher rate of spontaneous abortion early in the pregnancy (typically prior to the 20th week) (Kline et al., 1980; Andersen et al., 2012). Third, alcohol use can increase the rate of stillbirth, defined as occurring past the 20th week. Fourth, alcohol use leads to fetal alcohol spectrum disorder (FASD) and associated conditions, which can impact child development in terms of behavior and cognition later in life (von Hinke Kessler Scholder et al., 2014; Mamluk et al., 2017; May et al., 2021). Critically, all of these outcomes are irreversible, and so the consequences are permanent for the women and children involved.

Alcohol use among reproductive aged women in the United States has changed significantly over the last 30 years. Rates of alcohol use and binge drinking in men and women have been converging as women increase alcohol consumption, with the highest levels of drinking found among women 21-25 years of age who already have a high incidence of unintended pregnancy (White et al., 2015; Slater and Haughwout, 2017). While drinking at any stage of pregnancy has potential negative effects on fetal development; one of the most critical periods is during the first trimester, 6-8 weeks of which will pass while the women in question do not even know they are pregnant (Gosdin et al., 2022). With costs from FASD estimated to be between \$1.29-10 billion in the U.S. annually, rising alcohol consumption among women of reproductive age should be of great concern to policymakers (Greenmyer et al., 2020).

However, few policies have been shown to impact drinking rates among women of reproductive age. Alcohol taxes are one possibility; Wagenaar et al. (2009) provides a meta-analysis of studies on alcohol excise taxes, prices, and consumption, finding a robust inverse relationship between excise taxes and alcohol consumption.[1] Zhang (2010) has examined responses to alcohol taxation among pregnant women, finding significant reduction in binge drinking rates as well as a decreased incidence of low birth weight.[2]

A second policy with the potential to change drinking behavior is warning signs concerning the dangers of alcohol use during pregnancy, typically posted at the point of sale (henceforth referred to as "warning signs").[3] About half of U.S. states now have such policies, the most recent adopter being Arkansas in 2019. From these policies, Cil (2017) finds a 35% decrease in any alcohol use and a 75% decrease in binge drinking by pregnant women, as well as 3.8% decrease in very low birth weight incidence.

This study aims to determine how these two policies, alcohol taxes and warning signs, impact the full range of potential health effects in the context of pregnancy, from unintended pregnancy and abortion to evidence of FASD in childhood. To do this, I consider outcomes across more than thirty years of data from six sources, and employ difference-in-difference methodologies that are designed to account for staggered adoption, potential dynamic effects, and continuous treatment (in the case of alcohol taxes). Further, I employ a novel

[1] A more recent meta-analysis of studies on alcohol taxation and control policies found that, broadly, alcohol taxes and minimum unit price policies do reduce alcohol consumption substantially (Kilian et al., 2023).

[2] Specifically, Zhang (2010) finds a 1 cent increase in beer tax (about 0.1 cents per standard drink) leads to a decrease in low birth weight incidence by 1-2%, while binge drinking among pregnant women decreases by 3pp (1.5pp) with a 1 cent increase in beer (wine) taxes.

[3] See figure 3 for an example.

approach to excise taxes as a source of policy variation by creating a composite alcohol tax measure.

This study makes novel contributions to the literature in the areas of women's health and pregnancy, alcohol policy, externalities from alcohol use, and intergenerational externalities. By considering outcomes beyond self-reported drinking and natality data, I provide a more reliable estimate of the potential effectiveness of these policy interventions. Moreover, this allows me to confront the issue of endogenous misreporting of alcohol use by considering outcomes well into childhood; a significant effect should appear consistently rather than sporadically. My results indicate that neither policy leads to effective reduction of alcohol use among women of reproductive age or improvement in health outcomes concerning pregnancy, contrary to prior literature.

2 Background

Alcohol use during pregnancy, including binge drinking, is common across the world, in both developed and developing nations (Lange et al., 2017). Through the twentieth century, this was rarely considered an issue for fetal development; it was not until 1977 that the U.S. Department of Health, Education, and Welfare (later Department of Health and Human Services) issued a health advisory indicating that pregnant women should limit themselves to two drinks per day (Warren, 2015). In the years following, medical research conclusively demonstrated the risks of fetal alcohol spectrum disorders (FASD) and pushed for labeling changes to warn women of the dangers of drinking during pregnancy (Sokol et al., 2003). The warning label requirement was passed in 1988.[4] It was not until 2005, though, that the U.S. Surgeon General officially warned

[4]For an extended review of the history of attitudes concerning alcohol use during pregnancy, see Warren (2015).

Americans that any alcohol use by women pregnant or seeking to become pregnant was dangerous, and that therefore abstinence from alcohol was the optimal choice for fetal health (Carmona, 2005). Contemporary research supports the conclusion that even small amounts of prenatal alcohol use can potentially have negative impacts on health, and that prenatal alcohol use is the leading preventable cause of birth defects in the U.S. (Williams et al., 2015; Mamluk et al., 2017, 2021).

The recommendation to abstain from alcohol is part of a trend of increasing expectations on mothers following advances in the understanding of disease and infant mortality. In the early twentieth century, as awareness rose concerning hygiene and preventable childhood disease, cultural attitudes may have led to a shifting of blame for poor child health and mortality from amorphous factors beyond the control of families to the direct actions (or inaction) of parents, and mothers most particularly.[5] While abstention clearly leads to optimal health outcomes based on the medical literature[6], it is important that we contextualize this additional restriction on maternal behavior as one in a long series of potentially guilt-inducing decisions related to motherhood. Decisions about pregnancy already involve conception timing and labor market consequences, health insurance coverage, relationship stability and family/peer support networks, worries over uncontrollable genetic factors related to infant health, and of course financial planning matters. Abstaining from alcohol use, though it is conceptually a simple binary decision informed by clear policy, is ultimately one more marginal stress factor for women who are already in a highly stressful position.

[5] For a review of the increasing burden on mothers, see Ladd-Taylor and Umansky (1998).

[6] See, e.g., Kesmodel et al. (2002); Sokol et al. (2003); Williams et al. (2015); Mamluk et al. (2021); Hur et al. (2022). However, Emily Oster argues that evidence supports the safety of moderate alcohol consumption by pregnant women (Oster, 2014).

2.1 Economic Considerations

How do we think about alcohol use and pregnancy in an economic context? Individuals evaluate various factors when deciding whether and how much to drink, including pleasure derived from alcohol use, beverage price, transportation options and costs while intoxicated, personal safety, and expected health effects. The health risks are not perfectly known, but information about them can be updated; for example, the warning label on a bottle of liquor can inform a drinker of a previously unknown health risk, or perhaps raise its salience, leading to an increase in perceived cost (Chaloupka et al., 1998). In a similar way, when a woman suspects she may be pregnant, this acts as a health shock, raising the expected costs of drinking by adding the negative health impacts on the developing fetus to the existing set of costs.

The direct impact from the shock of pregnancy on the woman can be substantial. In a rational addiction framework, this could result in a shift from one steady state of behavior to another, potentially leading to a lifelong decrease in alcohol consumption (Cook and Moore, 2002). It is also possible that this could affect other risky health behaviors in the same manner. At the same time, the risk to the developing fetus (and subsequently the child) is an externality from the woman's alcohol use, in the same way that the risk of alcohol-related traffic fatalities would be. However, it has effects that may not be realized for a long time; this makes it a kind of intergenerational externality, where the woman's alcohol use can result in developmental problems in the child that increase later-life health care costs, affect educational attainment, and even reduce lifetime earnings potential.

The literature on alcohol externalities in the context of traffic fatalities covers a wide variety of policies, including taxes, minimum legal drinking age laws, and Sunday sales restrictions (Young and Bielinska-Kwapisz, 2006; Carpenter and Dobkin, 2009; Lovenheim and Steefel, 2011; Scherer and Fell, 2019). Intergenerational externalities have been considered in the case of social safety net programs (East et al., 2023) and cigarette smoking and taxation, including in the context of pregnancy (Bantle and Haisken-DeNew, 2002; Simon, 2016; Hoehn-Velasco et al., 2023). Beyond the health of the individual subject to the policy, the economic impact extends into subsequent generations, meaning that positive (negative) changes to behavior can have outsize positive (negative) impacts on future welfare.

Earlier studies on alcohol taxes and warning signs only focused on the first stage (drinking during pregnancy) and outcomes at birth (Zhang, 2010; Cil, 2017). To detect and account for policy impacts, it is essential to look at outcomes that extend beyond natality data and self-reported alcohol use.

2.2 Alcohol Use

Figures 4, 5, 6, 7, and 8 document a substantial change in drinking behavior among young women over the past thirty years. First, the total per-capita ethanol consumption across all beverage types has increased by approximately 15% since 1995 and continues to rise.[7] Second, we see a convergence in drinking behavior between younger cohorts of men and women, as noted in White et al. (2015). Third, the women showing the highest levels of drinking are 21-25 years of age, which is also documented using National Survey on Drug Use and Health (NSDUH) data in Slater and Haughwout (2017). Fourth, among women who

[7] Using estimates around 2010 from Nielsen consumer panel data in Saffer et al. (2022), the "heavy drinker" 90th percentile of households in terms of alcohol consumption (excluding those which purchased no alcohol in the prior 12 months) purchased greater than or equal to 38.87 ounces of ethanol per month (per adult). "Moderate drinkers" were defined as being in the 50th to 90th percentile, with the lower value cutoff being 5.47 ounces of ethanol per month. Per Saffer et al. (2022) this aligns with 2010 NSDUH data showing 66% of households are drinkers and 7% are heavy drinkers. It is worth noting that this translates into $5.47/0.6 = 9.12$ standard drinks per month at the 50th percentile and $38.87/0.6 = 64.78$ standard drinks per month at the 90th percentile. This works out to about two standard drinks per week at the 50th percentile and fifteen standard drinks per week at the 90th percentile.

are drinking, the incidence of binge drinking is increasing over time.

We also see changes in drinking during pregnancy, as indicated below in figure 9. Both drinking and binge drinking incidence are increasing in the data. Just as concerning, we see an increase in reported drinking in the three months before pregnancy in the CDC's Pregnancy Risk Assessment Monitoring System (PRAMS) data (Centers for Disease Control and Prevention, 2024). Most women will not be aware they are pregnant for between 6-8 weeks, meaning they are highly likely to continue drinking at the three months prior rate during at least that portion of the first trimester, when risks to fetal development are very high.

Figure 11 suggests an increase in drinking prior to pregnancy along the intensive margin on average,[8] which aligns with the estimates shown in the CDC's Behavioral Risk Factor Surveillance System (BRFSS) data[9]. In addition, the overall increase in reported drinking before pregnancy is driven by women who are over twenty-one years of age, as illustrated in figure 12. About 10% of the PRAMS sample reports drinking more than 3 drinks per week in the three months prior to pregnancy, and 32% reports at least one drink per week. If we use the estimates from Saffer et al. (2022), drinkers at the 50th percentile are consuming about 2 standard drinks per week, while drinkers at the 90th percentile are consuming about 15 per week. Considering that the PRAMS question is not asking about standard drinks in particular, drinking may be more intense than we might expect if we think only in terms of standard drinks, which may have less alcohol than what someone considers a single drink. In particular, that estimate of 32% having at least one drink per week may match up with the 50th percentile of drinkers in terms of standard drinks.

[8] Figure 10 shows a similar trend for the extensive margin.

[9] U.S. Department of Health and Human Services and Centers for Disease Control and Prevention (2024)

2.3 Pregnancy

Figure 13 documents the increasing age at first birth among women in the U.S. Looking at this, we might be tempted to conclude that the incidence of unintended pregnancy[10] is decreasing significantly over time, but there is substantial heterogeneity in the data (Mosher et al., 2012). For example, PRAMS data indicates a 35% rate for white women, a 65% rate for black women, a 50% rate for women with a high school degree or less, and a 23% rate for women with a college degree.

Examining differences between 1995 and 2020 in the rate of unintended pregnancy in figure 14, we see an enormous gap between the first two age groups and the rest of the sample, but limited change in the rate of unintended pregnancy over time.

2.4 Health Consequences

There are four major health risks concerning pregnancy as a consequence of alcohol use: unintended pregnancy (and hence abortion), fetal death prior to 20 weeks (i.e. spontaneous abortion), fetal death post-20 weeks (i.e. stillbirth), and FASD. Increasing rates of alcohol use and binge drinking among reproductive aged women may be translating into higher risk for each of these. However, all four outcomes have considerable measurement difficulties, making exact analysis of these effects challenging.

Unintended pregnancy tends to result in negative health outcomes for the child and negative economic outcomes for both the mother and the child (Mosher et al., 2012). While alcohol use is itself correlated with other risky behavior, the

[10]Unintended pregnancy is defined using responses to the question: “Thinking back to just before you got pregnant, how did you feel about becoming pregnant?” If the response is “sooner” or “wanted to be pregnant then”, then the pregnancy is considered to be intended. Otherwise it is coded as unintended, with the response being “later,” “not sure,” or “did not want.”

use of alcohol can lead to risky sexual behavior and thus unintended pregnancy (Naimi et al., 2003). The incidence of unintended pregnancy is not homogeneous in the population, but is heavily biased toward younger women, a group which seems to demonstrate increasing binge drinking.

One potential outcome of unintended pregnancy is abortion. Most abortions take place very early in pregnancy, 80.9% at ≤ 9 weeks and 93.1% at ≤ 13 weeks in 2020 (Kortsmit, 2022). The recent overturning of Roe v. Wade at the federal level and increasing restrictions on abortion, especially for younger women, are leading to greater obstacles to abortion access (Myers, 2024; Jones and Pineda-Torres, 2024). Alcohol-related policies may play a role in reducing unintended pregnancy and its downstream welfare impacts in a post-Roe abortion environment.

Spontaneous abortion is estimated to occur in between 10-20% of pregnancies, but of course this is not perfectly documented. The literature on alcohol's effect on this outcome has been mixed over time, but more recent evidence from large-scale studies supports the conclusion that alcohol use increases the incidence of spontaneous abortion, particularly in the first trimester (Kline et al., 1980; Andersen et al., 2012). In particular, Andersen et al. (2012), studying a Danish national birth cohort of over ninety thousand women, report a spontaneous abortion hazard ratio (relative to the non-drinking group) of 1.66 for moderate drinkers (2-3 drinks per week) and 2.82 for heavy drinkers (4+ drinks per week) in the first trimester. If we assume a baseline rate of only 5% among nondrinkers, then that implies a rate of 8.3% for moderate and 14.1% for heavy drinkers, with corresponding decreases in risk if alcohol use is reduced.

Fetal alcohol spectrum disorder (FASD) is an umbrella term that includes several conditions. These include fetal alcohol syndrome (FAS), the most severe condition, pFAS, or partial fetal alcohol syndrome, alcohol-related neurodevelopmental disorder (ARND), and alcohol-related birth defects (ARBD) (May and Gossage, 2001). All of these conditions can be difficult to detect in many cases, and each of them is usually observed at different stages of development. Some FASD indicators can be observed at birth, but many others relate to behavioral outcomes which will not be apparent until years later (Hur et al., 2022). As a result, the precise prevalence and incidence of FASD is highly uncertain, although researchers do document consistently higher rates of FASD in higher-risk (i.e. higher alcohol use) communities (Roozen et al., 2016). Despite heterogeneity in terms of observed prevalence, it is clear from the literature that increasing alcohol use results in increasing incidence of FASD; Sokol et al. (2003) estimated an overall FASD prevalence to be 9.1 per 1000, with higher rates among lower-educated and minority groups, while more recent studies indicate 65 per 1000 (6.5%) when examining children[11] (May et al., 2021).

2.5 Alcohol Policies

The following policy responses to alcohol use have been subject to analysis in the context of pregnancy: 1) education and physician guidance, 2) minimum legal drinking age laws (MLDA), 3) vertical ID laws, 4) federal warning labels on alcohol containers, 5) state point-of-sale (and physician's office) warning

[11] Studies which cover whole communities of children are referred to as "active case ascertainment" studies, and they typically provide better insight than passive surveillance studies in general. In the U.S., those studies examining children show the following rates per 1000 (Results documented from the survey in Roozen et al. (2016)):

- FAS 2.4 (May et al. 1983),
- FAS 5.92 (Burd et al. 1999),
- FAS 4.91/5.21 (Clarren et al. 2001),
- FAS 4.34 (Poitra et al. 2003),
- FAS 0.23 (Weiss et al. 2004),
- FAS 8.37; pFAS 16.05; ARND 9.07; FASD 33.50 (May et al. 2014).

signs[12], 6) federal excise taxes, 7) state excise taxes[13], and 8) punitive policies related to pregnancy. The latter category includes reporting behavior during pregnancy to Child Protective Services, making alcohol use during pregnancy subject to child abuse and neglect laws, and even civil commitment of pregnant women. Federal warning labels were mandated for alcohol containers in 1988 (Warren, 2015). In 2005, the surgeon general announced that there was no safe level of alcohol use during pregnancy (Carmona, 2005). Increasing the rate of abstinence from alcohol use during pregnancy is a Healthy People 2030 goal for the U.S. Department of Health and Human Services.[14]

At present, public health organizations advocate for reductions in alcohol use through taxes. Raising prices via taxes is a major component of the World Health Organization's SAFER initiative, and the same approach is endorsed by the Substance Abuse and Mental Health Services Administration as well as the CDC.[15] These organizations also prefer supportive and educational policies (e.g. warning signs) over punitive policies (e.g. substance use during pregnancy defined as child abuse).

From earlier research, we know that MLDAs have a substantial effect on underage drinking, particularly among men, but do not reduce binge drinking among young women (Carpenter et al., 2016). Vertical ID laws do not seem to be effective in reducing underage drinking and smoking, based on recent work (Mtenga and Pesko, 2024). Federal excise taxes seem to have reduced traffic fatalities and injury related to alcohol use, but have been unchanged since 1991 (Cook and Durrance, 2013). Concerning punitive policies, they tend to have very limited use in practice and are generally applied to the use of illegal drugs,

[12] See figure 2 for warning sign laws visualization. An example of such a warning sign from Georgia is shown in figure 3

[13] See figure 1 for state-level tax visualization.

[14] See https://health.gov/healthypeople.

[15] See https://www.who.int/initiatives/SAFER, https://www.samhsa.gov/find-help/atod/alcohol, and https://www.cdc.gov/alcohol/prevention/index.html.

but nevertheless may have a negative effect on fetal health overall (Angelotta and Appelbaum, 2017; Boone and McMichael, 2021).

In this paper, I study two policies that have both substantial variation in implementation as well as previously documented efficacy in reducing alcohol consumption, particularly among those individuals over the minimum legal drinking age. The first of these is state-level excise taxes, which have previously been investigated in the context of prenatal drinking and infant health only once, in Zhang (2010). The author uses BRFSS and NVSS Natality data covering 1985-2002, finding that tax increases reduce prenatal binge drinking and low birth weight incidence. The second policy, state-mandated warning signs, has also been the subject of only a single paper, Cil (2017). Here, the author uses the same data sets as Zhang (2010), but over the years 1980-2010 (1985-2010 for BRFSS). The paper documents substantial reductions in prenatal drinking and very low birth weight incidence from warning sign law passage.

While these papers represent the most substantial investigation of this topic, they have limitations. The first is naturally that more years of data are available, covering additional variation in both excise tax rates and warning sign laws. More critically, recent developments in the difference-in-difference literature have documented concerns with the basic two-way fixed effects model, particularly in cases involving staggered treatment adoption (Goodman-Bacon, 2021; Sun and Abraham, 2021; De Chaisemartin et al., 2024). Finally, there is an opportunity to examine outcomes beyond the scope of the previous papers, including unintended pregnancy, abortion rates, and childhood development indicators post-birth.

3 Data

I use data from six major sources to provide a range of outcomes relating to alcohol use and pregnancy. For thorough information on pregnancy and health, I use the restricted-access Pregnancy Risk Assessment Monitoring Survey (PRAMS) data (Centers for Disease Control and Prevention, 2024). The PRAMS surveys mothers who have given birth in the last year about various health risks and outcomes. Alcohol use and binge drinking incidence among the general population and self-reported pregnant women comes from CDC BRFSS, 1984-2022 (U.S. Department of Health and Human Services and Centers for Disease Control and Prevention, 2024). Data on abortion rates and policies are sourced from the Guttmacher Institute data center (Maddow-Zimet and Kost, 2021, 2022). Data on state-level births comes from the restricted-access Natality Detail Files via the Centers for Disease Control (CDC), the National Vital Statistics Service (NVSS), and the National Center for Health Statistics (NCHS) from 1995-2022 (NCHS, 2024). Data on fetal deaths from 2005-2022 is taken from CDC WONDER (U.S. Department of Health and Human Services et al., 2024). Finally, childhood outcome data that may be related to FASD is taken from the National Survey of Children's Health, 2016-2022 (U.S. Department of Health and Human Services et al., 2024).

Name	Time Range	Descriptive
PRAMS	1987-2021	Table 4
BRFSS	1984-2022	Table 5
Abortion Data	1988-2020	Table 6
Natality Detail Files	1982-2022	Table 7
Fetal Death	2005-2022	Table 8
NSCH	2016-2022	Table 9

Primary Data Sources

For the PRAMS, BRFSS, and NSCH data sets, observations are collapsed to the state-year level using population weights from their respective data set. For additional details concerning outcomes, control variables, and data organization, please refer to appendix A.

3.1 Other Data

Data on alcohol excise taxes for distilled spirits (i.e. liquor), wine, and beer comes initially from a database compiled by the Tax Policy Center for years 1982-2023 (Tax Policy Center, 2023). Using this annual data as a starting point, I researched individual state-level excise tax changes to determine more precise dates for policy changes.[16]

Information on alcohol use and pregnancy state point of sale warning signs comes from the NIAAA's Alcohol Policy Information System (APIS) (National Institute on Alcohol Abuse and Alcoholism, 2023c).[17] Sunday sales law restrictions are taken from APIS (National Institute on Alcohol Abuse and Alcoholism, 2023a), and augmented using data in Stehr (2007) and Lovenheim and Steefel (2011). Blood Alcohol Content (BAC) laws are taken from APIS (National Institute on Alcohol Abuse and Alcoholism, 2023b) and from Scherer and Fell (2019). NIAAA alcohol use data are taken from Slater and Alpert (2023).[18]

4 Methodology

4.1 Composite Excise Tax Measure

It is common in the literature to proxy all alcohol taxes at the state level using beer taxes, due to the presence of state liquor and wine monopolies whose prices are not easily observable to researchers.[19] Alcohol excise taxes are levied

[16] See table 1 for recent tax change dates by state.
[17] See table 2 for warning sign effective dates.
[18] See table 10.
[19] See, e.g., Ruhm (1995), Silver et al. (2019), and Nelson and Moran (2019).

on the categories of distilled spirits, wine, and beer; each single tax is potentially subject to change individually or as part of a shift of all three taxes at once, depending on the state legislature's goals. Moreover, in no state are tax values harmonized with respect to ethanol content. This analysis is primarily concerned with potential health impacts from excise taxes as intermediated by beverage prices, rather than the overall excise tax level, so the primary specification will be a composite tax measure which describes the cost per unit of the drug, in this case ethanol.

To construct this measure, I begin by adjusting each category of alcohol tax using the average alcohol by volume (ABV) of that alcohol type sold using estimates from Martinez et al. (2019).[20] This yields a dollars-per-gallon of pure ethanol tax for each type. Then, I weight the taxes by the national consumption shares of each type as of 1999 using NIAAA data (Slater and Alpert, 2023).[21] The national consumption shares for 1999 can be assumed to be independent of any one state's composition, and will not reflect endogeneity in state taxes as they might have had I used a share measure changing at the year level. Once we sum these shares, I have a total dollars-per-gallon of ethanol excise tax rate for the state, giving an estimate of the excise tax cost for the average gallon of ethanol sold. From here, I adjust the value to reflect the tax per standard drink in terms of ethanol, in cents, by adjusting to 0.6 fluid ounces of ethanol per standard drink (0.0046875 gallons) and multiplying by 100 cents. The computation for a single state is thus:

$$TAX_{StdDrk} = 100 \times \frac{0.6}{128} \times \sum_{i \in \{l,w,b\}} \left(SHARE1999_i \times \frac{TAX_i}{ABV_i} \right) \tag{1}$$

For states with a liquor or wine monopoly in a given year, I regress the

[20]In particular, the ABV estimate is the average of the 2003 and 2016 values for each alcohol category: liquor: 37.6%, wine: 11.95%, beer: 4.695%.

[21]These values are: liquor share: 0.2885954, wine share: 0.1426035, beer share: 0.5688011.

liquor or wine tax on the beer tax in non-monopoly states and use a linear prediction for the liquor or wine tax in that state-year cell. Then I incorporate this prediction for those states in place of the zero value for the monopoly tax.

As an illustration, consider the tax environment in Illinois as of 2010. The liquor tax was \$8.55 per proof gallon[22], beer \$0.231 per gallon[23], and wine \$1.39 per wine gallon[24]. If we adjust each by their approximate ABV, the tax rate per gallon of pure ethanol is liquor at \$22.74, beer at \$4.92, and wine at \$11.63. Finally, after we weight by the consumption shares and adjust to reflect a single standard drink, we get a value of \$0.05165 tax per standard drink on average. For summary statistics of the tax values, see table 3.

4.2 Two-Way Fixed Effects

I approach the change in taxes and warning sign passage using a difference-in-differences approach, starting with the basic two-way fixed effects (TWFE) framework, and then employing newer methods.

$$Y_{st} = \alpha + \beta_1 TAX_{st} + \beta_2 WS_{st} + \gamma X_{st} + \lambda_s + \delta_t + \varepsilon_{st} \tag{2}$$

In the above specification, Y_{st} denotes the outcome, X_{st} a vector of covariates, λ_s and δ_t state and year fixed effects, and ε_{st} the error term. TAX_{st} indicates continuous alcohol excise tax, while WS_{st} is an indicator for warning sign law effective. The covariates include demographic controls such as age, race, education, and marital status where available, as well as state controls such as BAC laws, Sunday sales laws, cigarette taxes, smoke-free laws, vertical

[22] Typically the volume in gallons multiplied by the percentage alcohol of the beverage, multiplied by two and divided by 100. Thus a gallon of liquor at 40% alcohol by volume is 80 proof.

[23] Statutory language typically levies this at the barrel level, equivalent to 31 gallons.

[24] A standard gallon.

ID laws, minimum wage, unemployment rate, and poverty rate. For the abortion regressions, I also include TRAP laws, minimum waiting period laws, and parental involvement laws.

4.3 De Chaisemartin and d'Haultfoeuille (2024)

The standard TWFE approach has been demonstrated to have difficulties with heterogeneous treatment effects and staggered adoption (De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Sun and Abraham, 2021; Borusyak et al., 2024). To account for potential heterogeneity, dynamic effects from policy changes, and staggered adoption concerns, I use the method from De Chaisemartin and d'Haultfoeuille (2024).[25] This method is particularly useful in that it can flexibly accommodate unbalanced panel data and be used with continuously distributed treatments, as in the case of excise taxes. In addition, states may enter with different initial treatment values, and this is the only estimator that supports such a quasi-experimental setup.

I create a threshold value categorical variable for use with the De Chaisemartin and d'Haultfoeuille (2024) estimator, using 2 cent (per standard drink) bins. This binning process is the recommended method from the authors, and the thresholds provide adequate variation for examining effects from state-level changes in any of the three alcohol tax values, as they range from 0 to 12 cents over the whole data set from 1982-2023. For the warning signs laws, the treatment is binary and no other bins are required.

[25] In particular, I use the Stata package `did_multiplegt_dyn` (de Chaisemartin et al., 2024), specifying 5 pre- and post-periods in the main analysis, using normalized event study estimators to yield an unbiased average treatment effect (De Chaisemartin and d'Haultfoeuille, 2023; De Chaisemartin and d'Haultfoeuille, 2024).

4.4 Stacked Difference-in-Differences

Since the warning signs laws are a binary treatment, I am also able to consider a different estimation method, stacked difference-in-differences. Originally developed in Cengiz et al. (2019), the method handles the problem of staggered treatment timing by separating each treatment timing group into its own "sub-experiment." This approach has been formalized and extended to use weights based on the sample size of the treated and control units in each sub-experiment by Wing et al. (2024).

In brief, Wing et al. (2024) addresses variation in the number of pre- and post-periods about each treatment, as well as the total number of treated and control units. The method does this by first separating each treatment timing group into its own sub-experiment, and then having the researcher pre-specify a number of pre- and post-periods that must exist for each treatment timing. Those events for which the data does not support the specified number of periods are not considered in the analysis. In this analysis, I specify 5 pre- and post-periods.

$$\begin{aligned} Y_{sae} = \alpha_0 + \alpha_1 D_{sa} + &\sum_{\substack{h=-\kappa_{\text{pre}}\ldots\kappa_{\text{post}} \\ h\neq -1}} \big[\lambda_e \mathbf{1}[e=h] + \delta_e D_{sa} \times \mathbf{1}[e=h]\big] \\ &+ \gamma \boldsymbol{X_{st}} + \mu_{sae} \end{aligned} \tag{3}$$

Here Y_{sae} denotes outcome Y in state s in sub-experiment (i.e. treatment timing) a and event time (time relative to policy adoption) e. κ_{pre} and κ_{post} denote the number of pre- and post-periods chosen. D_{sa} is an indicator equaling 1 if state s is treated in sub-experiment a.

One critical component of the Wing et al. (2024) approach is the use of an appropriate weight for accurate effect estimation. Data in this analysis is aggregated to the state-year level, and for the PRAMS, BRFSS, and NCHS the data is collapsed using the data set's provided population weight. For the stacked regression, we use the standard stack weight from Wing et al. (2024), which gives greater weight to sub-experiments with larger shares of the treated sample.[26] Once the analysis is run, the post-period estimates are linearly combined to generate a treatment effect with standard errors clustered at the state level.

5 Results

5.1 Effects on Alcohol Use

Across the estimates (see table 11), the TWFE estimator shows a greater number of significant results than those derived from DCDH and stacked DID. In the NIAAA data on the full population, TWFE estimates show a 3.9% decrease in standard drinks per capita from warning signs and a 1.4% decrease from a one cent tax per standard drink increase. The DCDH estimator gives an insignificant estimate for both, with the same sign and smaller effects, while the event studies in figure 15 shows inconclusive evidence of an effect from warning signs. Overall, these indicate some evidence of a negative effect on aggregate drinking from warning signs, and a null result from tax increases.

Turning to the BRFSS data, which is restricted only to women of reproductive age, I observe no significant effects, and the event studies in figures 16 and 17 support this. The pre-pregnancy drinking outcomes from the PRAMS also show null effects when examining the event studies (figures 18 and 19). The two significant coefficients using TWFE change sign when trying the alternate estimators.

The results from the BRFSS subsample of women currently reporting preg-

[26] See table 1 of Wing et al. (2024) for descriptions of weighting schemes. The approach used in this analysis matches that in the empirical application documented in the paper.

nancy are reported in table 12. The standard drinks per year variable shows negatively signed results, with only the TWFE estimates significant. However, the event studies show a null effect (figure 20). I find similar effects on binge drinking from warning signs as Cil (2017) using TWFE, but estimates using DCDH and stacked DID are smaller in magnitude (19% and 59% of the TWFE magnitude respectively) and insignificant. Moreover, the standard errors are comparable between the estimators. Examining the event studies in figure 22, I conclude that this estimate cannot be distinguished from zero.

5.1.1 Heterogeneity in BRFSS

I stratify the BRFSS any alcohol use and binge drinking variables by age bins (figure C.10), race categories (figure C.11), and education levels (figure C.12) to examine the possibility of any heterogeneity in response among the population of reproductive aged women. Overall estimates cluster close to zero for for warning signs across all three estimators for both outcomes. For taxes, the TWFE estimates are higher than DCDH in most cases, with DCDH at zero for any alcohol use and a less precise zero for binge drinking. Confidence intervals are much larger for the race and education stratifications due to the Hispanic and "some college" groups in particular.

No group shows a notable response to warning signs, although estimates for the Hispanic population are particularly noisy. Tax estimates are of small magnitude with larger confidence bands, and the point estimates flip sign between DCDH and TWFE by race and education; none of these appear to significantly differ from a null effect overall in terms of self-reported drinking outcomes.

5.2 Effects on Unintended Pregnancy and Abortion

The coefficient on unintended pregnancy flips sign between TWFE/DCDH and stacked for warning signs, and then between TWFE and DCDH for taxes. Event studies for both treatments show null effects (figure 23). We do see suggestive evidence of a reduction in abortion (table 13, figure 24) and also teen abortion (figure 25) from taxes. The estimates are on the order of a 1.5-3% reduction using DCDH and TWFE. Warning signs show the sign changing to positive for stacked DID. More work is needed to examine this outcome, particularly for tax increases.

5.2.1 Heterogeneity in Unintended Pregnancy

I observe no notable pattern of differences in effects when stratifying by age group, race, or education. We might have expected larger effects for younger women, black women, or low-education women from either of these policies, but nothing notable appears in the estimates.[27]

5.3 Effects on Early Outcomes

The next set of results focuses on evaluating "second stage" outcomes of fetal death post-20 weeks (i.e. stillbirth) as well as outcomes at the time of delivery. The estimates in table 14 show increases in stillbirths from tax increases, but the event study (figure 26) is not indicative of a sustained effect; it is possible these results are driven by a reporting change[28] in one or more of the states over the relatively limited 2005-2021 period.

For the outcomes drawn from natality data, no effects are large or significant for either taxes or warning signs. APGAR score is consistently positive but very

[27] See figures C.13, C.14, and C.15 for details.

[28] States vary in terms of the gestational timing, fetal weight, and quality of data collection for the fetal death outcome, with reporting requirements at the state level changing over time.

small in magnitude (0.1% at the largest). Very preterm birth incidence shows insignificant coefficients of about 1-2% of the outcome mean. Other outcomes also have small coefficient magnitudes relative to the mean, inconsistent signs, and mostly flat event studies. For example, very preterm birth shows no evidence of a possible decrease from taxes or warning signs (figure 30), while very low birth weight impacts are also insignificant (figure 28).

5.3.1 Heterogeneity in Early Outcomes

For very low birth weight and very preterm birth incidence, I observe no meaningful differences across age groups, education levels, or race. Overall, this supports the null finding from the main estimates.[29]

5.4 Effects on Childhood Outcomes

The final set of outcomes are drawn from the NSCH, and show outcomes which may be impacted by alcohol use during pregnancy, or potentially during breastfeeding; I do not have the ability to distinguish between these two causes. The estimates in table 15 show no strong effects from either policy, and the event studies support this. Some are very noisy (e.g. figure 32) while others are restricted to only one round of data collection (figures C.8 and C.9).[30] Overall, I find no clear indication of significant effects from taxes or warning signs, but the estimates for taxes are consistently negatively signed, where warning signs show more sign changes.

[29] See figures C.16 - C.21 for details.

[30] I am hopeful that future rounds of the NSCH will have additional data on FASD and FASD evaluation that can clarify this issue, since these questions were introduced in the 2022 questionnaire.

5.5 Robustness

To test the reliability of my results, I have examined a number of alternate specifications. In brief, estimates without additional controls do not show uniform changes; in fact, in some cases small estimates even change sign. I attribute this particularly to the exclusion of tax effects in warning sign regressions or vice-versa. The BAC and Sunday sales restrictions do slightly increase the confidence intervals in many cases, but I feel it is important to retain them as they provide a control for the overall alcohol policy environment in each state.

I also examine a specification inflating the tax values to real 2022 dollars, and then adjusting the tax threshold values used in DCDH accordingly. In this case I do not show substantial change in the outcome, but the binning in DCDH is less reliable as it also may capture changes from one bin to another as the real tax value declines due to inflation. In addition, I tested a logged tax value version of my regressions. Again, this does not provide evidence of significant impacts from these two policies. I have also examined several of my data sources when restricting to non-liquor monopoly states only. This significantly reduces the power of the analysis, and shows no results which contradict the main estimates. Finally, I examine a specification using only beer taxes, excluding liquor and wine taxes from the analysis. This switches the sign of the DCDH result for low birth weight, but the estimate remains insignificant. Overall, multiple changes to the specification do not significantly alter the estimates or event studies.[31]

One of the two primary concerns is the question of sample restriction. Both Cil (2017) and Zhang (2010) use data no later than 2005-2010. Many of the policy changes in warning signs in particular happen relatively early in the data set, and even though the trimmed observations used in the stacked DID esti-

[31] I have also tested a triple difference estimation approach for warning signs using the BRFSS data on alcohol use during pregnancy. I see consistently insignificant results on the warning sign and pregnant interaction coefficient using this method.

mator should account for this, I rerun my own analysis removing observations after 2005. The results show the same overall patterns as with the full data, although some data sources (e.g. fetal deaths) cannot be estimated with these restrictions. In particular, the any alcohol (among currently pregnant women) estimates are negative for taxes. I again note suggestive declines in abortion rates from taxes in this restricted subset of the data. Turning to the natality outcomes, coefficients on low birth weight, very low birth weight, and very preterm birth are less than 1% of the outcome mean for taxes; estimates are around -2% or smaller for warning signs. These effect magnitudes are not dissimilar to those in Cil (2017), although the newer estimators continue to show a null effect. For the childhood outcomes, taxes seem to have a fairly consistent negative impact on various negative outcomes (behavioral problems and speech disorders in particular). Warning signs by contrast show a much smaller magnitude change in DCDH versus TWFE, despite the positive coefficients in TWFE regressions. Further inquiry concerning the potential tax effects could be warranted from these results.[32]

The second major robustness test has to do with taxes specifically. Since many excise tax changes are small in magnitude, it is arguable that they will not have any binding effect on consumption. Consequently, I consider two cases of very large tax changes in order to determine whether we see evidence of any effect. To perform this analysis, I choose Alaska, which raised taxes in July 2002, and Illinois, which raised taxes in September 2008.[33] In both cases, using the synthetic difference-in-differences (SDID) approach of Arkhangelsky et al. (2021), I find no significant (persistent) effects on outcomes using total alcohol consumption from Slater and Alpert (2023) or the NVSS natality data. I use these data sets specifically because they form a balanced panel, which is required

[32] See tables C.10-C.14 for pre-2006 results. A graphical representation of selected outcomes can be found in figures C.22 and C.23.

[33] See table 1 for details of the tax changes.

for the SDID analysis. For the estimation, I use the Stata implementation documented in Clarke et al. (2023). In particular, I use `vce(placebo)` and `reps(100)` for the single-state treatment. Results from the Slater and Alpert (2023) standard drinks per capita yields insignificant point estimates for both states. Estimates for preterm/very preterm birth and low/very low birthweight, also show insignificant, near-zero effects.[34]

One final concern is whether fetal health outcomes are noticeably impacted with respect to self-reported drinking measures. I address this in more detail in appendix B, but in brief I note three significant points. Women who report any drinking in the three months prior to pregnancy show a significantly higher rate of unintended pregnancy. Those women who report drinking more than three drinks per week in the same period show much higher rates of unintended pregnancy; they also show a lower probability of their child being large for its gestational age, and a higher probability of being small for its gestational age. This indicates that even though self-reported drinking measures are subject to misreporting, they still show strong correlation with observable outcomes in the data.

6 Discussion

The economic impact of FASD is enormous. Amendah et al. (2011), examining Medicaid claims data in 2005, shows that healthcare expenditures for children (under 17 years of age) with FAS is 9 times greater than those without. Williams et al. (2015) documents the expense and difficulty of FASD screening in the U.S. and Canada, and provides a lifetime care cost estimate for a child with FASD of \$2.44M. In a survey of the literature, Greenmyer et al. (2020) estimates spending (in real 2020 dollars) to be \$1.29-10 billion annually for FASD in the U.S., and

[34] See table C.1.

CAD 1.9-10.5 billion in Canada. They also indicate a return from spending on programs targeting high-risk mothers of up to 62 times.

The high costs of FASD and alcohol use more broadly are almost certainly underestimated; many are only based on FAS rather than the FASD more broadly, and they cannot account for the welfare impacts from early-term pregnancy loss, unintended pregnancy, abortion, or the heightened risks of stillbirth. Moreover, FASD has cognitive and behavioral impacts that persist into adulthood. The intergenerational externality effect on adult health behavior and labor market outcomes could be severe. With this in mind, how effective are the policies which may impact alcohol use, and thus FASD?

Cil (2017) documents a 35% decrease in any alcohol use and a 75% decrease in binge drinking among pregnant women; the present analysis does not support that conclusion.[35] Coefficients for any alcohol use and binge drinking are uniformly smaller in my estimates, with the exception of the TWFE binge drinking coefficient, where the original estimate is extremely close and well within the confidence interval. Where Cil (2017) shows a -3.8% very low birth weight incidence, I find insignificant estimates of about one-half the magnitude. Overall, I find no substantive effect from warning signs across the full range of outcomes, from pre-pregnancy alcohol use to childhood health.[36]

For excise taxes, the literature documents evidence of reductions in drinking and Zhang (2010) notes binge drinking decreases among pregnant women by 3pp (1.5pp) with a 1 cent increase in beer (wine) taxes.[37] I am not able to substantiate this conclusion either with TWFE or DCDH using data beyond

[35]See figure 34 for a graphical comparison of some outcomes.

[36]It is important to note that Cil (2017) performs a propensity score matching stage, which functionally excludes approximately twenty states from the control group in the difference-in-difference analysis; my own results include these dropped states, which may account for differences in the TWFE regressions.

[37]For ease of comparison, I have adjusted the estimates from Zhang (2010) to reflect an implied tax per standard drink value, converting the relevant tax type by weighting by its ethanol content and then adjusting for one standard drink. See figure 33 for a graphical comparison of some outcomes.

the 1985-2002 period from the original study. I do find suggestive evidence for abortion outcomes, which merits additional study. Zhang (2010) also documents that a 1 cent increase in beer tax leads to 1.6% decrease in low birth weight incidence; by comparison I find that a 1 cent increase in tax leads to insignificant and inconsistently signed point estimates about one-third of the magnitude.

6.1 Conclusion

I cannot confirm beneficial effects from either state-level alcohol excise taxes or warning signs with respect to pregnancy-related outcomes. My estimates are in most cases smaller than the documented effects in earlier research, and event studies underscore the lack of effect rather than simple imprecision. Moreover, the robustness checks support that this is not due to adding years of data to the analysis. Most importantly, if these policies were having a real impact on alcohol use in pregnancy, I would expect to see an effect across several, and potentially many of these outcomes; the fact that I observe no significant changes from unintended pregnancy rates all the way through childhood health outcomes supports the notion that these policies are not making a strong impact on behavior.

Why don't these policies affect these outcomes? Warning signs may not impact drinking due to a simple lack of visibility. Retailers have an incentive not to make them too prominent, and government enforcement may not be very strong.[38] Moreover, individuals may not connect the warnings concerning "birth defects" to low or moderate drinking. Further, individuals in the population who would be responsive to such messaging are likely already aware through other public education campaigns. In particular, I suspect that the warning labels mandated by the Alcoholic Beverage Labeling Act of 1988[39] have had greater

[38] To explore this, I would like to run a survey online to determine whether individuals even notice these warning signs.

[39] H.R.5210 - 100th Congress (1987-1988): Anti-Drug Abuse Act of 1988. (1988, November

efficacy than either the contemporaneous warning sign passages of the late 1980s and early 1990s or subsequent warning sign laws. An alternative supportive policy, targeted interventions of high-risk groups, might have a better chance of making an impact than either warning labels or signs(Greenmyer et al., 2020).

The lack of effect from excise taxes is likely due to the small tax values overall, which only go up to about 12 cents per standard drink. When the taxes are especially low they are unlikely to influence behavior; when taxes do rise significantly, as in Alaska or Illinois, substitution to lower-cost alcohol likely reduces any significant ethanol consumption changes (Gehrsitz et al., 2021). It may be that a price floor on ethanol would be a better policy, as explored in Griffith et al. (2022). Such a binding floor should show a stronger effect than overall excise taxes since individuals would in all cases face an increase in cost per unit ethanol.

The impact from taxes on abortion outcomes are worthy of additional study. Given the high welfare cost of alcohol use with regard to pregnancy, the lack of strong effects is unfortunate. However, this result underscores the importance of unified messaging from healthcare providers and public policy researchers.[40]

18).

[40] More work is needed to examine drinking behavior in particular, as self-reported drinking outcomes are far from ideal. I am currently working to access consumer panel data which provides better estimates of alcohol consumption by women of reproductive age.

7 Figures

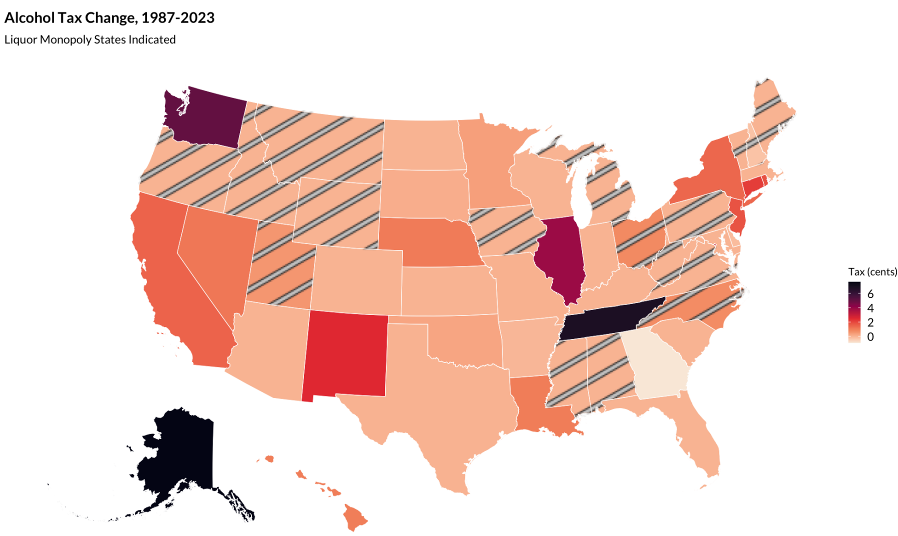

Figure 1: Change in composite alcohol excise tax per standard drink in cents, 1987-2023. States with stripe pattern have current state liquor sales monopoly. See methodology section for details of composite tax computation.

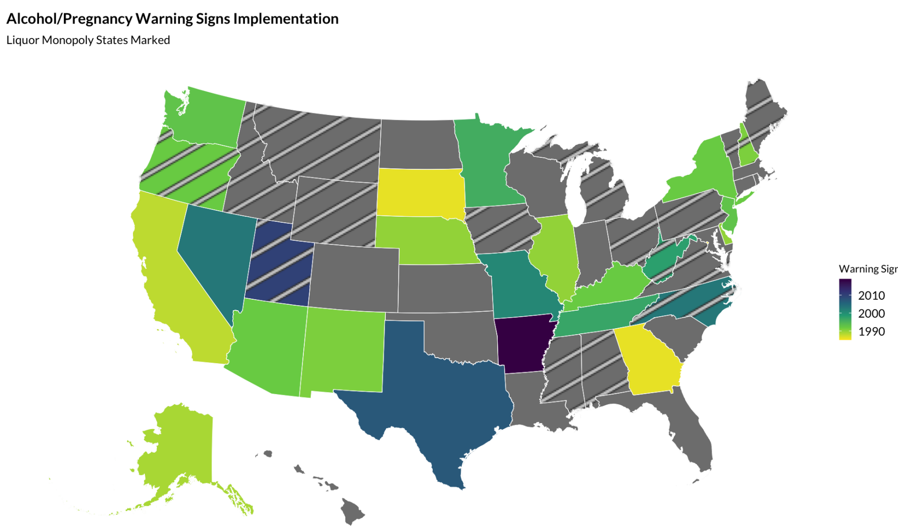

Figure 2: State pregnancy and alcohol use posted point of sale warning sign law passage through 2023. States with stripe pattern have current state liquor sales monopoly. Policy data drawn from Alcohol Policy Information System (National Institute on Alcohol Abuse and Alcoholism, 2023c).

Figure 3: A point-of-sale pregnancy and alcohol use warning sign, taken from the Georgia Department of Revenue https://dor.georgia.gov/alcohol-tobacco/alcohol-and-tobacco-division-law-enforcement/alcohol-tobacco-warningssigns.

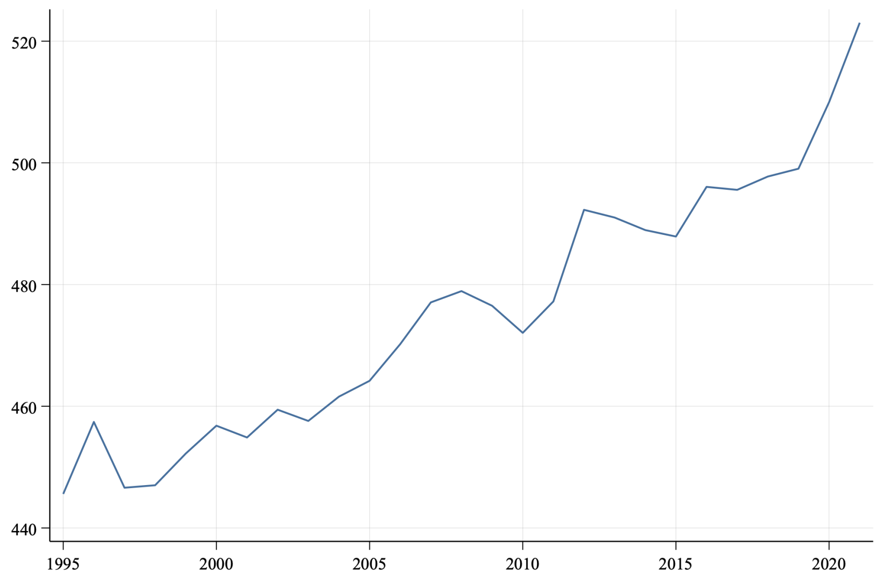

Figure 4: Total per capita alcohol consumption in terms of pure ethanol, United States, 1995-2021. Values are number of standard drinks per capita population 14 and older. One standard drink is defined to be 0.6 fluid ounces / 14 grams of ethanol, or approximately one 12 fl oz beer at 5% ABV, one 5 fl oz glass of wine at 12% ABV, or one 1.5 fl oz shot of distilled spirits at 40% ABV. Data taken from Slater and Alpert (2023).

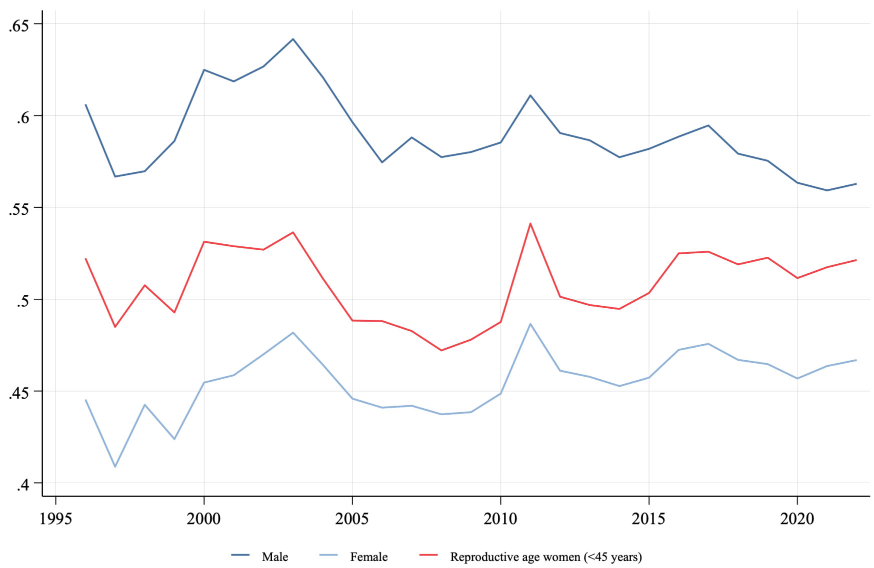

Figure 5: Any alcohol use in the last 30 days indicator, CDC BRFSS, 1995-2022. Includes all U.S. states available in BRFSS sample by year. Figure shows all male, all female, and all women of reproductive age (18-44). Estimates are weighted for national representation using BRFSS sample weights.

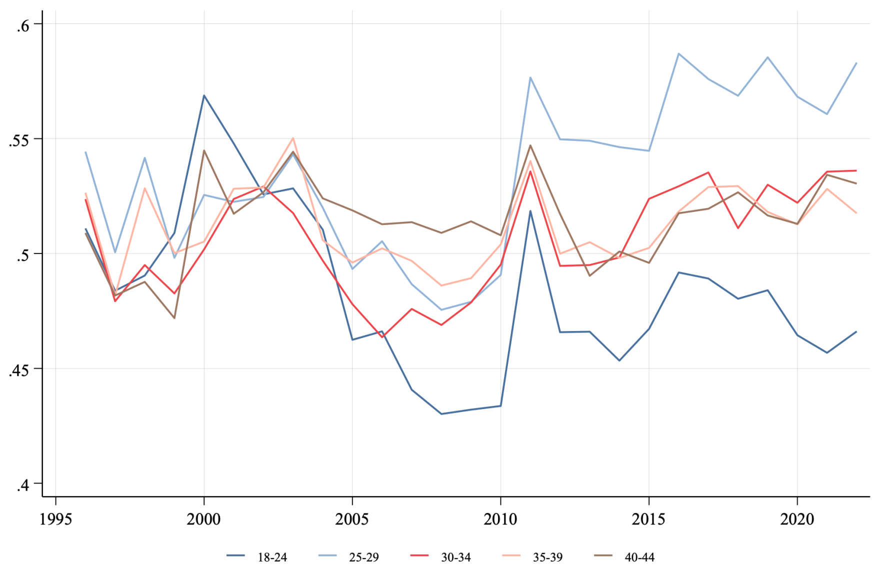

Figure 6: Any alcohol use in the last 30 days indicator, CDC BRFSS, 1995-2022. Includes all U.S. states available in BRFSS sample by year. Figure shows detail for reproductive aged women by age group. Estimates are weighted for national representation using BRFSS sample weights.

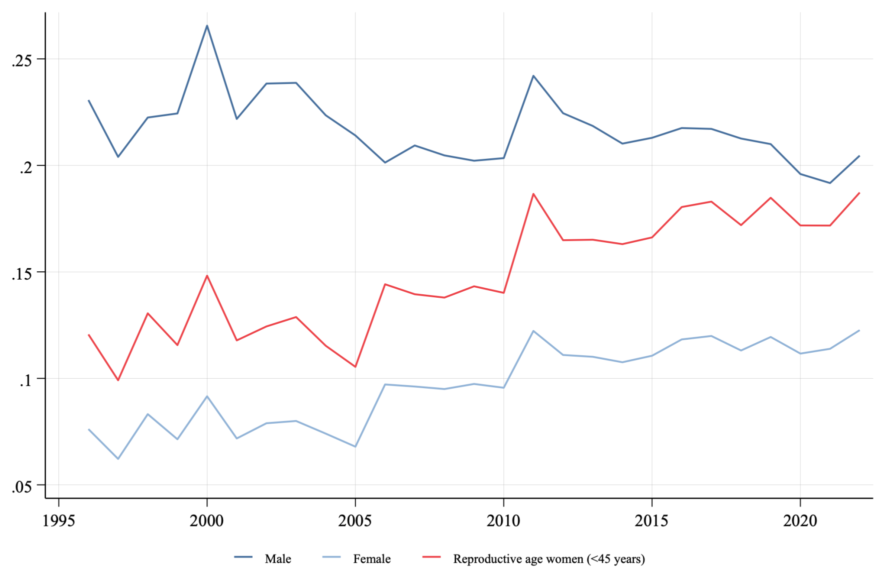

Figure 7: Binge drinking in the last 30 days indicator, CDC BRFSS, 1995-2022. Includes all U.S. states available in BRFSS sample by year. Figure shows all male, all female, and all women of reproductive age (18-44). Estimates are weighted for national representation using BRFSS sample weights.

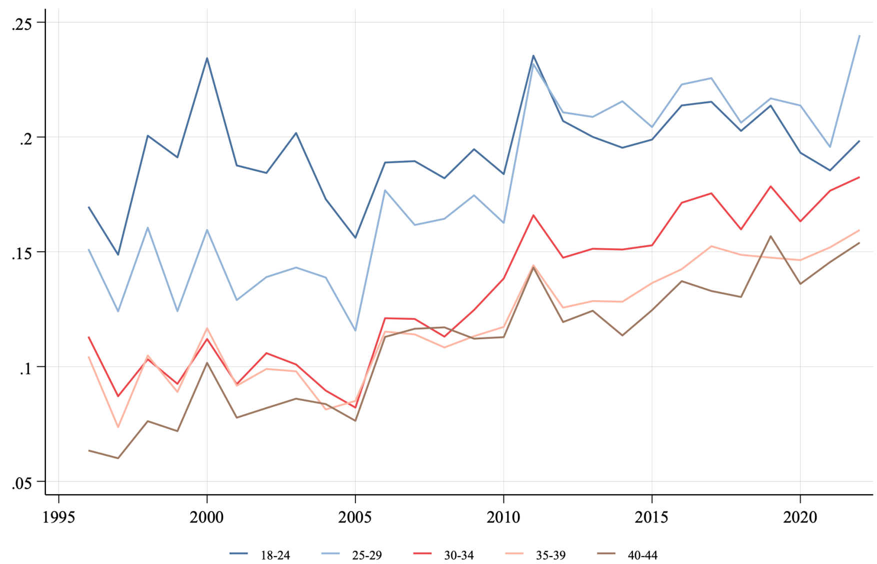

Figure 8: Binge drinking in the last 30 days indicator, CDC BRFSS, 1995-2022. Includes all U.S. states available in BRFSS sample by year. Figure shows detail for reproductive aged women by age group. Estimates are weighted for national representation using BRFSS sample weights.

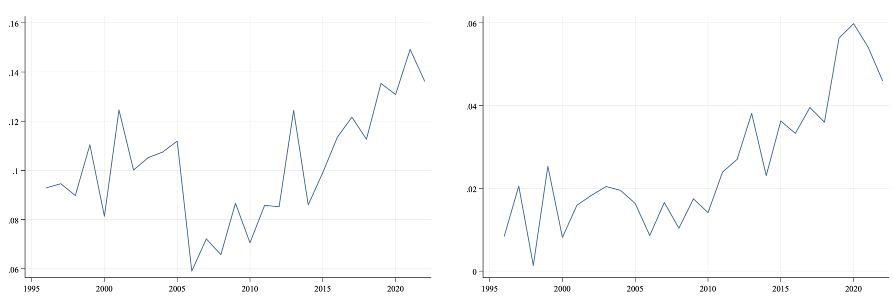

Figure 9: (Left) Any alcohol use in the last 30 days indicator, (Right) Binge drinking in the last 30 days indicator, CDC BRFSS, 1995-2022. Includes all U.S. states available in BRFSS sample by year. Figure shows women reporting they are currently pregnant. Estimates are weighted for national representation using BRFSS sample weights.

Figure 10: Drinking in the 3 months before pregnancy and drinking in the last 2 years indicators, PRAMS data, 1995-2021. Estimates are weighted using PRAMS analytic weights.

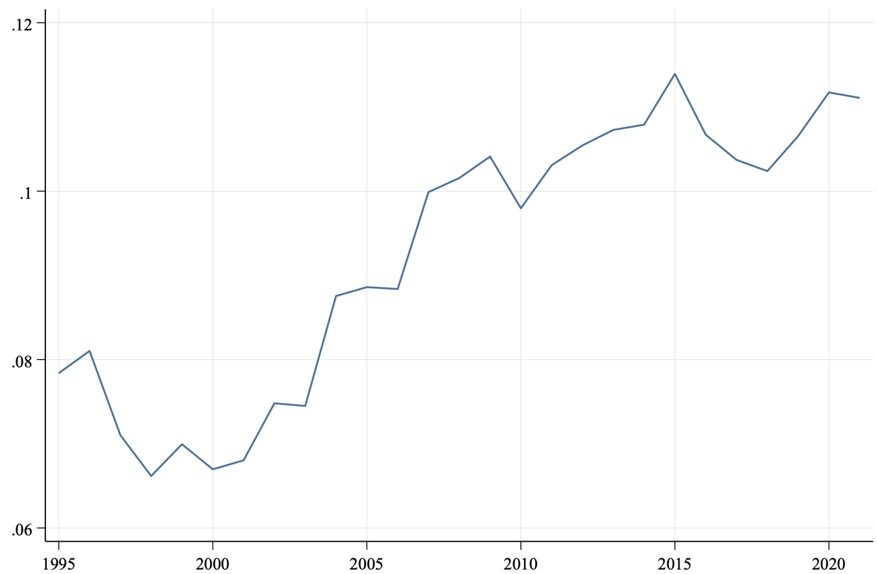

Figure 11: Drank more than 3 drinks per week in the 3 months before pregnancy indicator, PRAMS data, 1995-2021. Estimates are weighted using PRAMS analytic weights.

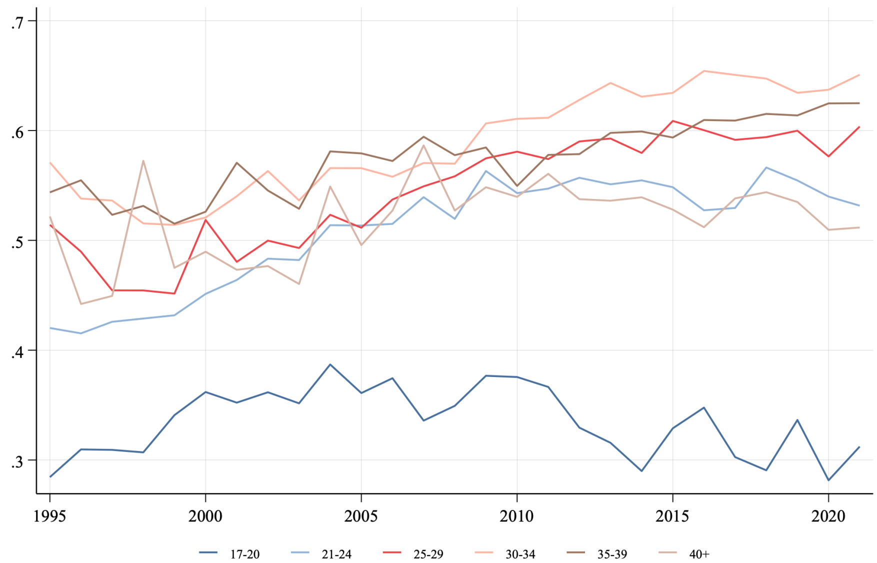

Figure 12: Drinking in the 3 months before pregnancy indicator, PRAMS data, 1995-2021. Figure shows detail for reproductive aged women by age group. Estimates are weighted using PRAMS analytic weights.

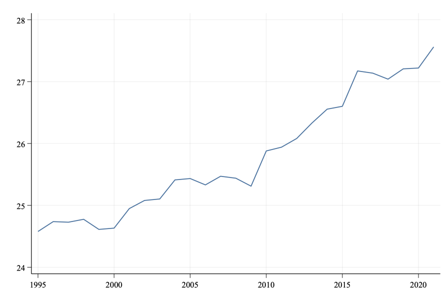

Figure 13: Age at first birth, PRAMS data, 1995-2021. Estimates are weighted using PRAMS analytic weights.

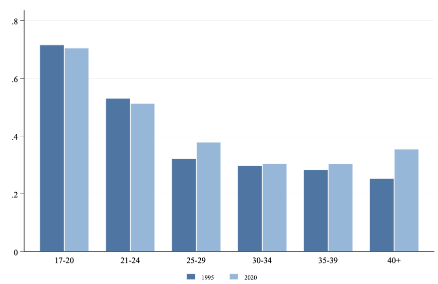

Figure 14: Rate of unintended pregnancy by age group, PRAMS data, 1995 and 2020. Estimates are weighted using PRAMS analytic weights.

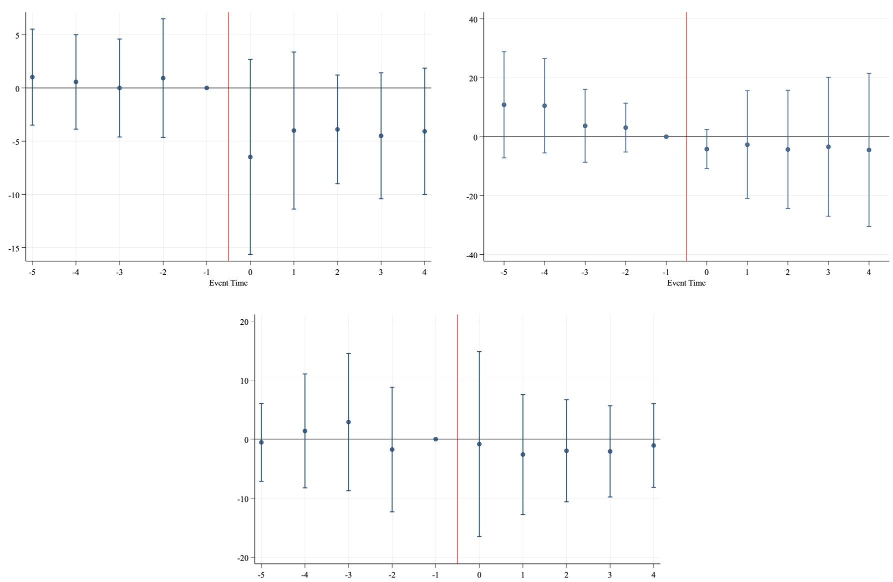

Figure 15: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on standard drinks per capita 14+, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

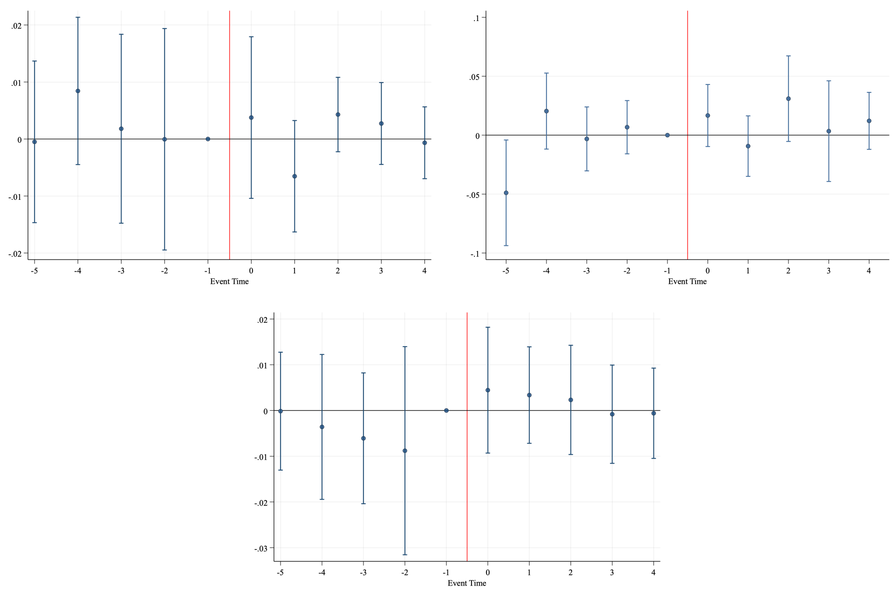

Figure 16: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on any alcohol use in BRFSS sample of women of reproductive age, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

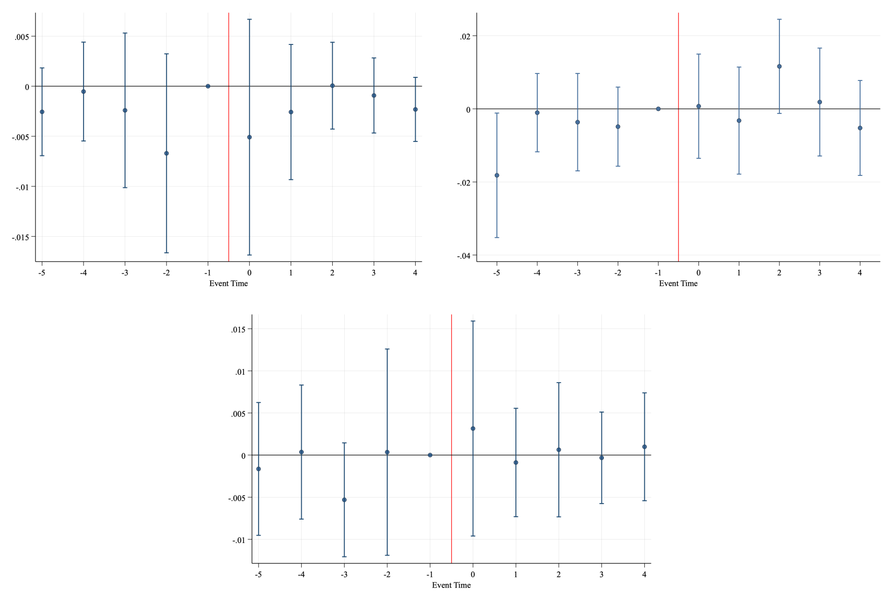

Figure 17: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on binge drinking in BRFSS sample of women of reproductive age, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

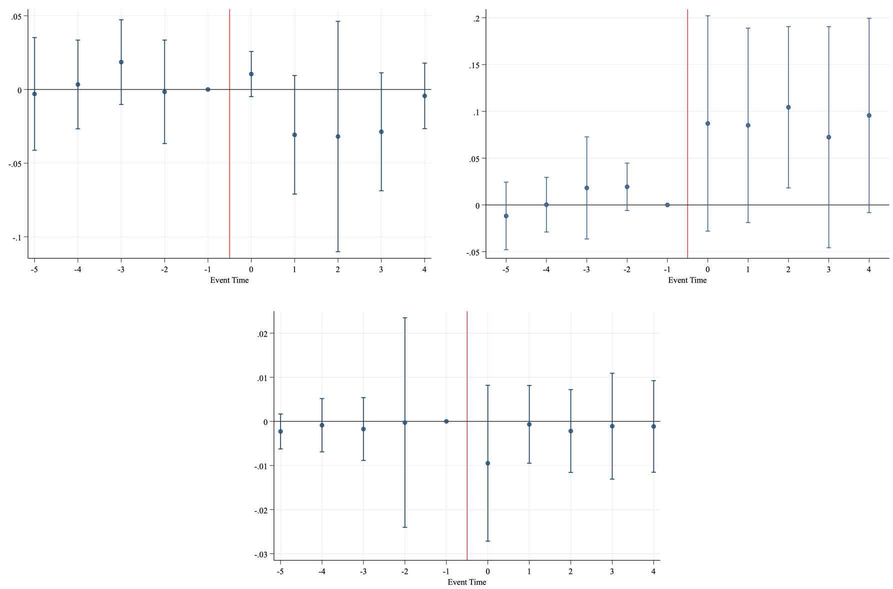

Figure 18: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on drinking in the 3 months prior to pregnancy, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

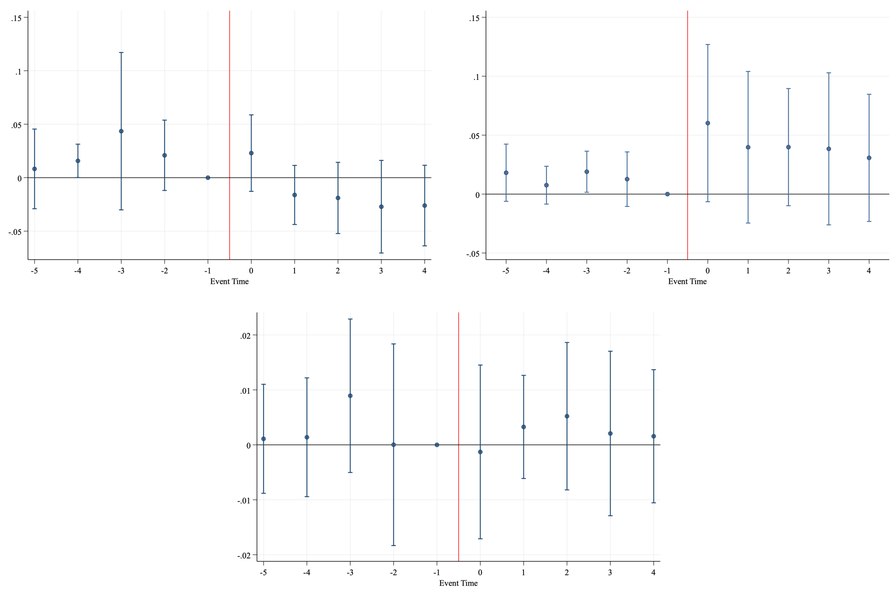

Figure 19: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on drinking more than 3 drinks per week in the 3 months prior to pregnancy, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

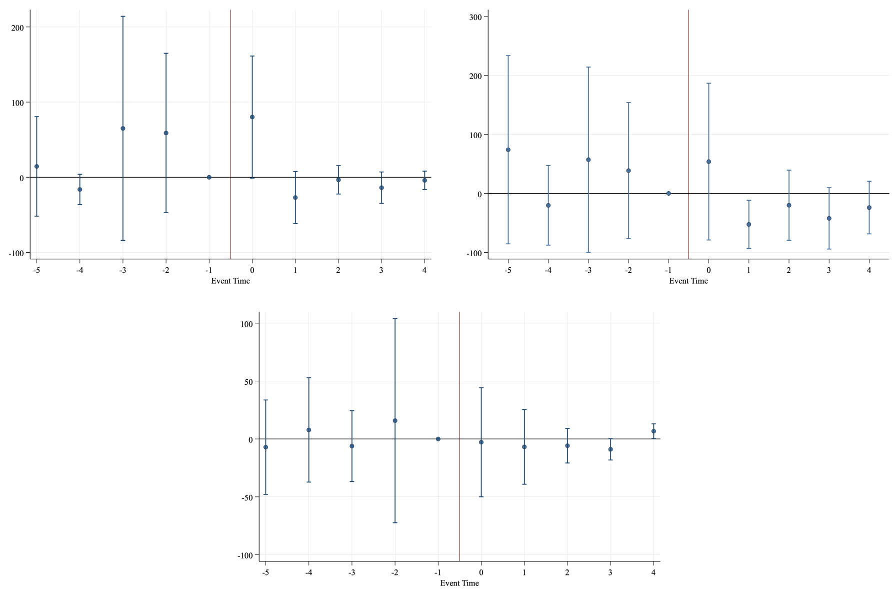

Figure 20: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on standard drinks per year in BRFSS pregnant subsample, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

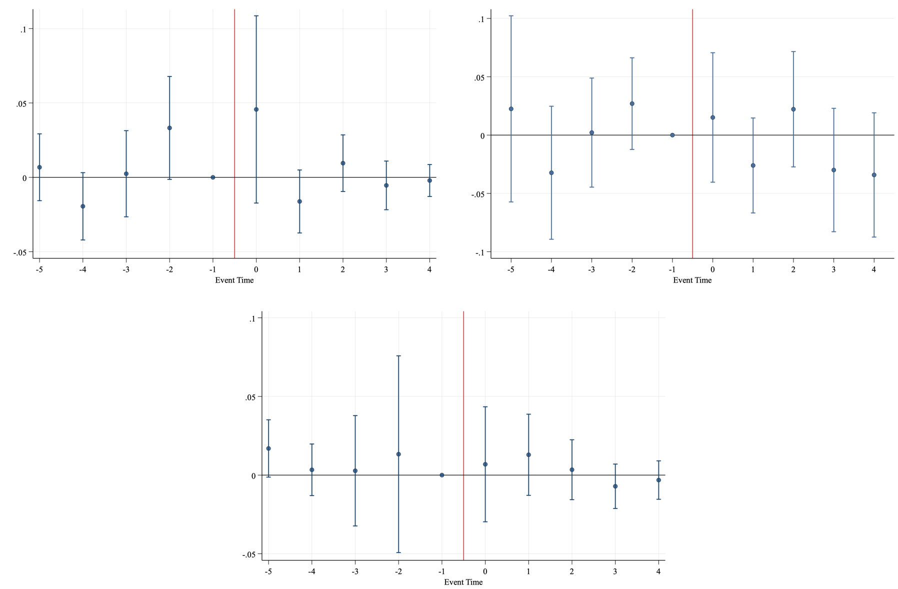

Figure 21: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on any alcohol use in BRFSS pregnant subsample, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

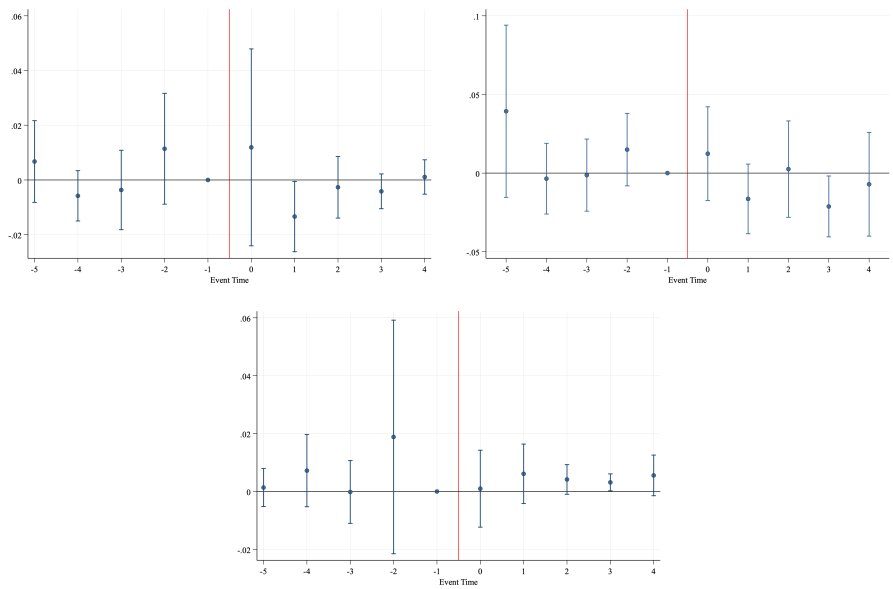

Figure 22: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on binge drinking in BRFSS pregnant subsample, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

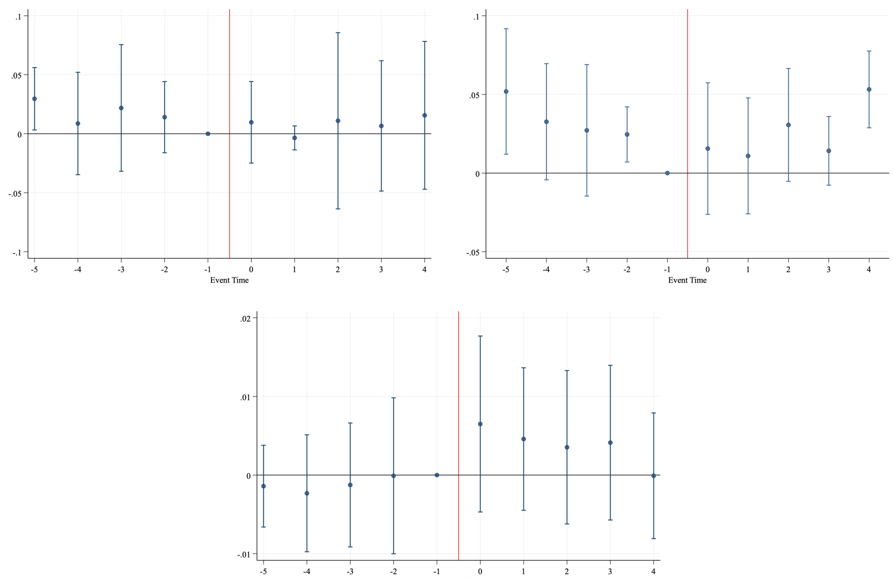

Figure 23: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on unintended pregnancy in PRAMS, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

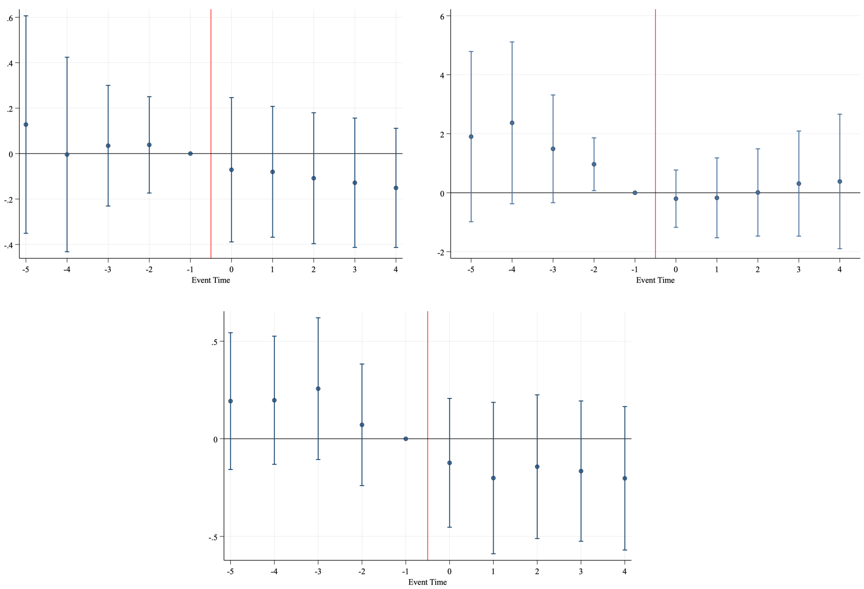

Figure 24: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on abortion rate, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

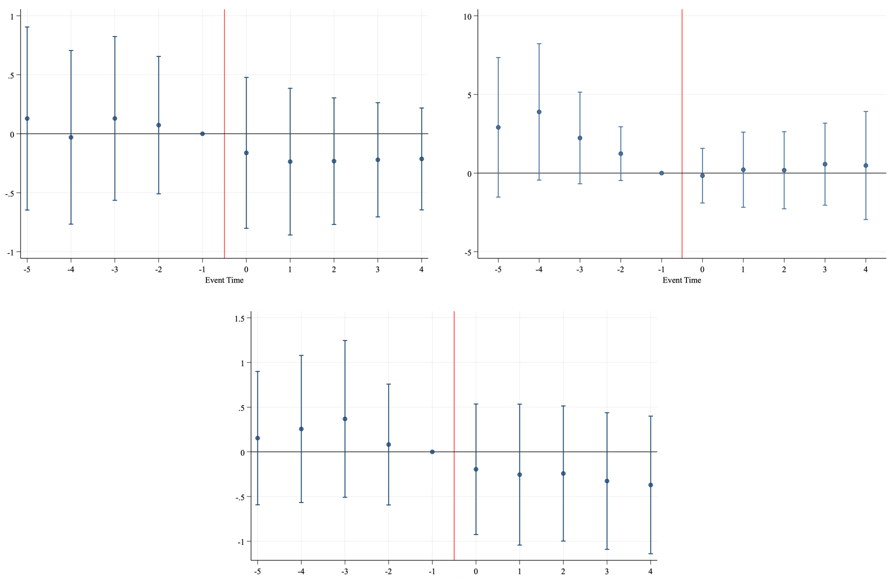

Figure 25: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on teen (15-19) abortion rate, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

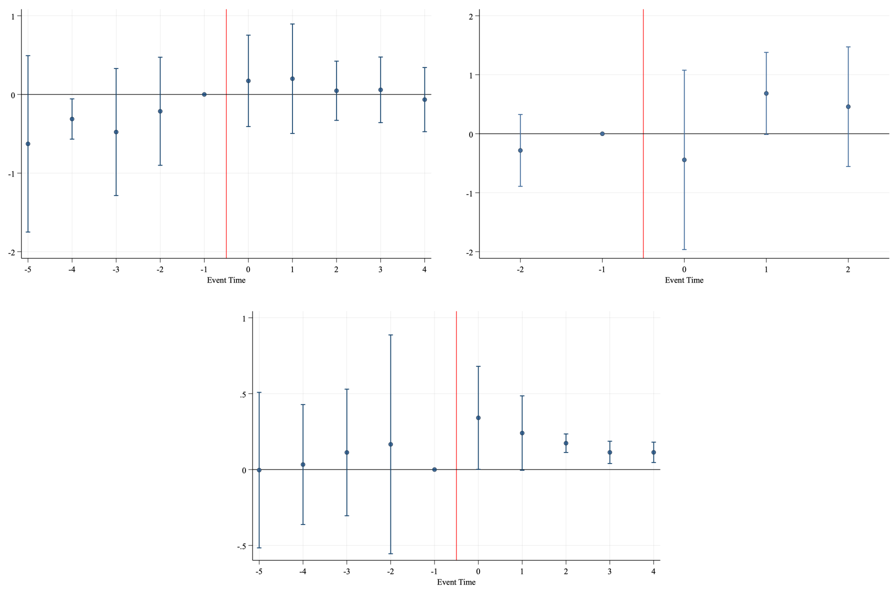

Figure 26: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on fetal deaths per 1,000 births, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

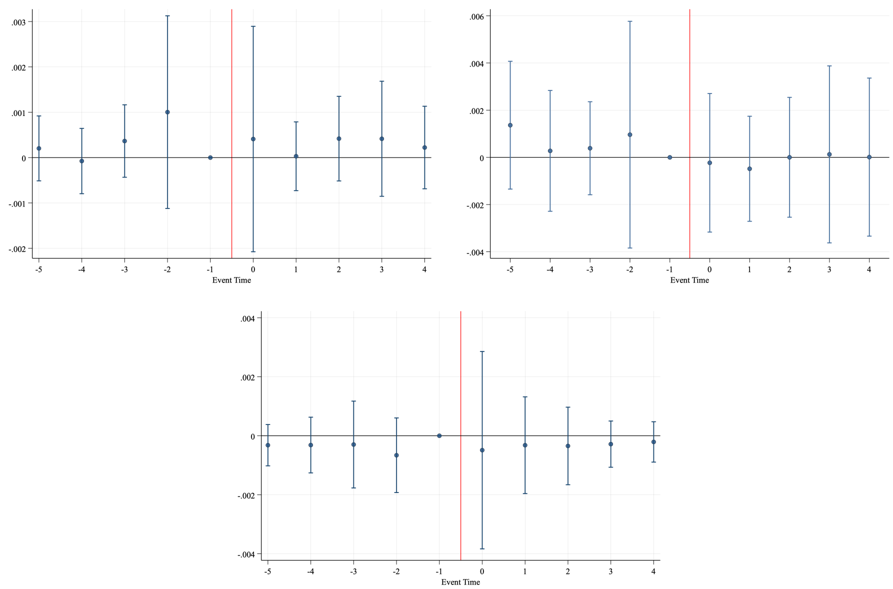

Figure 27: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on low birth weight, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

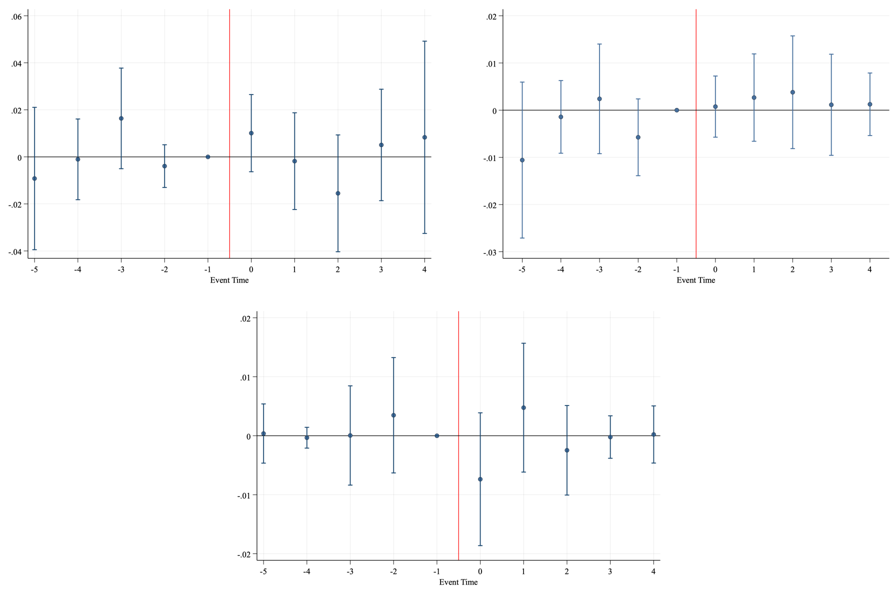

Figure 28: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on very low birth weight, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

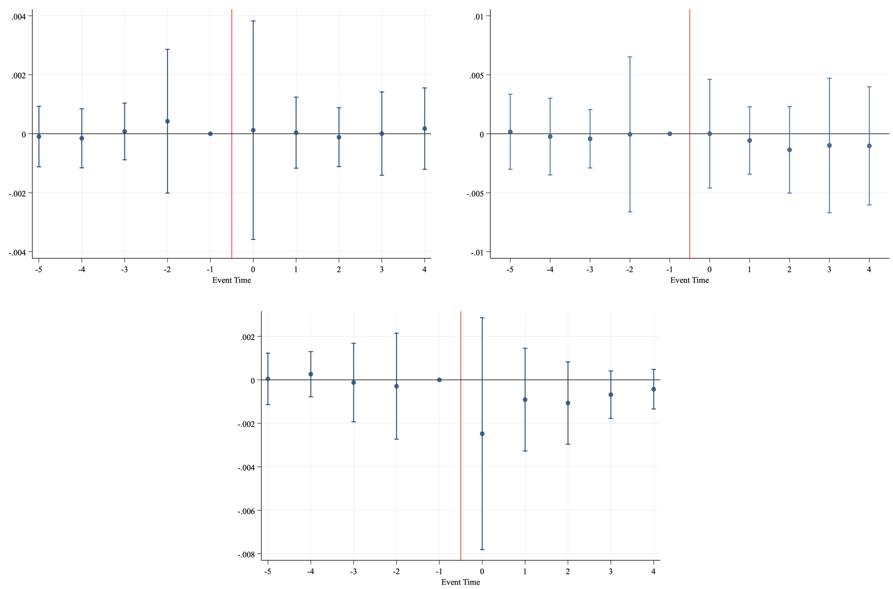

Figure 29: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on premature birth, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

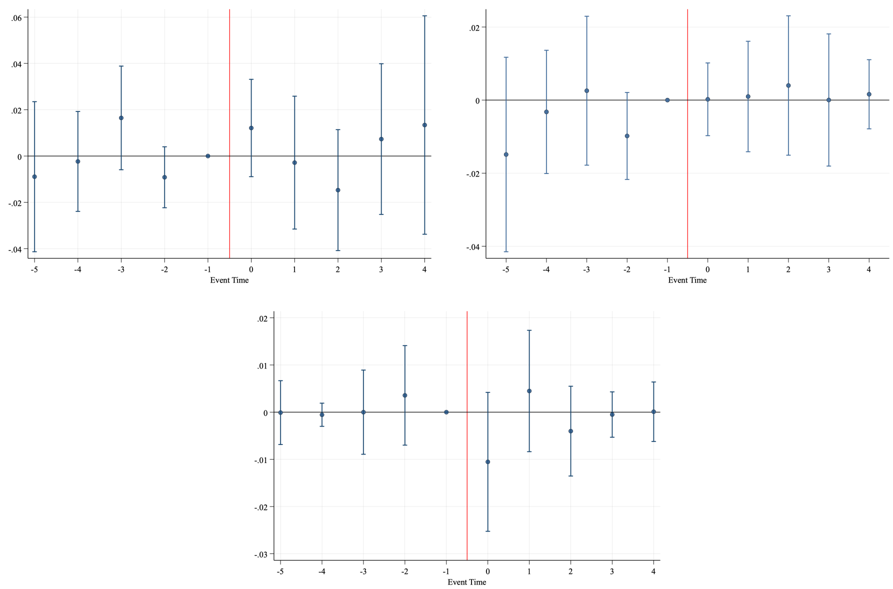

Figure 30: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on very premature birth, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

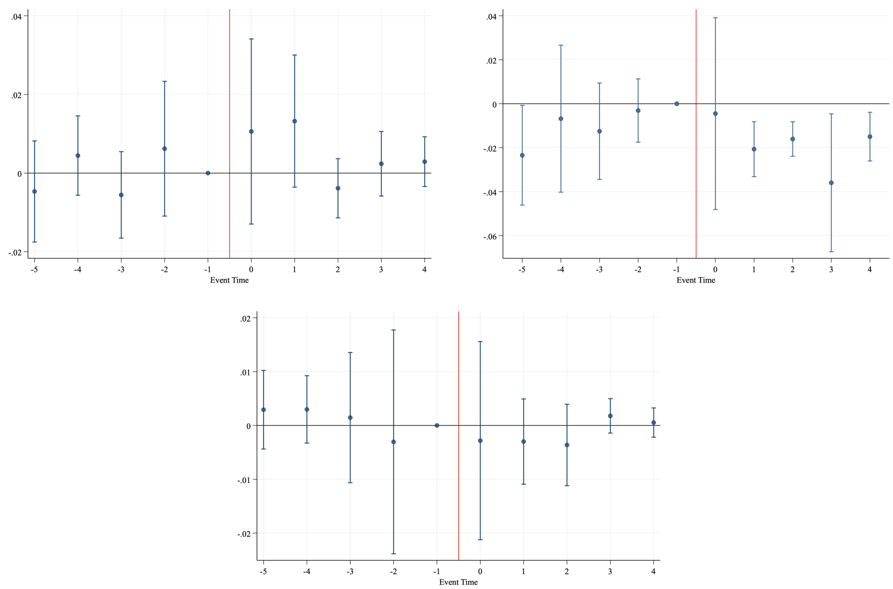

Figure 31: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on reported developmental delay, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

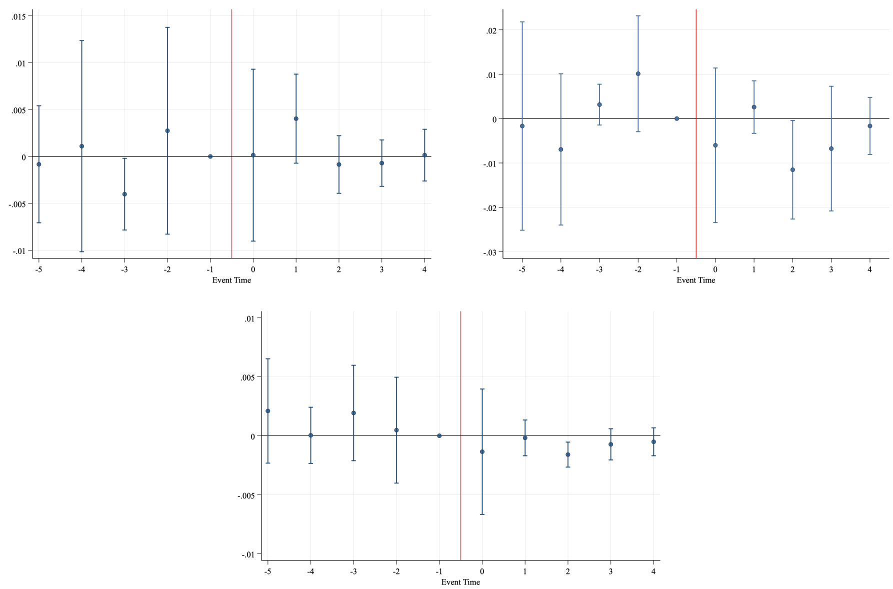

Figure 32: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on reported intellectual disability, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

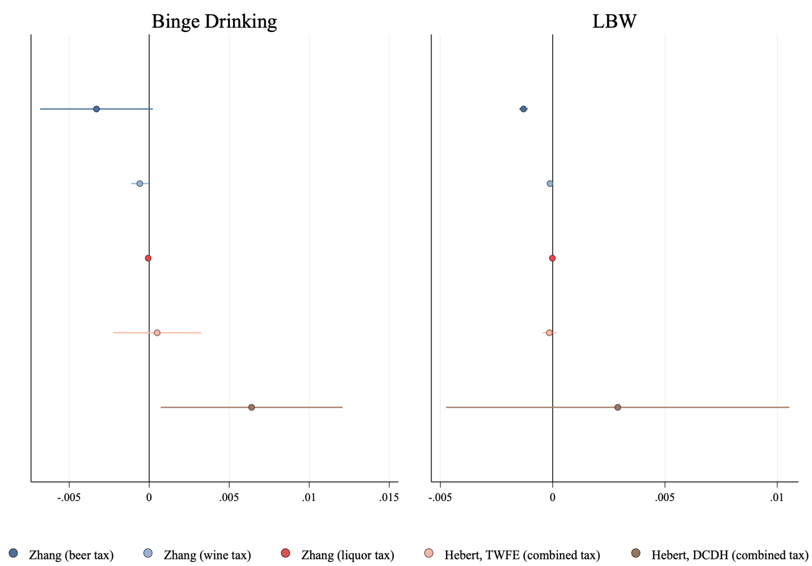

Figure 33: Binge drinking among pregnant women and low birth weight outcomes. Estimates for composite alcoholic beverage tax using TWFE and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Also includes estimates from Zhang (2010), adjusted to reflect an implied tax per standard drink value, converting the relevant tax type to weight by its ethanol content and then adjusting for one standard drink.

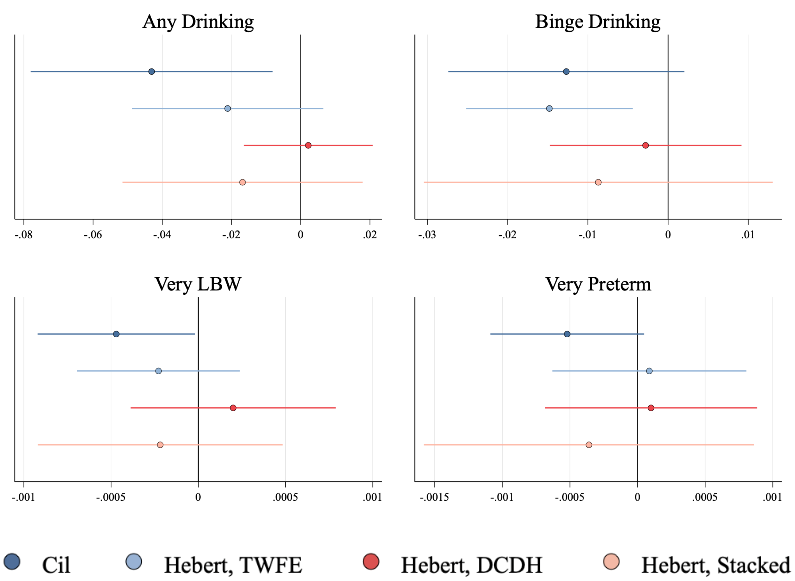

Figure 34: Any alcohol use and binge drinking among pregnant women, very low birth weight, and very preterm birth outcomes. Estimates for warning sign law passage using TWFE, De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference estimator. Also includes estimates from Cil (2017).

8 Tables

State	**Liquor Tax Change**	**Wine Tax Change**	**Beer Tax Change**
Alaska	July 2002 ($7.20)	July 2002 ($1.65)	July 2002 ($0.72)
Connecticut	July 2011 ($1.00) October 2019 ($0.54)	July 2011 ($0.12) October 2019 ($0.07)	July 2011 ($0.05)
Delaware	September 2017 ($3.00) 2021 (-$3.00)	September 2017 ($1.33) 2021 (-$1.33)	September 2017 ($0.17) 2021 (-$0.17)
D.C.	2021 ($3.00)	2021 ($1.33)	2021 ($0.17)
Illinois	September 2009 ($4.05)	September 2009 ($0.66)	September 2009 ($0.05)
Louisiana	2017 ($0.53)	2017 ($0.65)	2017 ($0.08)
Missouri		2003 ($0.06)	
Nebraska	June 2003 ($0.75)	June 2003 ($0.20)	June 2003 ($0.08)
Nevada	August 2003 ($1.55)	August 2003 ($0.30)	August 2003 ($0.07)
New Jersey	August 2009 ($1.10)	August 2009 ($0.17)	
New York		2010 ($0.11)	2004 (-$0.01) 2010 ($0.03)
North Carolina[a]		2010 ($0.20)	2010 ($0.08)
Rhode Island	July 2013 ($1.65)	July 2013 ($0.80)	July 2013 ($0.01)
Tennessee	2003 ($0.40)	2003 ($0.11)	2003 ($0.01) 2014 ($1.01) 2016 ($0.14)
Utah[a,b]			2004 ($0.05)
Washington[a]	June 2012 ($14.27)		2011 ($0.50) 2014 (-$0.50)
Wisconsin	September 2005 ($0.06)		

Table 1: Month and year of alcohol excise tax changes by type, 2000-2021. Amount of (liquor/wine/beer) excise tax change in parentheses, as documented in state's legislation. When multiple changes occur they are listed sequentially. [a] denotes liquor monopoly state. [b] denotes wine monopoly state. Note that Washington state ended its liquor monopoly in 2012, and New Hampshire ended its wine monopoly in 2023. Refer to Tax Policy Center (2023).

State	Effective Date	On-premises sale	Off-premises sale
Alaska	8/30/1989	Yes	Yes
Arizona	1/1/1992	Yes	Yes
Arkansas	7/24/2019	Yes	Yes
California	11/7/1988	Yes	Yes
Delaware	1/1/1990	Yes	Yes
District of Columbia	11/19/1985	Yes	Yes
Georgia	7/1/1986	Yes	No
Illinois	1/1/1990	Yes	Yes
Kentucky	7/14/1992	Yes	Yes
Minnesota	4/2/1996	Yes	Yes
Missouri	8/28/2001	Yes	Yes
Nebraska	2/17/1990	Yes	Yes
Nevada	10/1/2003	Yes	No
New Hampshire	8/19/1991	Yes	Yes
New Jersey	9/1/1993	Yes	Yes
New Mexico	6/14/1991	Yes	Yes
New York	4/1/1992	Yes	Yes
North Carolina	7/20/2003	No	Yes
Oregon	1/1/1992	Yes	Yes
South Dakota	7/1/1986	Yes	Yes
Tennessee	7/1/1997	Yes	Yes
Texas	9/1/2007	Yes	No
Utah	7/1/2010	Yes	Yes
Washington	8/4/1993	Yes	Yes
West Virginia	7/1/1998	Yes	Yes

Table 2: Alcohol and pregnancy point-of-sale and other location warning sign laws by state. On- and off-premises sale refers to retailers that sell alcoholic beverages either for on- or off-premises consumption, respectively. Note that Delaware and Kentucky also require posting warning signs in physician's offices. Data sourced from National Institute on Alcohol Abuse and Alcoholism (2023c) and Cil (2017).

	Mean	SD	Min	Max
All States				
Liquor	2.58	2.57	0	14.27
Beer	0.28	0.26	0.02	1.29
Wine	0.74	0.58	0	2.50
Tax per Std Drk	0.0342	0.0213	0.0095	0.1208
Non-Monopoly States				
Liquor	3.94	2.16	1.5	14.27
Beer	0.27	0.27	0.03	1.29
Wine	0.77	0.59	0.01	2.50
Tax per Std Drk	0.0339	0.0228	0.0095	0.1208

Table 3: Excise tax rates by type of alcohol in dollars, including composite tax per standard drink. 1987-2023. Top panel shows all states, while bottom panel is restricted to non-monopoly states.

	(1)		
	mean	sd	count
Unintended pregnancy	0.429	0.495	856475
Gestational age	37.718	3.061	880366
Large for gestational age	0.089	0.285	839867
Small for gestational age	0.164	0.370	839867
Infant Low Birth Weight ($<$ 2500 grams)	0.263	0.440	878877
Infant Premature Birth ($<$ 37 weeks)	0.215	0.411	880366
Infant admitted to NICU	0.207	0.405	730711
Infant deceased	0.016	0.125	862387
Drank alcohol 3 mo. before pregnancy	0.506	0.500	859210
$>$ 3 drinks/week 3 mo. before pregnancy	0.157	0.364	503630
Very low birth weight ($<$ 1500 grams)	0.056	0.230	880366
Very preterm birth ($<$ 32 weeks)	0.074	0.262	880366
17-20	0.135	0.342	880366
21-24	0.191	0.393	880366
25-29	0.277	0.447	880366
30-34	0.244	0.430	880366
35-39	0.125	0.331	880366
40 plus	0.028	0.166	880366
High school or less	0.164	0.370	880366
Some college	0.255	0.436	880366
BA or higher	0.285	0.452	880366
White	0.550	0.497	880366
Black	0.171	0.376	880366
Hispanic	0.134	0.341	880366
Other race	0.145	0.352	880366
Married	0.614	0.487	880366
Observations	880366		

Table 4: Descriptive statistics for CDC PRAMS data, 1987-2021 (Centers for Disease Control and Prevention, 2024).

	(1)		
	mean	sd	count
Any alcohol use last 30 days	0.512	0.500	1748769
Any binge drinking last 30 days	0.143	0.350	1755176
Currently pregnant	0.045	0.207	1929460
White	0.641	0.480	1992580
Black	0.122	0.327	1992580
Hispanic	0.118	0.322	1992580
Othre Race	0.120	0.325	1992580
18-24	0.248	0.432	1992580
25-29	0.173	0.378	1992580
30-34	0.203	0.402	1992580
35-39	0.186	0.389	1992580
40-44	0.190	0.392	1992580
High School or less	0.439	0.496	1992580
Some College	0.268	0.443	1992580
BA or Higher	0.293	0.455	1992580
Married	0.518	0.500	1992580
Cellphone	0.257	0.437	1992580
Observations	1992580		

Table 5: Descriptive statistics for BRFSS data, 1984-2022, women of reproductive age, using BRFSS sample weights (U.S. Department of Health and Human Services and Centers for Disease Control and Prevention, 2024).

	mean	sd	count
Abortion Rater	16.2873	8.772	1734
Teen abortion rate	17.926	13.100	1734
Observations	1734		

Table 6: Descriptive statistics for abortion data, 1988-2021, state-year cells (Maddow-Zimet and Kost, 2021, 2022).

	(1)		
	mean	sd	count
Birthweight	3301.009	74.060	2091
Apgar Score	8.848	0.131	2091
Premature	0.115	0.023	2091
Low Birth Weight	0.077	0.017	2091
Small for Gest. Age	0.097	0.016	2091
Large for Gest. Age	0.100	0.017	2091
White	0.662	0.189	2091
Black	0.133	0.132	2091
Hispanic	0.121	0.124	2091
Other Race	0.083	0.109	2091
Married	0.666	0.098	2091
18-24	0.317	0.077	2091
25-29	0.292	0.029	2091
30-34	0.233	0.050	2091
35-39	0.103	0.040	2091
40 plus	0.021	0.011	2091
High School or Less	0.476	0.148	2091
Some College	0.237	0.071	2091
BA or Higher	0.216	0.125	2091
Observations	2091		

Table 7: Descriptive statistics for NVSS Natality data, 1982-2022, state-year cells (U.S. Department of Health and Human Services et al., 2024).

	(1)		
	mean	sd	count
Fetal deaths per 1000 births	4.461	1.857	830
White	0.610	0.175	830
Black	0.135	0.118	830
Hispanic	0.160	0.123	830
Other race	0.094	0.101	830
Married	0.605	0.070	830
18-24	0.275	0.069	830
25-29	0.292	0.027	830
30-34	0.260	0.046	830
35-39	0.125	0.037	830
40 plus	0.028	0.010	830
High school or less	0.367	0.123	830
Some college	0.260	0.086	830
BA or higher	0.280	0.104	830
Observations	830		

Table 8: Descriptive statistics for NVSS Fetal Death data, 2005-2021, state-year cells (U.S. Department of Health and Human Services et al., 2024).

	(1)		
	mean	sd	count
Behavioral Problems	0.077	0.267	278713
Developmental Delay	0.066	0.249	278448
Intellectual Disability	0.011	0.103	278525
Speech Disorder	0.080	0.271	278591
Learning Disability	0.067	0.250	278603
ADD/ADHD	0.086	0.281	277665
FASD	0.002	0.049	53842
Evaluation for FASD Recommended	0.003	0.052	53798
White	0.501	0.500	279546
Black	0.132	0.339	279546
Other race	0.107	0.310	279546
Hispanic	0.260	0.438	279546
High school or less	0.286	0.452	279546
Some college	0.211	0.408	279546
BA or higher	0.498	0.500	279546
Observations	279546		

Table 9: Descriptive statistics for NSCH data, 2016-2022 (U.S. Department of Health and Human Services et al., 2024).

	(1)		
	mean	sd	count
Standard drinks per capita age 14+	509.866	121.177	2040
Tax per Std. Drink	1.045	0.533	2036
Warning Sign	0.331	0.471	2040
Cigarette Tax	0.799	0.882	2040
Smoke-free Law	0.188	0.389	2040
Vertical ID Law	0.428	0.495	2040
State Minimum Wage (Real 2022$)	8.904	1.581	2040
State Unemployment Rate	5.834	2.102	2040
State Poverty rate	12.881	3.805	2040
BAC threshold law	0.089	0.010	2040
Sunday alcohol sales limit	0.462	0.499	2040
Observations	2040		

Table 10: Descriptive statistics for state-level alcohol consumption (Slater and Alpert, 2023) and various policy variables, 1982-2021.

		(1) Std. Drk.	(2) Any Alc	(3) Binge	(4) 3mo Bef	(5) > 3 drk/wk
WS	TWFE	-19.58**	-0.00278	-0.00281	0.0197	0.0310***
		(9.591)	(0.00847)	(0.00296)	(0.0194)	(0.0104)
	DCDH	-6.4009	0.0087	0.0009	-0.0106	-0.0054
		(4.49)	(0.0095)	(0.0030)	(0.0169)	(0.0160)
	Stacked	-4.620	0.00929	0.00200	0.0839	0.0370
		(9.313)	(0.0126)	(0.00494)	(0.0599)	(0.0317)
Tax	TWFE	-7.299***	0.00485	0.00180	0.00381***	0.00208
		(2.403)	(0.00559)	(0.00161)	(0.00177)	(0.00186)
	DCDH	-2.49	0.0001	0.0061	-0.0135	-0.0098
		(6.25)	(0.0057)	(0.0095)	(0.0156)	(0.0200)
Mean of Dep. Var.		509.9	0.514	0.145	0.545	0.190

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Full sample estimated effects on primary drinking outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Standard drinks per capita 14+ comes from NIAAA data; indicators for any alcohol use in the last 30 days and any binge drinking in the last 30 days come from BRFSS. Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. NIAAA regressions do not include demographic covariates. Standard errors are clustered at the state level.

		(1) Std. Drk.	(2) Any Alc	(3) Binge
WS	TWFE	-42.66***	-0.0211	-0.0148***
		(14.78)	(0.0141)	(0.00530)
	DCDH	-2.9171	0.0022	-0.0028
		(10.646)	(0.0095)	(0.0061)
	Stacked	-24.36	-0.0168	-0.0087
		(22.79)	(0.0177)	(0.0111)
Tax	TWFE	-4.028	0.0019	0.0005
		(3.848)	(0.0042)	(0.0014)
	DCDH	-4.2672	0.0003	0.0064**
		(6.3191)	(0.0112)	(0.0029)
Mean of Dep. Var.		53.34	0.113	0.0247

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 12: Pregnant subsample estimated effects on primary drinking outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Standard drinks per year, indicators for any alcohol use in the last 30 days, and any binge drinking in the last 30 days come from BRFSS. Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

		(1) Unintended	(2) Abortion	(3) Abortion (Teen)
WS	TWFE	-0.0097	-0.905	-0.397
		(0.0134)	(0.906)	(1.642)
	DCDH	0.0160	-0.1799	-0.3244
		(0.0467)	(0.2032)	(0.3628)
	Stacked	0.0272**	0.199	0.406
		(0.0113)	(0.731)	(1.160)
Tax	TWFE	-0.0027	-0.408**	-0.544*
		(0.0018)	(0.171)	(0.330)
	DCDH	0.0039	-0.2628	-0.4593
		(0.0055)	(0.2721)	(0.5779)
Mean of Dep. Var.		0.415	15.80	17.53

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 13: Full sample estimated effects on pregnancy-related outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Unintended pregnancy indicator comes from PRAMS data. Abortion rate data from Maddow-Zimet and Kost (2021, 2022). Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

		(1) Stillbirth	(2) XLGA	(3) XSGA	(4) LBW	(5) VLBW	(6) Preterm	(7) V Preterm	(8) APGAR
WS	TWFE	0.555	-0.000515	0.000487	0.000259	-0.000228	0.000658	0.0000874	0.0165
		(0.515)	(0.000710)	(0.000689)	(0.000678)	(0.000238)	(0.00101)	(0.000366)	(0.0178)
	DCDH	0.075	-0.0002	0.0001	0.0004	0.0002	0.0001	0.0001	0.0026
		(0.2658)	(0.0002)	(0.0003)	(0.0007)	(0.0003)	(0.0009)	(0.0004)	(0.0031)
	Stacked	0.104	-0.000281	0.000601	-0.000378	-0.000218	-0.00113	-0.000359	0.00543
		(0.276)	(0.00152)	(0.00158)	(0.00106)	(0.000358)	(0.00150)	(0.000623)	(0.00835)
Tax	TWFE	0.142***	0.000499	-0.000293	-0.000145	-0.0000259	-0.0000625	0.0000427	0.00337
		(0.0504)	(0.000349)	(0.000196)	(0.000160)	(0.0000549)	(0.000221)	(0.0000905)	(0.00301)
	DCDH	0.2387***	-0.0002	0.0004	-0.0004	-0.0002	-0.0012	-0.0007	0.0004
		(0.0493)	(0.0003)	(0.0006)	(0.0008)	(0.0004)	(0.0011)	(0.0007)	(0.0040)
Mean of Dep. Var.		4.461	0.1000	0.0968	0.0764	0.0134	0.114	0.0252	8.852

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 14: Full sample estimated effects on pregnancy-related outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Stillbirth data comes from CDC WONDER (U.S. Department of Health and Human Services et al., 2024). Other outcomes taken from NVSS Natality data (NCHS, 2024). Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

		(1) **B. Prob**	(2) **Dev. Delay**	(3) **Int.**	(4) **Speech**	(5) **Learn**	(6) **ADD/ADHD**	(7) **FASD**	(8) **FASD Eval**
WS	TWFE	0.00617	0.00576	0.00195	0.00415	0.0141**	0.0251**	0.00124	0.00251
		(0.00531)	(0.00567)	(0.00284)	(0.00597)	(0.00681)	(0.0113)	(0.00265)	(0.00319)
	DCDH	0.0000	0.0049	0.0004	-0.0033	0.0013	0.0094	-0.0001	0.0007
		(0.0051)	(0.0050)	(0.0020)	(0.0052)	(0.0065)	(0.0107)	(0.0005)	(0.0018)
	Stacked	0.0257	-0.0156	-0.00379	-0.0101	0.00401	0.00195	-0.000510	0.00328
		(0.0203)	(0.00967)	(0.00434)	(0.0104)	(0.0107)	(0.0126)	(0.00207)	(0.00242)
Tax	TWFE	-0.00190*	-0.0000250	0.000321	-0.00113	-0.000490	-0.000403	-0.000253	0.000567**
		(0.000963)	(0.000500)	(0.000544)	(0.000709)	(0.00128)	(0.00162)	(0.000470)	(0.000276)
	DCDH	-0.0050	-0.0011	-0.0012*	-0.0030	-0.0053	-0.0028	0.0000	0.0017
		(0.0047)	(0.0037)	(0.0007)	(0.0038)	(0.0055)	(0.0052)	(0.0012)	(0.0019)
Mean of Dep. Var.		0.0741	0.0648	0.0104	0.0724	0.0647	0.0850	0.00275	0.00285

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Full sample estimated effects on pregnancy-related outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Outcomes taken from NSCH: Behavioral Problems, Developmental Delay, Intellectual Disability, Speech Disorder, Learning Disability, ADD/ADHD, FASD, Evaluation for FASD Recommended by Physician (U.S. Department of Health and Human Services et al., 2024). Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

A Extended Data Description

A.1 PRAMS

For thorough information on pregnancy and health, I use the restricted-access Pregnancy Risk Assessment Monitoring Survey (PRAMS) data (Centers for Disease Control and Prevention, 2024).[41] This survey began in 1987 and runs annually in the U.S. in participating states, with a larger number of states participating over time. As of 2020, 40 states and the District of Columbia met the required response rate criteria for inclusion in the data set.[42] The PRAMS survey typically has between 1000 and 3000 observations per state per year. Any state whose survey response rate falls below 50%[43] for the year in question is not included in the data set.

The survey questionnaire is updated every few years by the CDC, most recently in 2016 with the introduction of PRAMS Phase 8, and individual states also offer state-specific survey addenda. Questions in the PRAMS cover details about a variety of topics including prenatal care and health behaviors, prior pregnancy, family history, and infant care.[44]

The alcohol-related outcomes in PRAMS include: drank in the three months before pregnancy, drank in the last three months of pregnancy, and drank in the last two years (prior to the survey). For the first two, the data includes binary variables as well as a categorical number of drinks per week. I use this latter variable to construct an expected number of drinks per week variable for each outcome, so that I can measure changes along the extensive margin. It is important to note that these are self-reported outcomes that cannot be verified

[41] See table 4.

[42] At present, Connecticut, Florida, North Carolina, Oklahoma, and Texas are not participating in the restricted data disclosure portal via CDC. I am reaching out to these states individually for potential data access.

[43] This threshold was higher prior to 2018.

[44] For further details on PRAMS methodology and design, refer to Shulman et al. (2018).

with any biomarker for substance use. Moreover, the variables for drinking during pregnancy are omitted from approximately half of participating states' questionnaires post-2015.

Concerning demographics, the data includes categories for Asian, Native American, and Native Hawaiian. Mother's age is a continuous variable (with some imputation needed for certain states). Marital status is either married or unmarried. Maternal education is coded in five categories: less than 8th grade, 9-12th grade without diploma, high school graduate, some college without degree, and bachelor's degree or higher. I use a four category race variable (white, black, other, and Hispanic), plus three levels of mother's education: high school or less, some college, and BA or higher. Observations missing these demographic details are omitted from the analysis.

Both Alaska and Vermont omit the birth month from PRAMS reporting. Consequently, I label births from these states as taking place in the middle of the year of birth. I code gestation timing using the same approach as Currie and Rossin-Slater (2013).

A.2 BRFSS

Alcohol use and binge drinking incidence among the general population and self-reported pregnant women comes from CDC BRFSS, 1984-2022 (U.S. Department of Health and Human Services and Centers for Disease Control and Prevention, 2024).[45] I use the same race and education categories as those for PRAMS, but the age bins in BRFSS mean that 18-25 year old individuals are in a single group. I use a standard drinks measure as well, but due to changes over time in its reporting and number of unreliable observations, it is not part of the main specification. I drop observations missing demographic covariates from the analysis.

[45] See table 5.

A.3 Abortion Data

Data on abortion rates and policies are sourced from the Guttmacher Institute data center.[46] In particular, abortion rate data are taken from Maddow-Zimet and Kost (2021, 2022). These range from 1988-2020, with 1-3 year gaps in the early years of the data. In these cases I linearly interpolate the abortion rate by state. County abortion provider data is taken from Frost et al. (2016). Concerning policies, minimum waiting period laws come from Myers (2021), parental involvement laws from Myers and Ladd (2020), and targeted restrictions on abortion providers (TRAP laws) from Jones and Pineda-Torres (2024).

A.4 NVSS Natality

Data on state-level births comes from the restricted-access Natality Detail Files via the Centers for Disease Control (CDC), the National Vital Statistics Service (NVSS), and the National Center for Health Statistics (NCHS) from 1982-2022 (NCHS, 2024).[47] These data come from U.S. birth certificate records, and provide a full record of all births recorded on birth certificates in the U.S. in that time period.

These data contain a host of useful information at the individual level. In 2003, birth certificate coding was revised by NVSS, and these revisions were adopted by individual states from 2004 to 2015. For the purposes of this study, relevant information is coded with sufficient consistency across the original and revised birth certificates.

In particular, data on alcohol use listed on birth certificates is known to be unreliable and substantially underreported (Northam and Knapp, 2006). Consequently, although the data has excellent demographic detail and health data concerning natality, it does not have information on alcohol consumption

[46] See table 6.
[47] See table 7.

to act as a proper first stage.

In this data, I code race with four categories: non-Hispanic white, non-Hispanic black, Hispanic, and missing/other. I code marital status as either married, unmarried, or other. Mother's age can be continuous, but I also employ categorical breakdowns in my compositional analysis below. I also include birth order (first or second plus) to stratify the data. Regarding gestation timing, I rely on the method used in Currie and Rossin-Slater (2013). Observations missing demographics covariates are dropped from the analysis.

A.5 NVSS Fetal Death

Data on fetal deaths from 2005-2022 is taken from CDC WONDER (U.S. Department of Health and Human Services et al., 2024).[48] I use the same four-category race variable as in the natality data, along with age bins and marital status. The outcomes are presented in fetal deaths per 1,000 births.

A.6 National Survey of Children's Health

Childhood outcome data that may be related to FASD is taken from the National Survey of Children's Health, 2016-2022 (U.S. Department of Health and Human Services et al., 2024).[49] The survey covers children up to age 17, so this provides a substantial range of imputed birth years for analysis from 1999 to 2021. Using the detail surveys, I use a four-category race variable as well as mother's education.

The outcomes listed are those which may be impacted by FASD. In particular, they are: behavioral problems, developmental delay, intellectual disability, speech disorder, learning disability, ADD/ADHD diagnosis, and in the final survey year both FASD diagnosis and evaluation for FASD recommended by a

[48] See table 8.

[49] See table 9.

health care provider.

It is important to note that the identifying assumption in this data is that individuals have not relocated to another state after giving birth to their child, which certainly introduces the possibility of bias. If we assume the policies do reduce FASD and related conditions, then individuals moving from policy-implementing states to non-policy-implementing states after giving birth would bias the estimates downward, and the same would be true of individuals moving the other way.

B Correlations Between Alcohol Use and Birth Outcomes

To investigate the correlation between first trimester alcohol use and birth outcomes, I use the rate of drinking three months prior to pregnancy along with the rate of drinking during the last trimester. The PRAMS also has a categorical intensive margin variable for these variables, with levels of drinks per week: 0, less than 1, 1-3, 4-6, 7-13, more than 14. I regress these outcomes on the drinking status indicators using PRAMS analytic weights and state and year fixed effects. I also include the following control variables: marital status, education, age, and race. About 10% of the sample reports drinking more than 3 drinks per week in the three months prior to pregnancy. Per the PRAMS, the average alcohol consumption in this group is about 7 drinks per week, or 365 drinks per year. From the NIAAA data above, if we assume 500 standard drinks per person and two-thirds of households drinking at all, then about 750 standard drinks per person would be the average consumption. The 365 reported drinks may be an underestimate, as one drink is likely to be more than a single standard drink. It is certain that there is considerable heterogeneity among women in this group. About 6.5% of the sample reports drinking in the third trimester, with about 5.5% of that subgroup reporting more than 3 drinks oer week.

Tables C.2 and C.3 show outcomes for the simple binary drank/did not drink three months prior to pregnancy. We show significant but small effects, some of which are counterintuitive. For example, gestational age is slightly higher, low birth weight incidence is slightly lower, and premature birth incidence is slightly lower for the group which reports drinking. These are small effects, but it is important to keep in mind that these only reflect live births and not miscarriages. If drinking does increase the incidence of spontaneous abortion, those women who are drinking in the first trimester would be less likely to be represented in the data. When we control for demographic factors, we see an increase in the rate of unintended pregnancy of 11.2% from the non-drinking group.

When we examine women who report drinking more than three drinks per week in the three months before pregnancy in tables C.4 and C.5, we find a much stronger difference from the non-drinkers. Unintended pregnancy shows a 19.2% increase, considerably higher than even the 11.2% in the any drinking sample. Interestingly, infants are 14.9% less likely to be large for gestational age and 10% more likely to be small for gestational age for the mothers who report this drinking intensity. So despite showing longer gestation, lower incidence of low birth weight, and lower incidence of preterm birth, these infants demonstrate significant markers for developmental issues related to alcohol use.

Turning to the last trimester, tables C.6 and C.7 show results for drinking in the last trimester. We see 9.2% higher rate of unintended pregnancy, 12.4% lower likelihood of being large for gestational age, and 6.8% higher likelihood of being small for gestational age. They are also slightly less likely to be preterm or low birth weight, as in the 3 months prior to pregnancy group.

When we examine women who report drinking more than 3 drinks per week in the last trimester (tables C.8 and C.9), we see an increase in unintended pregnancy of 20.2%. In addition, we see insignificant but negatively signed coefficients for gestational age. Infants are 28% less likely to be large for gestational age, and 30% more likely to be small for gestational age. They are 36% more likely to be low birth weight, and 10.7% more likely to be admitted to the NICU.

These correlations imply strong negative effects on birth outcomes. If we assume that misreporting (biased downward) of self-reported drinking can be correlated with negative health outcomes of the infant, it could be the case that these underestimate the real effect. In addition, it is important to recall that these results are from a survey of women who have carried pregnancy to term. Based on this selection, it is likely that the true effect on unintended pregnancy may be even higher when accounting for intentional abortion as well as spontaneous abortion.

C Additional Figures and Tables

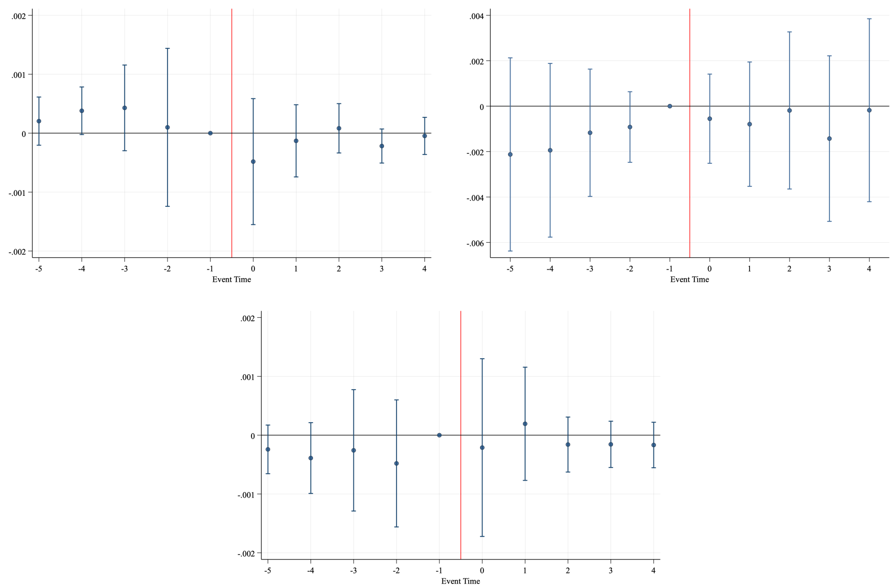

Figure C.1: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on extra large for gestational age, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

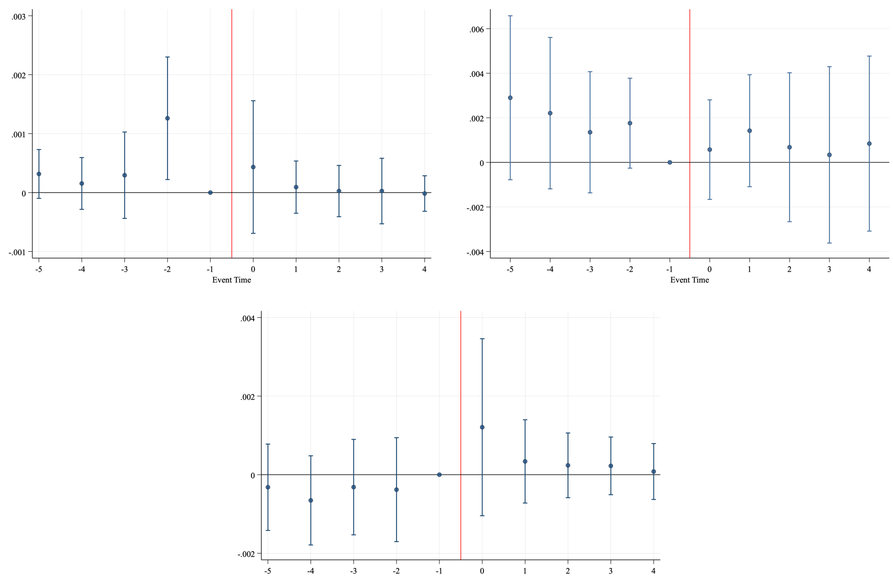

Figure C.2: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on extra small for gestational age, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

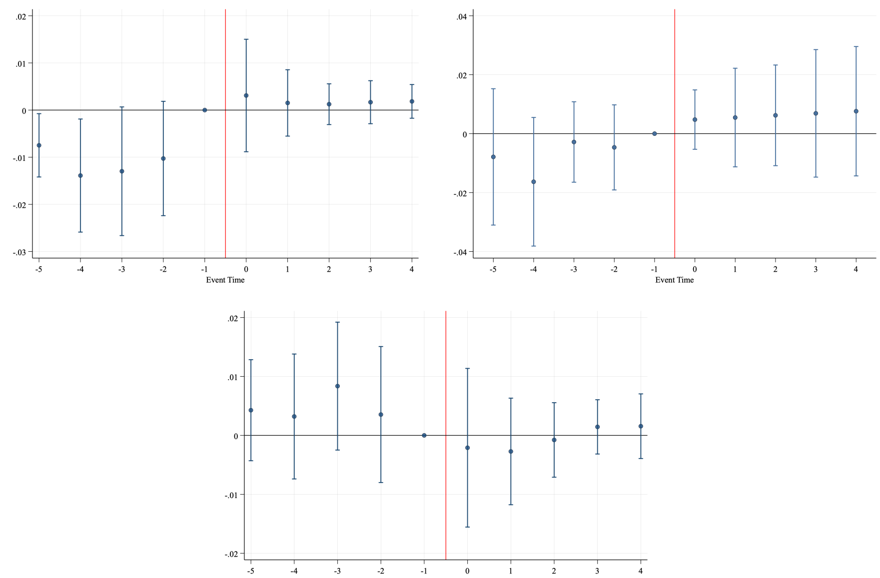

Figure C.3: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on APGAR5 score, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

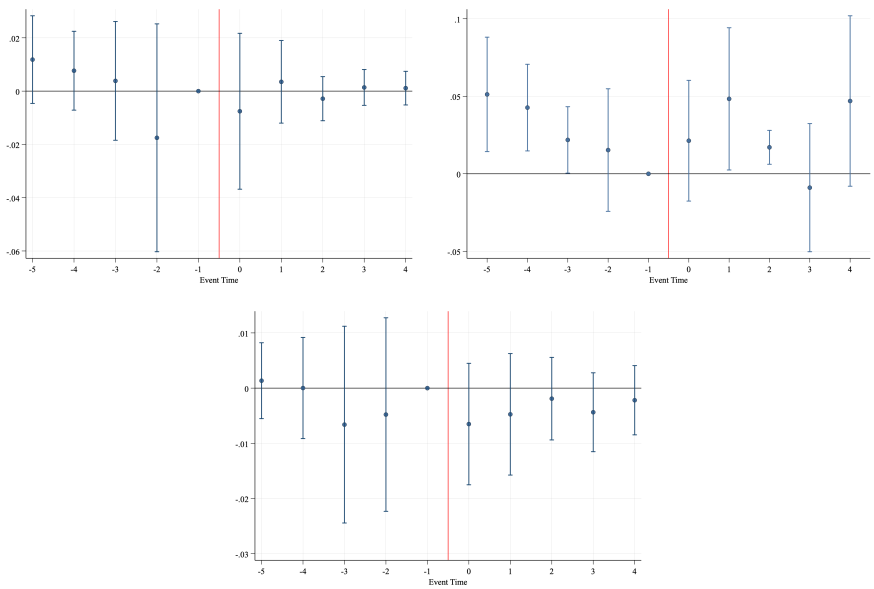

Figure C.4: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on reported behavioral problems, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

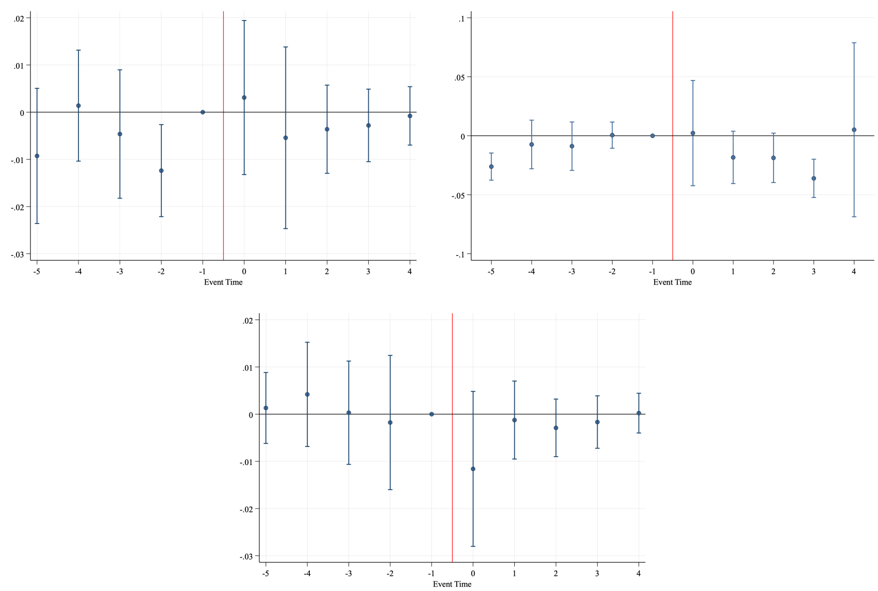

Figure C.5: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on reported speech disorder, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

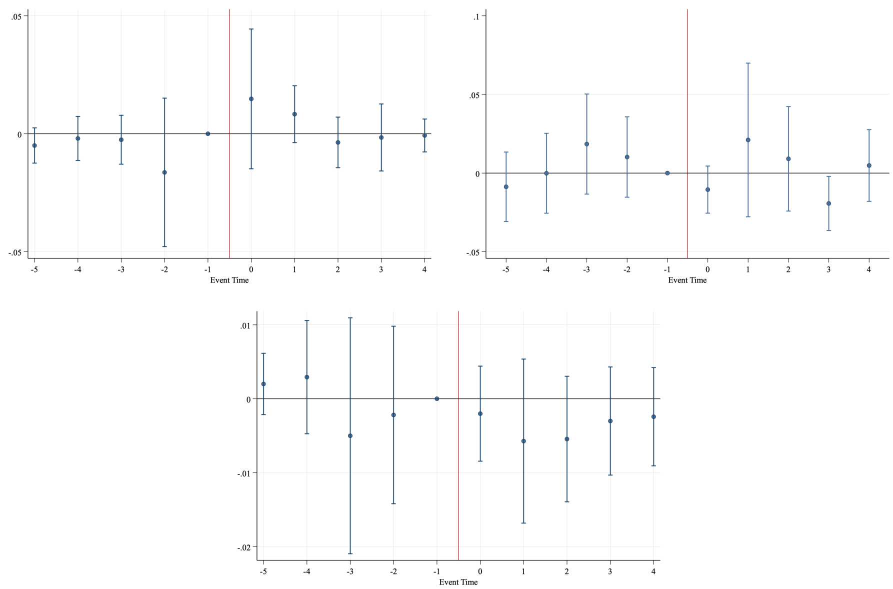

Figure C.6: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on learning disability, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

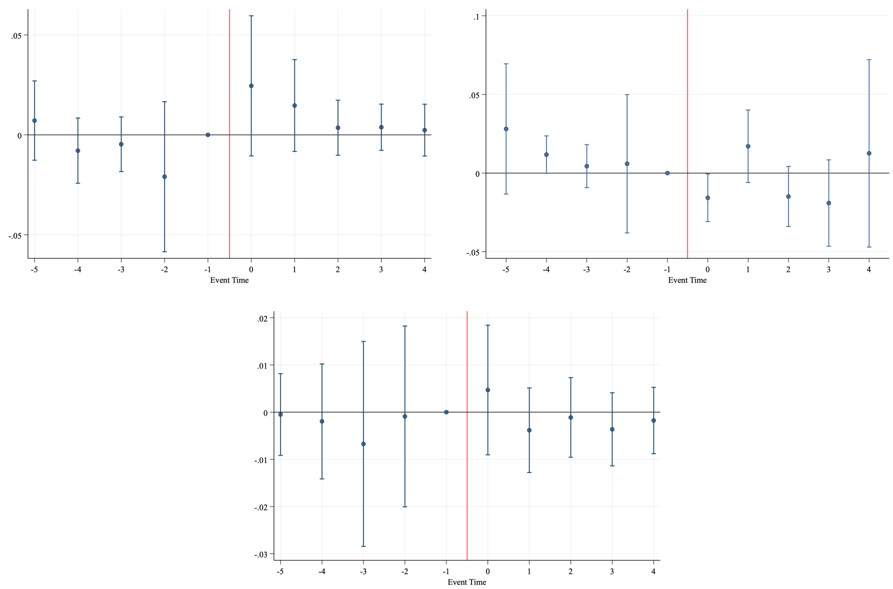

Figure C.7: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on ADD/ADHD, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

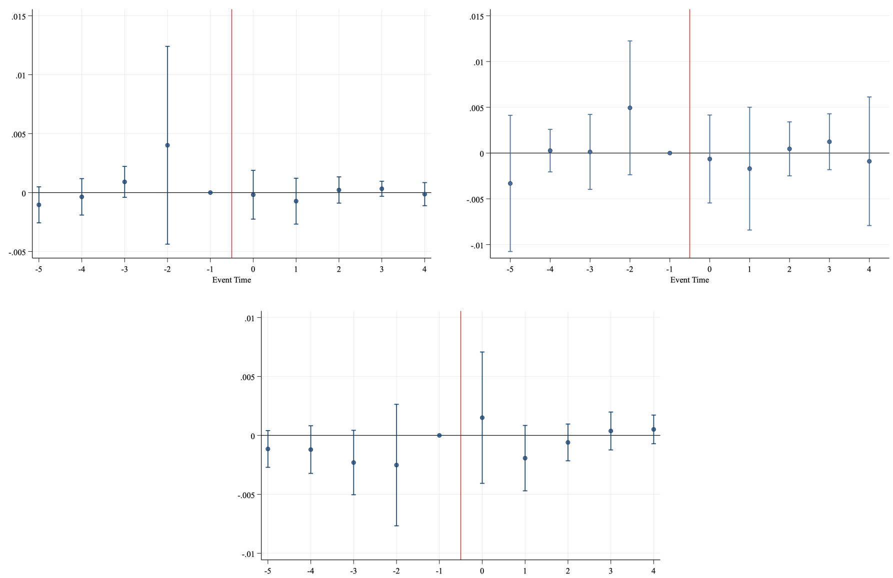

Figure C.8: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on FASD, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

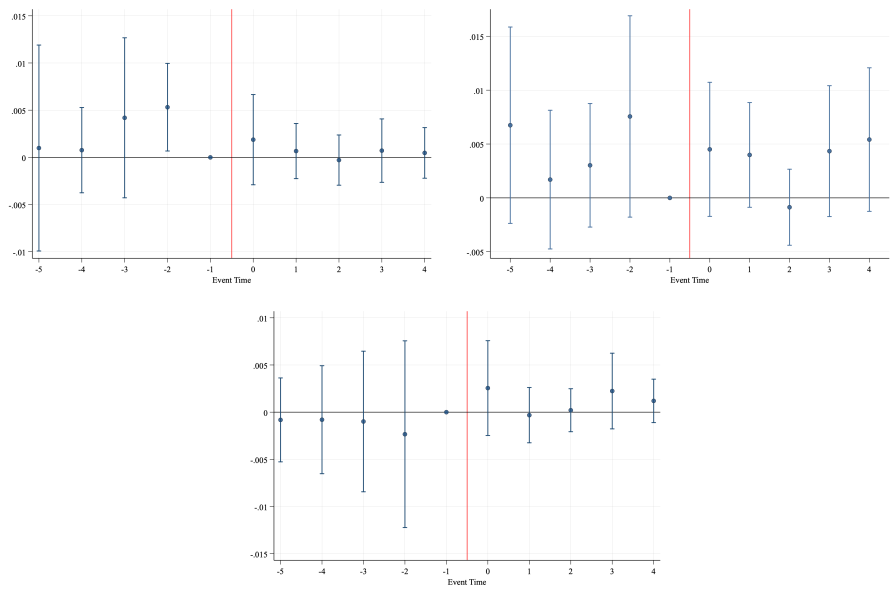

Figure C.9: Event study, warning sign law passage (top) and composite alcoholic beverage tax (bottom), effect on recommendation for FASD evaluation, using De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH) and Wing et al. (2024) stacked difference-in-difference estimator. Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

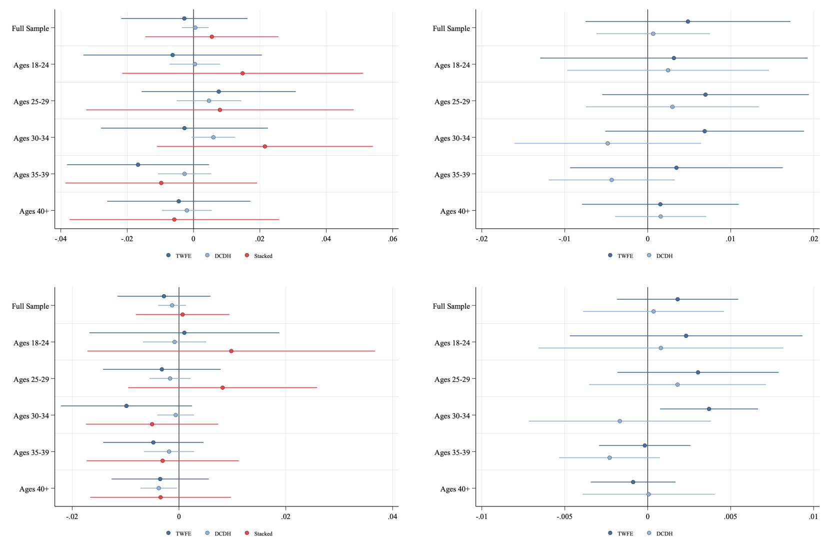

Figure C.10: Estimated effects stratified by age group, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on any alcohol use in the last 30 days (top) and any binge drinking in the last 30 days (bottom), using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

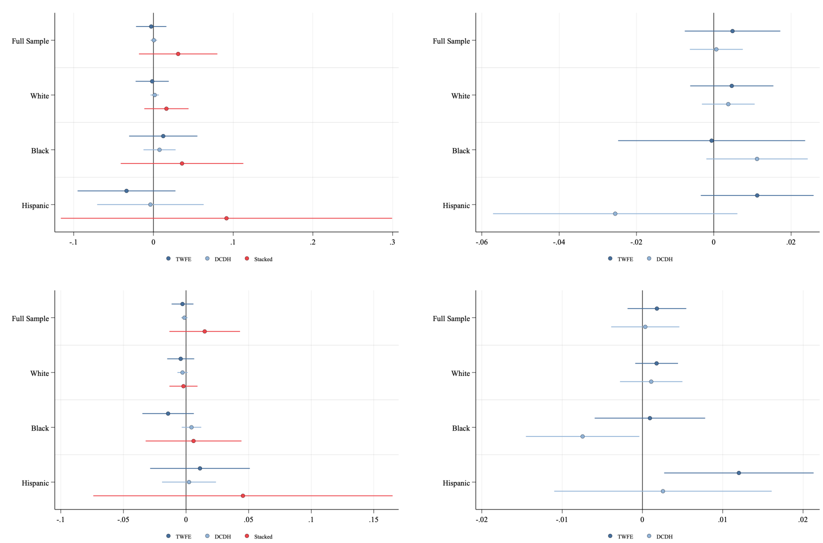

Figure C.11: Estimated effects stratified by race, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on any alcohol use in the last 30 days (top) and any binge drinking in the last 30 days (bottom), using two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

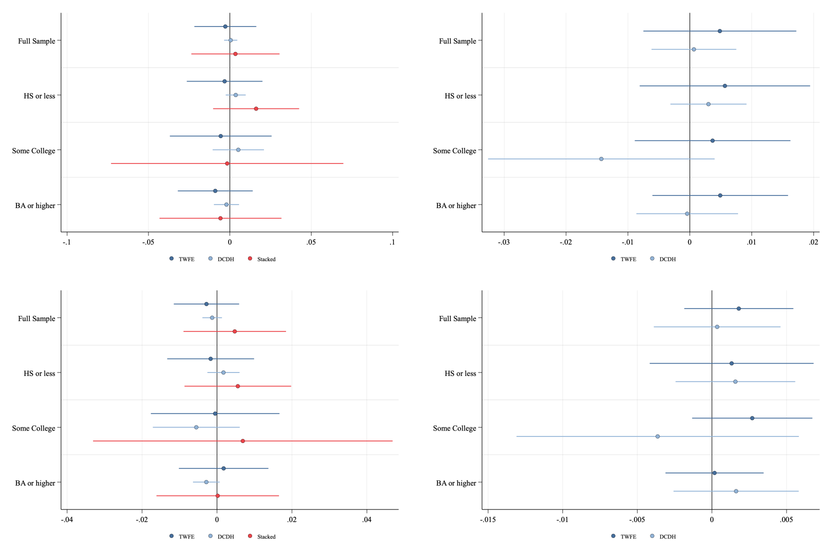

Figure C.12: Estimated effects stratified by education level, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on any alcohol use in the last 30 days (top) and any binge drinking in the last 30 days (bottom), using two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

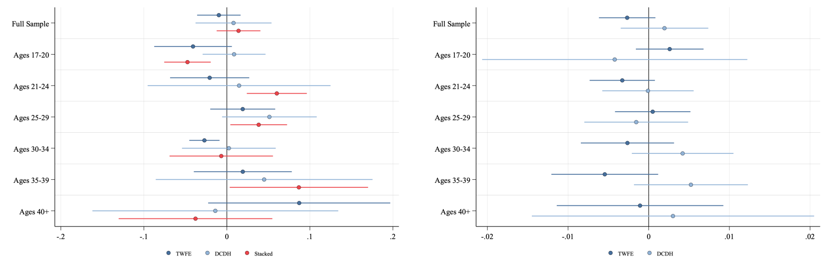

Figure C.13: Estimated effects stratified by age group, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on unintended pregnancy, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

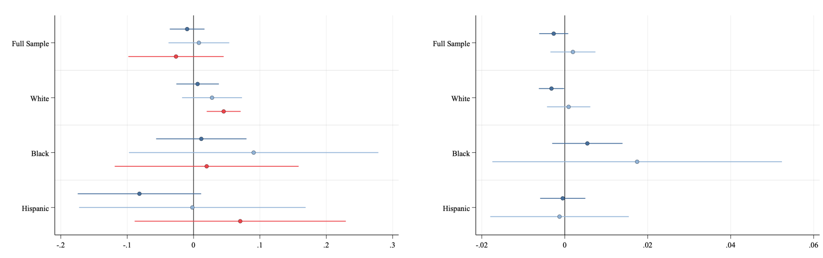

Figure C.14: Estimated effects stratified by race, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on unintended pregnancy, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

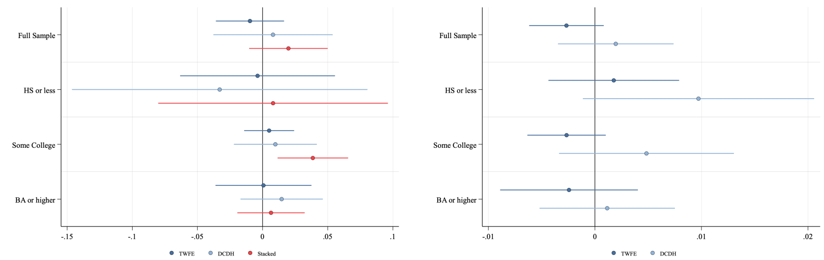

Figure C.15: Estimated effects stratified by education level, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on unintended pregnancy, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

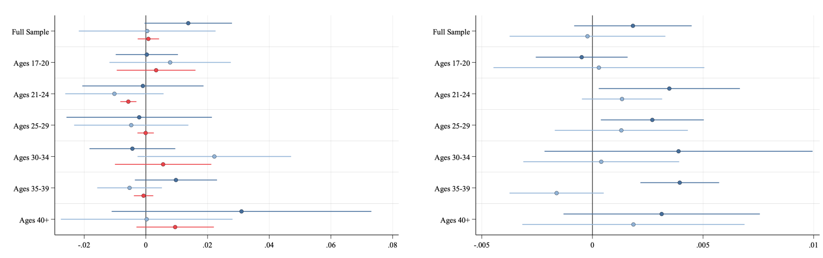

Figure C.16: Estimated effects stratified by age group, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on very low birth weight incidence, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

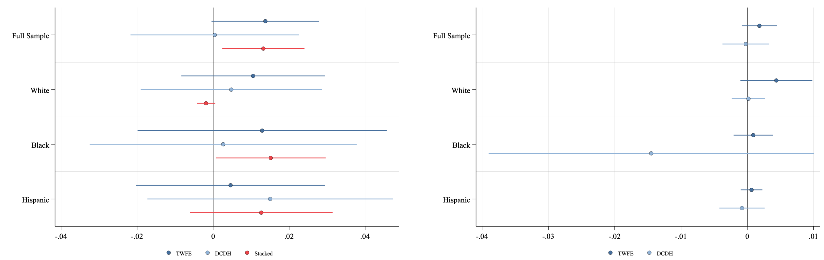

Figure C.17: Estimated effects stratified by race, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on very low birth weight incidence, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

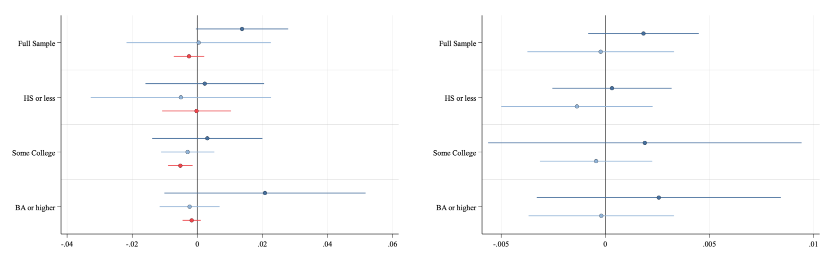

Figure C.18: Estimated effects stratified by education level, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on very low birth weight incidence, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

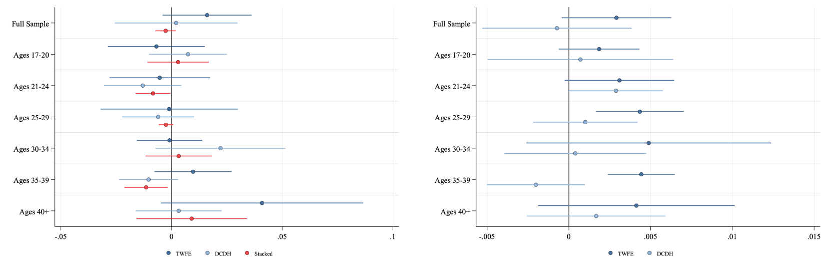

Figure C.19: Estimated effects stratified by age group, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on very preterm birth incidence, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

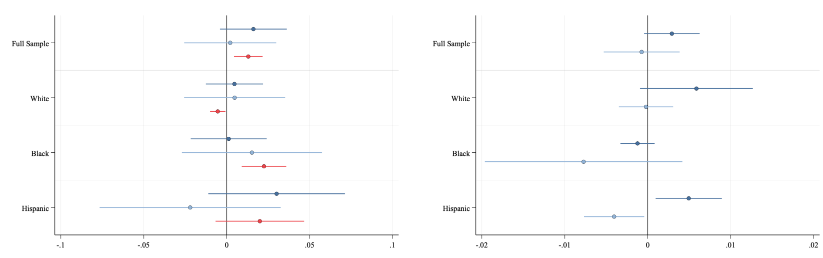

Figure C.20: Estimated effects stratified by race, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on very preterm birth incidence, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

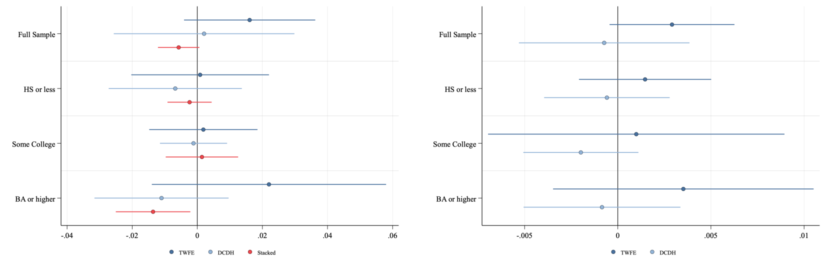

Figure C.21: Estimated effects stratified by education level, from warning sign law passage (left) and composite alcoholic beverage taxes (right), on very preterm birth incidence, using two-way fixed effects (TWFE) and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Demographic controls include age, race, marital status, and education. State policy controls include BAC laws, Sunday sales laws, state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

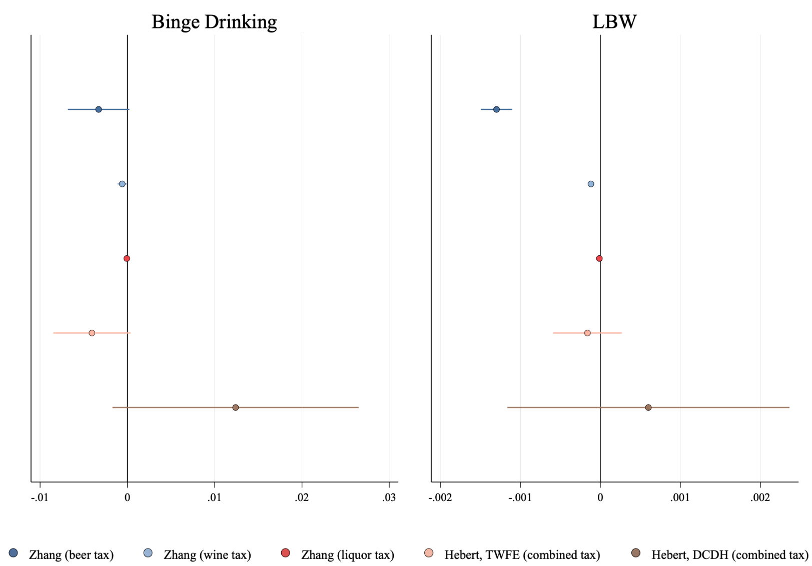

Figure C.22: Binge drinking among pregnant women and low birth weight outcomes, pre-2006 data only. Estimates for composite alcoholic beverage tax using TWFE and De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH). Also includes estimates from Zhang (2010), adjusted to reflect an implied tax per standard drink value, converting the relevant tax type to weight by its ethanol content and then adjusting for one standard drink.

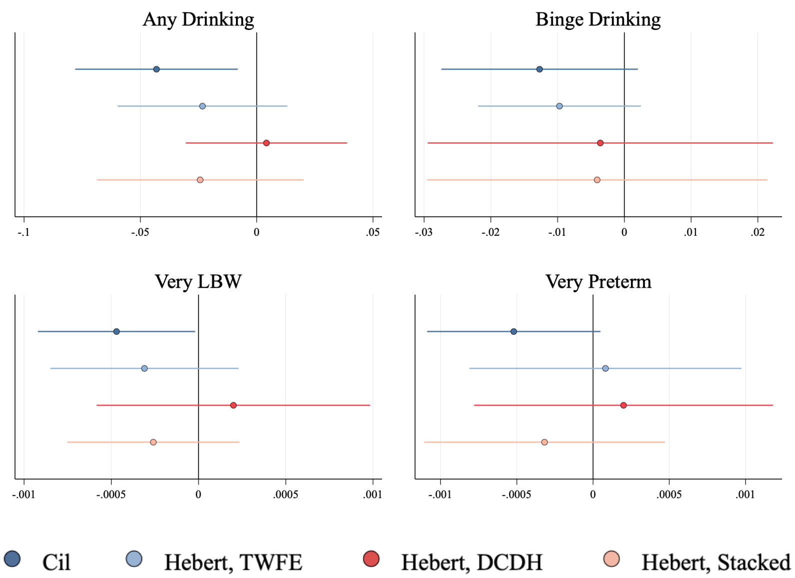

Figure C.23: Any alcohol use and binge drinking among pregnant women, very low birth weight, and very preterm birth outcomes, pre-2006 data only. Estimates for warning sign law passage using TWFE, De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference estimator. Also includes estimates from Cil (2017).

	All States		Non-Monopoly States	
	AK	IL	AK	IL
Std. Drinks	2.30	-13.41	-4.12	5.93
	(18.86)	(22.54)	(19.95)	(32.45)
Premature	0.0035	-0.0015	0.0038	-0.0006
	(0.0034)	(0.0062)	(0.0065)	(0.0064)
Very Premature	-0.0009	-0.0010	-0.0007	-0.0008
	(0.0013)	(0.0022)	(0.0032)	(0.0019)
LBW	0.0019	-0.0006	0.0024	-0.0001
	(0.0023)	(0.0029)	(0.0063)	(0.0028)
VLBW	0.0003	-0.0003	-0.0001	-0.0001
	(0.0006)	(0.0010)	(0.0012)	(0.0008)

Table C.1: Synthetic difference-in-difference (Arkhangelsky et al., 2021) regressions on standard drinks per capita (Slater and Alpert, 2023), premature and very premature birth rate, and low and very low birth weight incidence (NCHS, 2024). Treatment is tax increase in Alaska and Illinois, regressed separately. Columns include one specification including all states, and another including only non-liquor monopoly states. Method used is from Clarke et al. (2023). Options include `vce(placebo)` and `reps(100)` for the single-state treatment.

	(1) Unintended	(2) Unintended	(3) Gest Age	(4) Gest Age	(5) LGA	(6) LGA	(7) SGA	(8) SGA
Drank 3 months before pregnancy	-0.0157**	0.0465***	0.123***	0.0696***	-0.00144	-0.00569***	-0.00582***	0.00137
	(0.00763)	(0.00295)	(0.00795)	(0.00732)	(0.00142)	(0.00150)	(0.00134)	(0.00106)
Marital Status		-0.287***		0.0322**		0.0260***		-0.0305***
		(0.00559)		(0.0120)		(0.00173)		(0.00185)
High school or GED or less		0.0301***		0.0128		-0.0121***		0.0150***
		(0.00536)		(0.0173)		(0.00180)		(0.00238)
Some college or Associate's		-0.0297***		0.0153		0.0117***		-0.0193***
		(0.00328)		(0.0123)		(0.00227)		(0.00238)
BA or higher		-0.148***		0.110***		0.0121***		-0.0253***
		(0.00515)		(0.0152)		(0.00255)		(0.00207)
White NH		-0.0581***		0.132***		0.00824*		-0.0163***
		(0.00400)		(0.0192)		(0.00416)		(0.00373)
Black NH		0.0723***		-0.228***		0.0223***		-0.0328***
		(0.00687)		(0.0248)		(0.00496)		(0.00440)
Hispanic		-0.0612***		0.120***		0.0204***		-0.0345***
		(0.00618)		(0.0292)		(0.00480)		(0.00382)
Observations	797064	797064	815467	815467	778794	778794	778794	778794
Mean of Dep. Var	0.413	0.413	38.64	38.64	0.103	0.103	0.0970	0.0970
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.2: Birth outcome regressions on drinking in the three months before pregnancy indicator, PRAMS data, 1995-2021. Columns 1,2 unintended pregnancy; 3,4 gestational age in weeks; 5,6 large for gestational age (90th percentile or higher); 7,8 small for gestational age (10th percentile or lower). Control variables include mother's age, race, education level, and marital status. All regressions include state and year fixed effects. Estimates are weighted using PRAMS analytic weights. Standard errors are clustered at the state level.

	(1) LBW	(2) LBW	(3) Prem	(4) Prem	(5) NICU	(6) NICU	(7) Deceased	(8) Deceased
Drank 3 months before pregnancy	-0.0136***	-0.00510***	-0.0135***	-0.00806***	-0.0156***	-0.00874***	-0.00179***	-0.000845**
	(0.00111)	(0.000734)	(0.00109)	(0.000970)	(0.00149)	(0.00102)	(0.000338)	(0.000332)
Marital Status		-0.0183***		-0.0111***		-0.0144***		-0.000924***
		(0.000892)		(0.00141)		(0.00210)		(0.000261)
High school or GED or less		0.00517***		0.00361**		0.00534**		0.00141***
		(0.00159)		(0.00169)		(0.00200)		(0.000319)
Some college or Associate's		-0.00810***		-0.00424***		-0.00165		-0.000933***
		(0.000971)		(0.00153)		(0.00154)		(0.000287)
BA or higher		-0.0116***		-0.00928***		-0.00779***		-0.00172***
		(0.00114)		(0.00152)		(0.00136)		(0.000227)
White NH		-0.0183***		-0.00473**		-0.0151***		-0.00111***
		(0.00193)		(0.00207)		(0.00283)		(0.000287)
Black NH		0.0353***		0.0322***		0.0210***		0.00346***
		(0.00240)		(0.00276)		(0.00371)		(0.000537)
Hispanic		-0.0232***		-0.00921***		-0.0105***		-0.00142***
		(0.00237)		(0.00268)		(0.00330)		(0.000425)
Observations	814340	814340	815467	815467	672061	672061	802462	802462
Mean of Dep. Var	0.0715	0.0715	0.0885	0.0885	0.109	0.109	0.00514	0.00514
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.3: Birth outcome regressions on drinking in the three months before pregnancy indicator, PRAMS data, 1995-2021. Columns 1,2 low birth weight (¡2500g); 3,4 premature birth (¡37 weeks); 5,6 admitted to NICU after birth; 7,8 infant deceased at time of interview (live birth). Control variables include mother's age, race, education level, and marital status. All regressions include state and year fixed effects. Estimates are weighted using PRAMS analytic weights. Standard errors are clustered at the state level.

	(1) Unintended	(2) Unintended	(3) Gest Age	(4) Gest Age	(5) LGA	(6) LGA	(7) SGA	(8) SGA
Drank 3+ drinks/week	0.0310***	0.0828***	0.255***	0.205***	-0.0123***	-0.0151***	0.00579***	0.0101***
	(0.0101)	(0.00389)	(0.0126)	(0.0124)	(0.00183)	(0.00188)	(0.00174)	(0.00148)
Marital Status		-0.270***		0.0704***		0.0277***		-0.0312***
		(0.00705)		(0.0160)		(0.00275)		(0.00222)
High school or GED or less		0.0329***		0.0338		-0.0116***		0.0140***
		(0.00645)		(0.0207)		(0.00235)		(0.00229)
Some college or Associate's		-0.0284***		0.00163		0.0123***		-0.0169***
		(0.00401)		(0.0170)		(0.00229)		(0.00212)
BA or higher		-0.151***		0.0933***		0.00991***		-0.0246***
		(0.00662)		(0.0193)		(0.00263)		(0.00223)
White NH		-0.0561***		0.116***		0.0156***		-0.0195***
		(0.00445)		(0.0198)		(0.00481)		(0.00398)
Black NH		0.0832***		-0.202***		0.0269***		-0.0367***
		(0.00736)		(0.0242)		(0.00584)		(0.00542)
Hispanic		-0.0773***		0.136***		0.0252***		-0.0398***
		(0.00713)		(0.0340)		(0.00502)		(0.00463)
Observations	462856	462856	475024	475024	453882	453882	453882	453882
Mean of Dep. Var	0.429	0.429	38.61	38.61	0.101	0.101	0.101	0.101
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.4: Birth outcome regressions on drinking 3+ drinks per week in the three months before pregnancy indicator, PRAMS data, 1995-2021. Columns 1,2 unintended pregnancy; 3,4 gestational age in weeks; 5,6 large for gestational age (90th percentile or higher); 7,8 small for gestational age (10th percentile or lower). Control variables include mother's age, race, education level, and marital status. All regressions include state and year fixed effects. Estimates are weighted using PRAMS analytic weights. Standard errors are clustered at the state level.

	(1) LBW	(2) LBW	(3) Prem	(4) Prem	(5) NICU	(6) NICU	(7) Deceased	(8) Deceased
Drank 3+ drinks/week	-0.0169***	-0.00873***	-0.0203***	-0.0156***	-0.0204***	-0.0129***	-0.00219***	-0.00112**
	(0.00166)	(0.00117)	(0.00160)	(0.00157)	(0.00239)	(0.00244)	(0.000506)	(0.000471)
Marital Status		-0.0204***		-0.0153***		-0.0172***		-0.000914***
		(0.00133)		(0.00179)		(0.00216)		(0.000293)
High school or GED or less		0.00318*		0.00164		0.00458*		0.00154***
		(0.00181)		(0.00188)		(0.00257)		(0.000474)
Some college or Associate's		-0.00733***		-0.00206		-0.00127		-0.000856**
		(0.00110)		(0.00192)		(0.00259)		(0.000325)
BA or higher		-0.0104***		-0.00839***		-0.00806***		-0.00170***
		(0.00127)		(0.00225)		(0.00216)		(0.000372)
White NH		-0.0189***		-0.00267		-0.0171***		-0.00139***
		(0.00194)		(0.00254)		(0.00273)		(0.000456)
Black NH		0.0325***		0.0320***		0.0215***		0.00289***
		(0.00252)		(0.00380)		(0.00389)		(0.000727)
Hispanic		-0.0263***		-0.00951**		-0.0119***		-0.00162***
		(0.00240)		(0.00357)		(0.00342)		(0.000576)
Observations	474349	474349	475024	475024	396162	396162	466539	466539
Mean of Dep. Var	0.0761	0.0761	0.0926	0.0926	0.114	0.114	0.00574	0.00574
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.5: Birth outcome regressions on drinking 3+ drinks per week in the three months before pregnancy indicator, PRAMS data, 1995-2021. Columns 1,2 low birth weight (¡2500g); 3,4 premature birth (¡37 weeks); 5,6 admitted to NICU after birth; 7,8 infant deceased at time of interview (live birth). Control variables include mother's age, race, education level, and marital status. All regressions include state and year fixed effects. Estimates are weighted using PRAMS analytic weights. Standard errors are clustered at the state level.

	(1) Unintended	(2) Unintended	(3) Gest Age	(4) Gest Age	(5) LGA	(6) LGA	(7) SGA	(8) SGA
Drank last trimester (Y/N)	0.0197***	0.0382***	0.187***	0.154***	-0.0128***	-0.0125***	0.00437*	0.00672***
	(0.00444)	(0.00360)	(0.0170)	(0.0155)	(0.00314)	(0.00312)	(0.00224)	(0.00208)
Marital Status		-0.243***		0.0898***		0.0144***		-0.0271***
		(0.00567)		(0.0139)		(0.00174)		(0.00229)
High school or GED or less		-0.0119**		-0.0212		-0.00582***		0.0131***
		(0.00489)		(0.0178)		(0.00177)		(0.00288)
Some college or Associate's		-0.00122		0.0433***		0.00534**		-0.0168***
		(0.00386)		(0.0116)		(0.00231)		(0.00236)
BA or higher		-0.0949***		0.184***		-0.00175		-0.0214***
		(0.00466)		(0.0160)		(0.00257)		(0.00219)
White NH		-0.0487***		0.134***		0.00917**		-0.0164***
		(0.00338)		(0.0216)		(0.00447)		(0.00402)
Black NH		0.0724***		-0.231***		0.0237***		-0.0332***
		(0.00566)		(0.0262)		(0.00535)		(0.00493)
Hispanic		-0.0506***		0.131***		0.0196***		-0.0351***
		(0.00680)		(0.0330)		(0.00506)		(0.00415)
Observations	750831	750831	771998	771998	735476	735476	735476	735476
Mean of Dep. Var	0.417	0.417	38.67	38.67	0.103	0.103	0.0981	0.0981
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.6: Birth outcome regressions on drinking in the last trimester indicator, PRAMS data, 1995-2021. Columns 1,2 unintended pregnancy; 3,4 gestational age in weeks; 5,6 large for gestational age (90th percentile or higher); 7,8 small for gestational age (10th percentile or lower). Control variables include mother's age, race, education level, and marital status. All regressions include state and year fixed effects. Estimates are weighted using PRAMS analytic weights. Standard errors are clustered at the state level.

	(1) LBW	(2) LBW	(3) Prem	(4) Prem	(5) NICU	(6) NICU	(7) Deceased	(8) Deceased
Drank last trimester (Y/N)	-0.00991***	-0.00648***	-0.0176***	-0.0149***	-0.0145***	-0.0111***	-0.000806*	-0.000433
	(0.00148)	(0.00119)	(0.00130)	(0.00129)	(0.00229)	(0.00234)	(0.000458)	(0.000455)
Marital Status		-0.0198***		-0.0153***		-0.0171***		-0.000963***
		(0.000946)		(0.00160)		(0.00256)		(0.000327)
High school or GED or less		0.00551***		0.00584***		0.00754***		0.00163***
		(0.00179)		(0.00164)		(0.00190)		(0.000404)
Some college or Associate's		-0.00954***		-0.00636***		-0.00378***		-0.00105***
		(0.00101)		(0.00160)		(0.00129)		(0.000277)
BA or higher		-0.0157***		-0.0155***		-0.0138***		-0.00179***
		(0.00129)		(0.00174)		(0.00109)		(0.000239)
White NH		-0.0182***		-0.00510**		-0.0172***		-0.00133***
		(0.00197)		(0.00207)		(0.00263)		(0.000255)
Black NH		0.0353***		0.0326***		0.0203***		0.00344***
		(0.00256)		(0.00298)		(0.00377)		(0.000545)
Hispanic		-0.0229***		-0.0102***		-0.0104***		-0.00129***
		(0.00229)		(0.00304)		(0.00351)		(0.000413)
Observations	770560	770560	771998	771998	689811	689811	760012	760012
Mean of Dep. Var	0.0712	0.0712	0.0881	0.0881	0.110	0.110	0.00525	0.00525
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.7: Birth outcome regressions on drinking in the last trimester indicator, PRAMS data, 1995-2021. Columns 1,2 low birth weight (¡2500g); 3,4 premature birth (¡37 weeks); 5,6 admitted to NICU after birth; 7,8 infant deceased at time of interview (live birth). Control variables include mother's age, race, education level, and marital status. All regressions include state and year fixed effects. Estimates are weighted using PRAMS analytic weights. Standard errors are clustered at the state level.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unintended	Unintended	Gest Age	Gest Age	LGA	LGA	SGA	SGA
Drank > 3/wk last trimester	0.122***	0.0851***	-0.0579	-0.0283	-0.0291***	-0.0273***	0.0345**	0.0296**
	(0.0124)	(0.0120)	(0.0538)	(0.0487)	(0.00863)	(0.00857)	(0.0130)	(0.0126)
Marital Status		-0.244***		0.0883***		0.0145***		-0.0271***
		(0.00569)		(0.0139)		(0.00175)		(0.00227)
High school or GED or less		-0.0122**		-0.0217		-0.00574***		0.0131***
		(0.00492)		(0.0177)		(0.00178)		(0.00288)
Some college or Associate's		-0.000948		0.0444***		0.00525**		-0.0168***
		(0.00389)		(0.0114)		(0.00231)		(0.00237)
BA or higher		-0.0931***		0.191***		-0.00233		-0.0211***
		(0.00470)		(0.0161)		(0.00253)		(0.00223)
White NH		-0.0473***		0.140***		0.00870*		-0.0162***
		(0.00335)		(0.0223)		(0.00446)		(0.00401)
Black NH		0.0733***		-0.227***		0.0234***		-0.0330***
		(0.00573)		(0.0265)		(0.00537)		(0.00492)
Hispanic		-0.0497***		0.135***		0.0193***		-0.0349***
		(0.00688)		(0.0329)		(0.00506)		(0.00415)
Observations	750831	750831	771998	771998	735476	735476	735476	735476
Mean of Dep. Var	0.417	0.417	38.67	38.67	0.103	0.103	0.0981	0.0981
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.8: Birth outcome regressions on drinking 3+ drinks per week in the last trimester indicator, PRAMS data, 1995-2021. Columns 1,2 unintended pregnancy; 3,4 gestational age in weeks; 5,6 large for gestational age (90th percentile or higher); 7,8 small for gestational age (10th percentile or lower). Control variables include mother's age, race, education level, and marital status. All regressions include state and year fixed effects. Estimates are weighted using PRAMS analytic weights. Standard errors are clustered at the state level.

	(1) LBW	(2) LBW	(3) Prem	(4) Prem	(5) NICU	(6) NICU	(7) Deceased	(8) Deceased
Drank > 3/wk last trimester	0.0305**	0.0257**	0.0135	0.00957	0.0153**	0.0118**	0.000770	0.000357
	(0.0113)	(0.0102)	(0.0114)	(0.0105)	(0.00620)	(0.00580)	(0.00180)	(0.00179)
Marital Status		-0.0197***		-0.0151***		-0.0170***		-0.000958***
		(0.000953)		(0.00161)		(0.00256)		(0.000326)
High school or GED or less		0.00550***		0.00588***		0.00755***		0.00163***
		(0.00178)		(0.00163)		(0.00190)		(0.000405)
Some college or Associate's		-0.00958***		-0.00646***		-0.00384***		-0.00106***
		(0.00101)		(0.00159)		(0.00128)		(0.000279)
BA or higher		-0.0160***		-0.0162***		-0.0143***		-0.00181***
		(0.00128)		(0.00174)		(0.00116)		(0.000242)
White NH		-0.0184***		-0.00566**		-0.0176***		-0.00135***
		(0.00201)		(0.00209)		(0.00262)		(0.000260)
Black NH		0.0352***		0.0323***		0.0200***		0.00343***
		(0.00260)		(0.00294)		(0.00375)		(0.000547)
Hispanic		-0.0230***		-0.0105***		-0.0106***		-0.00130***
		(0.00229)		(0.00302)		(0.00351)		(0.000410)
Observations	770560	770560	771998	771998	689811	689811	760012	760012
Mean of Dep. Var	0.0712	0.0712	0.0881	0.0881	0.110	0.110	0.00525	0.00525
Demographic controls	No	Yes	No	Yes	No	Yes	No	Yes

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.9: Birth outcome regressions on drinking 3+ drinks per week in the last trimester indicator, PRAMS data, 1995-2021. Columns 1,2 low birth weight (¡2500g); 3,4 premature birth (¡37 weeks); 5,6 admitted to NICU after birth; 7,8 infant deceased at time of interview (live birth). Control variables include mother's age, race, education level, and marital status. All regressions include state and year fixed effects. Estimates are weighted using PRAMS analytic weights. Standard errors are clustered at the state level.

		(1) Std. Drk.	(2) Any Alc	(3) Binge	(4) 3mo Bef	(5) > 3 drk/wk
WS	TWFE	-11.95	-0.00679	0.00112	0.0125	0.0210
		(7.414)	(0.00915)	(0.00454)	(0.0240)	(0.0145)
	DCDH	-6.56	0.0008	-0.0028	-0.0376	-0.0401
		(5.23)	(0.0048)	(0.0030)	(0.0257)	(0.0396)
	Stacked	-7.970	0.00576	0.000123	NA	NA
		(6.262)	(0.0142)	(0.00685)	NA	NA
Tax	TWFE	-7.010***	0.00212	0.000718	0.00304*	0.00323**
		(1.793)	(0.00374)	(0.00193)	(0.00175)	(0.00143)
	DCDH	-2.00	-0.0145	0.0040	-0.0402	-0.0255
		(7.74)	(0.0123)	(0.0050)	(0.0300)	(0.0382)
Mean of Dep. Var.		504.6	0.511	0.118	0.480	0.139

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.10: Pre-2006 data, full sample estimated effects on primary drinking outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Standard drinks per capita 14+ comes from NIAAA data; indicators for any alcohol use in the last 30 days and any binge drinking in the last 30 days come from BRFSS. Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. NIAAA regressions do not include demographic covariates. Standard errors are clustered at the state level.

		(1) Std. Drk.	(2) Any Alc	(3) Binge
WS	TWFE	-29.02*	-0.0233	-0.00971
		(16.78)	(0.0186)	(0.00622)
	DCDH	-20.85	0.0042	-0.0036
		38.82	0.0177	0.0132
	Stacked	-33.07	-0.0243	-0.00407
		(28.50)	(0.0227)	(0.0130)
Tax	TWFE	-4.174	-0.00681	-0.00406*
		(6.404)	(0.00467)	(0.00226)
	DCDH	23.15*	-0.0087	0.0124*
		14.27	0.0156	0.0072
Mean of Dep. Var.		78.64	0.134	0.0201

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.11: Pre-2006 data, pregnant subsample estimated effects on primary drinking outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Standard drinks per year, indicators for any alcohol use in the last 30 days, and any binge drinking in the last 30 days come from BRFSS. Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

		(1) Unintended	(2) Abortion	(3) Abortion (Teen)
WS	TWFE	-0.0183	0.153	0.270
		(0.0124)	(0.611)	(1.238)
	DCDH	0.1307	-0.1812	-0.4347
		(0.1805)	(0.2428)	(0.4268)
	Stacked	NA	0.299	0.0320
		NA	(1.405)	(2.196)
Tax	TWFE	-0.00189*	-1.167*	-1.125
		(0.00105)	(0.584)	(1.305)
	DCDH	0.0252*	-0.4353	-0.4496
		(0.0141)	(0.4340)	(0.8919)
Mean of Dep. Var.		0.416	18.17	24.05

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.12: Pre-2006 data, full sample estimated effects on pregnancy-related outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Unintended pregnancy indicator comes from PRAMS data. Abortion rate data from Maddow-Zimet and Kost (2021, 2022). Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

		(1) Stillbirth	(2) XLGA	(3) XSGA	(4) LBW	(5) VLBW	(6) Preterm	(7) V Preterm	(8) APGAR
WS	TWFE	NA	-0.000742	-0.000429	0.000216	-0.000310	0.00139	0.0000816	0.00170
		NA	(0.000743)	(0.000614)	(0.000829)	(0.000275)	(0.00116)	(0.000455)	(0.0106)
	DCDH	NA	0.0000	0.0000	0.0004	0.0002	0.0002	0.0002	0.0000
		NA	(0.0003)	(0.0003)	(0.0009)	(0.0004)	(0.0012)	(0.0005)	(0.0028)
	Stacked	NA	0.000591	0.000418	-0.000689	-0.000259	-0.000946	-0.000318	-0.00885
		NA	(0.00135)	(0.00155)	(0.000810)	(0.000252)	(0.00129)	(0.000403)	(0.0107)
Tax	TWFE	NA	0.000278	-0.000239*	-0.000161	-0.0000783	-0.000567	-0.000201	0.00116
		NA	(0.000333)	(0.000129)	(0.000219)	(0.0000873)	(0.000422)	(0.000167)	(0.00232)
	DCDH	NA	-0.0002	0.0002	-0.0006	-0.0003	-0.0016	-0.0008	0.0009
		NA	(0.0004)	(0.0007)	(0.0009)	(0.0004)	(0.0014)	(0.0008)	(0.0044)
Mean of Dep. Var.		NA	0.0983	0.0964	0.0730	0.0132	0.110	0.0252	8.910

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.13: Pre-2006 data, full sample estimated effects on pregnancy-related outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Stillbirth data does not extend into the pre-2006 period. All other outcomes taken from NVSS Natality data (NCHS, 2024). Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

		(1) B. Prob	(2) Dev. Delay	(3) Int.	(4) Speech	(5) Learn	(6) ADD/ADHD	(7) FASD	(8) FASD Eval
WS	TWFE	0.00764	0.0275***	0.00962*	0.0174***	0.0399***	0.0755***	NA	NA
		(0.00525)	(0.00697)	(0.00542)	(0.00544)	(0.00646)	(0.0168)	NA	NA
	DCDH	-0.0018	0.0199	0.0040	-0.0030	0.0025	0.0117	NA	NA
		(0.0045)	(0.0160)	(0.0037)	(0.0051)	(0.0126)	(0.0174)	NA	NA
	Stacked	NA	NA	NA	NA	NA	NA	NA	NA
		NA	NA	NA	NA	NA	NA	NA	NA
Tax	TWFE	-0.00338**	-0.00306***	-0.000865	-0.00239*	-0.00495***	-0.00134	0.00104	0.00338
		(0.00129)	(0.000743)	(0.000778)	(0.00129)	(0.00133)	(0.00167)	(0.00916)	(0.0115)
	DCDH	-0.0058**	-0.0256	-0.0065	-0.0062**	-0.0346	0.0095	0.0057	0.0046
		(0.0029)	(0.0247)	(0.0041)	(0.0024)	(0.0323)	(0.0084)	(0.0052)	(0.0032)
Mean of Dep. Var.	0.0985	0.0671	0.0167	0.0645	0.0992	0.142	0.00242	0.00309	

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C.14: Pre-2006 data, full sample estimated effects on pregnancy-related outcomes from warning sign laws and composite alcoholic beverage taxes. Note that coefficient estimates for composite taxes in DCDH row are for 2 cent bins, so the actual estimate has been halved for comparison. Outcomes taken from NSCH: Behavioral Problems, Developmental Delay, Intellectual Disability, Speech Disorder, Learning Disability, ADD/ADHD, FASD, Evaluation for FASD Recommended by Physician (U.S. Department of Health and Human Services et al., 2024). Difference-in-difference methods are: two-way fixed effects (TWFE), De Chaisemartin and d'Haultfoeuille (2024) dynamic estimator (DCDH), and Wing et al. (2024) stacked difference-in-difference (Stacked). Demographic controls include age, race, marital status, and education. State policy controls include state cigarette taxes, smoke-free policy laws, vertical ID laws, state minimum wage in 2022 dollars, unemployment rate, and poverty rate. Standard errors are clustered at the state level.

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