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ABSTRACT

The Long-Term Impact of In-Utero Cigarette Taxes on Adult Prenatal Smoking*

This study examines the long-term link between in-utero cigarette taxes and adult prenatal smoking. We use U.S. birth certificate records to demonstrate that exposure to higher in-utero cigarette taxes (over 1965-2001) reduces later-life adult pre-pregnancy and prenatal smoking. We also show that higher in-utero cigarette taxes have long-lasting effects on adult health, and intergenerational consequences for infant health. Finally, we demonstrate that larger in-utero tax responsiveness correlates with smaller contemporary cigarette tax responsiveness, suggesting that higher in-utero taxes may alter the composition of remaining smokers and contribute to reductions in contemporary cigarette tax responsiveness.

JEL Classification: I12, I18, H71, H75

Keywords: prenatal smoking, cigarette taxes, long-term, early-life influences human capital

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1 Introduction

Do early-life public policies impact long-term health behaviors? While the prenatal and early-childhood environment has been demonstrated as crucial for human capital development,[1] fewer studies have considered the influence of the in-utero policy environment on adult health behaviors. In-utero influences and their impacts on long-run health behaviors, such as smoking, provide another avenue for early-childhood health to persist into adulthood. Observed adjustments in long-term health behaviors also unlock a plausible pathway for public policies to have intergenerational health effects on the next generation of children (East et al., 2017; Halliday et al., 2020, 2021).

This study examines whether higher in-utero cigarette taxes (between 1965 and 2001) have long-term intergenerational links to adult prenatal smoking (between 2009 and 2020). In particular, we question whether cigarette taxes in place during the mother's own in-utero development (faced by the grandmother) can affect later-life smoking during the mother's first delivery.[2] We define in-utero taxes as the state-level cigarette taxes in place during the mother's own in-utero development. Then, we consider whether higher in-utero taxes persistently reduce the likelihood of contemporary prenatal smoking.

Our focus on adult prenatal smoking is primarily due to the importance of smoking cessation during pregnancy and the well-reported measures of smoking available in the U.S birth certificate records. Nationally, 7.2% of pregnant women smoke prenatally, but substantial heterogeneity in prenatal smoking patterns exists. Younger mothers (20-24) and mothers with a high school degree have a higher prevalence of smoking during pregnancy, 10.7% and 12.2% (respectively) (Drake et al., 2018). Prenatal smoking is also more common in certain states, such as West Virginia (25%) and Kentucky (18%) (Drake et al., 2018). Prenatal smoking remains costly to public health as it detrimentally affects fetal development and raises the likelihood of pregnancy complications, such as low birth weight.[3] These developmental consequences of prenatal smoking also present long-term implications for health and human capital development (Simon, 2016; Settele and Van Ewijk, 2018).

To explore the link between in-utero cigarette taxes and prenatal smoking, we use

[1] See Behrman and Rosenzweig (2004); Almond (2006); Bleakley (2007); Case et al. (2008); Case and Paxson (2009); Currie (2009); Bozzoli et al. (2009); Maluccio et al. (2009); Currie and Almond (2011); Almond et al. (2011); Beach et al. (2016); Hoynes et al. (2016); Hjort et al. (2017); Bhalotra et al. (2017); Bütikofer et al. (2019); Hoehn-Velasco (2021)

[2] We observe the mother's smoking behavior during the pregnancy of their first birth.

[3] See Almond et al. (2005); Dempsey and Benowitz (2001); Thielen et al. (2008); Schroeder and Koh (2014).

the mother's own state of birth and the mother's age reported on the birth certificate. Using the mother's own birth state, where the mother was plausibly conceived, we link current pregnancies to the state-level cigarette tax regimes in place during the mother's own gestation years (1965 to 2001). We then consider whether these in-utero cigarette taxes affect later-life prenatal smoking using a fixed-effect model. Our analysis incorporates a battery of fixed effects, including the month-year of the current pregnancy's conception, the mother's (own) birth state, the mother's own conception year, the current residence state, as well as linear trends for the mother's (own) birth state and conception year. We also control for observable maternal characteristics, recent state-level cigarette taxes, and other relevant contemporary public policies, such as state and local tobacco control policies.

Our findings suggest that higher state-level cigarette taxes during the year of the mother's conception (and gestation) reduce the likelihood of smoking during pregnancy (for first-time adult mothers). A one percent increase in in-utero cigarette taxes lowers the probability of prenatal smoking by 0.14 percent and pre-pregnancy smoking by 0.12 percent. In linear terms, a one-dollar increase in the cigarette tax produces a 2.1 percentage point decline in prenatal smoking and a 2.7 percentage point decline in pre-pregnancy smoking.

We then explore the mechanisms for the observed importance of in-utero cigarette taxes using potential channels available in the birth certificate records. Our findings reveal that higher in-utero cigarette taxes impact both adult maternal and infant health (representing third-generation exposure). For maternal health, we show both first-stage effects on health at birth (over 1968-2001) as well as improved adult health (over 2009-2020). Newborns whose mothers were exposed to higher in-utero cigarette taxes show third-generation health benefits, a reduction in the probability of being very low birth weight. Together, the health effects indicate a potential biological impact of higher in-utero cigarette taxes.

Finally, we show that in-utero cigarette taxes only appear as an important determinant of prenatal smoking after 2006. The increasingly strong responsiveness to in-utero taxes in the past 15 years correlates with a reduction in responsiveness to teenage and contemporary cigarette taxes. The influence of teen and present-day taxes in earlier samples, but not recent years, helps to reconcile the differences between the present study and related work.[4] The recent rise in the importance of in-utero cigarette taxes also aligns with particularly effective (in-utero) cigarette tax increases that occurred over the 1980s and 1990s. Our findings demonstrate that in-utero taxes only

[4]See Evans and Ringel (1999); Gruber and Köszegi (2001); Bradford (2003); Colman et al. (2003); Levy and Meara (2006); Simon (2016); Adams et al. (2012); Dennett (2020).

recently arose as an effective policy instrument, aligning with in-utero exposure from 1980 onward, a key window of important cigarette tax policy.

2 Related Literature

The findings from this study build upon a broad literature that has considered the link between cigarette taxes and smoking behavior (Evans and Ringel, 1999; Farrelly et al., 2004; Gruber and Kőszegi, 2004; Lien and Evans, 2005; O'Donoghue and Rabin, 2006; DeCicca and McLeod, 2008; Nesson, 2017; Friedson and Rees, 2020). Studies that specifically focus on the effect of contemporary cigarette taxes and smoking in pregnancy include Evans and Ringel (1999); Gruber and Köszegi (2001); Gruber and Zinman (2001); Bradford (2003); Colman et al. (2003); Levy and Meara (2006); Simon (2016); Adams et al. (2012); Dennett (2020). These studies show that increases in contemporary cigarette taxes reduce smoking during pregnancy, with beneficial effects for infant health as well as long-term child health and achievement (Simon, 2016; Settele and Van Ewijk, 2018). Related work has also demonstrated the impact of taxes on the substitution between traditional cigarettes and non-cigarette products such as smokeless tobacco and e-cigarettes (Ohsfeldt et al., 1997; Pesko et al., 2020), including during pregnancy (Abouk et al., 2019).

While the majority of related work has focused on contemporary policies, a portion of the literature has also considered the longer-term impacts of cigarette taxes and public policies that discourage smoking. These studies include Auld and Zarrabi (2015); Darden and Gilleskie (2016); Darden (2017); Settele and Van Ewijk (2018); Darden et al. (2018); Friedson and Rees (2020); Catalano and Gilleskie (2021); Friedson et al. (2021a,b). From this literature, the most closely related studies include Friedson and Rees (2020), Friedson et al. (2021b), and Friedson et al. (2021a). These studies examine the long-term link between adult smoking behavior and exposure to higher cigarette taxes during the teen years. While our study is closely related to Friedson and Rees (2020); Friedson et al. (2021b,a), we focus on in-utero cigarette taxes rather than teenage taxes.

Finally, this study also adds to a large literature studying the long-term effects of the early childhood environment. These studies suggest that the prenatal period and early-childhood years are critical in determining human capital development and health in adulthood (Behrman and Rosenzweig, 2004; Almond, 2006; Bleakley, 2007; Case et al., 2008; Case and Paxson, 2009; Currie, 2009; Bozzoli et al., 2009; Maluccio et al., 2009; Currie and Almond, 2011; Almond et al., 2011; Beach et al., 2016; Hoynes et al., 2016; Hjort et al., 2017; Bhalotra et al., 2017; Bütikofer et al., 2019; Hoehn-Velasco, 2021). Much of this literature has focused on the negative effects of disease exposure in early life (Almond, 2006; Case et al., 2008; Case and Paxson, 2009; Currie, 2009; Bozzoli et al., 2009; Maluccio et al., 2009). Most closely related, a subset of studies have documented the long-term benefits to specific preventative public health programs (Bleakley, 2007; Beach et al., 2016; Hjort et al., 2017; Bhalotra et al., 2017; Bütikofer et al., 2019; Hoehn-Velasco, 2021) and more general public programs (Almond et al., 2011; Hoynes et al., 2016; East et al., 2017). We contribute to this literature by focusing on the long-term behavioral impacts of in-utero policies, in this case, cigarette taxes. In subsequent results, we demonstrate that prenatal exposure to higher cigarette taxes may also affect human capital development.[5]

3 Background

3.1 Why would in-utero taxes influence adult smoking?

We anticipate several potential channels through which in-utero taxes may impact smoking in adulthood. Our first proposed mechanism is through direct in-utero exposure to prenatal smoking. Higher cigarette taxes during the mother's in-utero development will affect the grandmother's decision to smoke during pregnancy as documented in Evans and Ringel (1999); Gruber and Köszegi (2001); Bradford (2003); Colman et al. (2003); Levy and Meara (2006); Adams et al. (2012); Simon (2016). This direct exposure to higher cigarette taxes by the first generation (grandmothers) will impact whether the second generation (mothers) are exposed to cigarette smoke in utero. First-generation exposure to higher taxes has been shown to directly impact the second generation's developing brain, which then affects early health and human capital development (Breslau et al., 1994; Bublitz and Stroud, 2011; Basten et al., 2015; Banderali et al., 2015; Akshoomoff et al., 2017).

In-utero exposure to prenatal smoking is particularly relevant as nicotine and carbon monoxide from prenatal smoking crosses the placental barrier and affects fetal development (Ekblad et al., 2015; Banderali et al., 2015). Thus, reduced prenatal smoking during gestation has broader implications for better fetal development (Thielen et al., 2008; Dempsey and Benowitz, 2001) as well as later infant health (Evans and Ringel, 1999; Levy and Meara, 2006; Adams et al., 2012; Simon, 2016; Bilgin et al., 2018). For in-

[5]Higher in-utero cigarette taxes may also produce a mortality selection effect. However, despite this potential channel, we expect the direct link between mortality selection and later-life adult smoking to be small.

stance, smoking during pregnancy is the number one risk factor for having a low birth weight infant (Almond et al., 2005), a marker of health at birth. Related work in Settele and Van Ewijk (2018) has also shown that reduced prenatal smoking improves children's human capital development, especially for low socioeconomic status children.[6] While it is not immediately evident whether worse health in infancy (and childhood) will positively or negatively affect adult smoking, the persistent biological impacts of prenatal smoke exposure on the developing fetus offers a potential pathway for the main effect.

Second, in-utero and childhood exposure to nicotine may affect the individual's general proclivity towards nicotine-containing products. In 2018, when declaring e-cigarettes an epidemic, one of the key arguments of the Surgeon General was the impact of nicotine exposure on the developing adolescent brain (HHS, 2016, 2018). The cited research indicates that smoking during pregnancy may affect the nicotine receptors in the fetal, newborn, and adolescent brain (Lv et al., 2008; England et al., 2015; Romoli et al., 2019). Much of this work has been conducted on rodents. For instance, Romoli et al. (2019) shows that mice exposed to nicotine through lactation over the first few weeks of life experienced long-term consequences on brain development. The developmental consequences included a greater receptivity to nicotine and overall sensitivity to addictive substances. While these studies have not yet been generalized to human health behaviors, they suggest that higher cigarette taxes may prevent exposure to nicotine through other pathways such as breastmilk (Napierala et al., 2016). Based on these related findings, reducing nicotine exposure during early life may prevent the next generation of smokers by lowering their proclivity towards tobacco and nicotine products. In this case, lower in-utero exposure to nicotine should then create a lasting, lifelong impact on smoking patterns.

Third, higher cigarette taxes may persistently impact the grandmother's, or first generation's, smoking patterns. The direct impact of higher cigarette taxes on the grandmother's smoking will affect whether the (second generation) mother is raised in a smoking environment. Children whose parents smoke may be more likely to smoke in adulthood (Bantle and Haisken-DeNew, 2002; Göhlmann et al., 2010). While the intergenerational transfer of health behavior from parent to child potentially operates through multiple channels, parental role modeling may play a key role. Observed parental health behaviors in childhood may predispose the child toward smoking, particularly in the early years of life (Bantle and Haisken-DeNew, 2002). The grand-

[6] Socioeconomic status has been shown to predict tobacco use and smoking behavior (Feinstein, 1993; Borg and Kristensen, 2000; Contoyannis and Jones, 2004; Laaksonen et al., 2005; Hiscock et al., 2012). We also demonstrate that human capital and SES strongly predict smoking behavior in our sample in Table A.10. Thus, if in-utero exposure to cigarette smoke affects human capital, it may thereby affect smoking through this change in human capital.

mother's smoking behavior may be particularly influential, with the grandmother acting as a role model for the mother. The grandmother also potentially spends more time (on average) with the children (as compared to the grandfather), offering more opportunities to model and transfer behaviors (Erola et al., 2016). While few studies have definitively demonstrated the transfer of health behaviors from parent to young child,[7] previous work has shown that parental health behaviors causally impact the health behaviors of adult children (Darden and Gilleskie, 2016; Fadlon and Nielsen, 2019). These studies indicate that health behaviors exhibited within family, such as smoking, have the potential to influence the adult child's proclivity toward tobacco. Further, beyond the direct role modeling effects, children of smoking parents have easier access to cigarettes in the household than non-smoking peer households. Household access to cigarettes could directly impact late-childhood and teenage smoking.

Fourth, cigarette taxes in place during the prenatal period shape the state-level cultural environment surrounding smoking. This shift in the cultural predisposition towards smoking should then affect the formation of the mother's beliefs through parents, peers, and acquaintances. Related work has demonstrated the importance of cultural transmission of smoking behaviors (Christopoulou and Lillard, 2015; Rodríguez-Planas and Sanz-de Galdeano, 2019; Kleinjans and Gill, 2020; Catalano and Gilleskie, 2021), and we expect that childhood exposure to a permissive smoking culture may play a role in shaping health behaviors. The degree of smoking permissiveness should also directly affect childhood exposure to secondhand smoke.

Finally, cigarette taxes raised during early childhood may be earmarked for public expenditures on education or other beneficial programs (Lav, 2002; Evans and Zhang, 2007). Thus, while the importance of higher cigarette taxes may initially appear to be directly through prenatal smoking, in fact, the omitted factor may be educational expenditures or public spending on health. In the robustness checks, we test whether public spending on education and health (or general tax revenues) can explain our main findings.

3.2 Cigarette Taxes Over Time

To demonstrate the variation in cigarette taxes over time, we show the average state-level cigarette taxes over 1965-2020 in Figure 1. Figure 1 displays the average real and nominal cigarette tax over the entire period of our study, capturing both in-utero and present-day cigarette taxes. The blue solid line shows the average real cigarette

[7] Göhlmann et al. (2010) also places some skepticism on the role modeling effect since the timing of parental smoking cessation does not appear particularly important for the child's smoking initiation.

tax (CPI-adjusted and reported in 2020 dollars), and the red dashed line presents the nominal cigarette tax. At the bottom of Figure 1, the green short-dashed line also illustrates the real changes in the tax rate from year-to-year.[8] The gray dashed line shows the year-over-year change in the nominal tax rate.

Figure B.1 then presents the evolution of real state-level cigarette taxes (by state). From 1965 to 2020, the largest change in cigarette taxes occurs in the Northeast (e.g., New York, Connecticut, Rhode Island) as well as in the District of Columbia, Hawaii, Washington, California, Illinois, and Minnesota. These state-level changes are also demonstrated in Figure B.2. Figure B.2 maps CPI-adjusted cigarette taxes by state in the decades 1970 and 1990 (Panel A) and the change in the tax rate over 1970-2020/1990-2020 (Panel B).[9]

4 Data

4.1 Birth Certificate Records

For the primary analysis, we rely on the restricted access Natality Detail Files from the Centers for Disease Control (CDC) and the National Center for Health Statistics (NCHS) (NVSS, 2009-2020). This data source reports all deliveries recorded on U.S. birth certificates for all states in the United States. For the main analysis, we rely on the years 2009-2020, which captures the 2003 Birth Certificate revision. In 2003, the Standard Birth Certificate was revised, and states adopted the new version of the birth certificate from 2004 to 2015 in a staggered fashion.[10] Key characteristics provided in the revision, such as smoking prior to pregnancy and health insurance information, were not released until 2009. Because of the change in data collection, we rely primarily on the revision in our main analysis. Using the revised records provides consistency in the outcomes and controls over time.

Despite our focus on the revised records, for a portion of the analysis (Section 9) we extend the analysis backward until 1996 and add the unrevised birth certificate records. Adding the unrevised data allows us to consider a longer time horizon of prenatal smoking, which enables us to narrow in on cohort-specific effects. A limitation

[8]Calculated as the inflation-adjusted year-over-year change in the nominal tax rate.

[9]We also show the CPI-adjusted cigarette taxes by state over decades 1970, 1980, 1990, 2000, 2010, and 2020 in Appendix Figure B.3. The maps demonstrate the regional variation in cigarette taxes over the course of 50 years.

[10]While certain states revised before 2009, the key information on prenatal smoking was not released until 2009 to prevent disclosure of locational information in public birth records.

of adding the unrevised records is that the unrevised data capture slightly different measures of prenatal smoking and other key demographic characteristics (discussed below in 4.2).

In Appendix Figure B.4, we present an example portion of the 2003 birth certificate form. The birth certificate form is filled out by a hospital administrator using both medical records and the mother's self-reported information.[11] This form records the maternal characteristics, such as age, education, payment method, maternal residence location (county and state), and maternal birth state. Most important for this study, the birth certificate records maternal smoking behavior, shown in Box 37 of Figure B.4. The revised records contain questions on the number of cigarettes smoked before pregnancy and during each trimester of the current pregnancy. In additional questions (not pictured), the birth certificate records capture characteristics of the newborn and the delivery, including where the delivery occurred (separately defined from the maternal residence location).

Throughout the analysis, we focus on adults (18 and over) to test the persistence of in-utero cigarette taxes into adult prenatal smoking.[12] We also select only first deliveries to avoid sampling the same mother multiple times during the study time frame. The final sample includes all first deliveries that occurred between 2009 and 2020 to mothers ages 18 to 49.[13] The mothers included in our primary sample of deliveries (occurring from 2009 to 2020) were born between 1966 and 2002 (in-utero over 1965-2001). We plot the distribution of maternal age and year of conception in Figure B.5. The majority of mothers are under 30, with maternal conception years bunched between 1980 and 1995. Figure B.6 also shows the maternal age distribution by maternal conception year. The histograms show that mothers born in the 1960s and 1970s are older first-time mothers, and those born in the 1990s/2000s are younger first-time mothers. To address the potential cohort-specific differences in prenatal smoking, we include maternal state of birth fixed effects, year of birth fixed effects, and state of birth (x the birth year) linear trends.

[11] The mother's worksheet is available at https://www.cdc.gov/nchs/data/dvs/moms-worksheet-2016-508.pdf

[12] One of the reasons we focus on adults is that contemporary cigarette taxes may be disproportionately important for teenagers' smoking patterns, even having permanent life-course effects throughout adulthood (Friedson and Rees, 2020). However, based on the findings in Friedson and Rees (2020) we also test the relative contribution of taxes in the teenage years for mothers that remain in their birth state in the robustness checks.

[13] We exclude those over 49 as the ages are grouped into 50 and above.

4.2 Measures of Cigarette Taxes and Smoking Behavior

We use the mother's age at delivery and the mother's reported state of birth to map the cigarette excise taxes in place during the mother's conception year. We subtract the mother's reported age from the month-year date of the present delivery to calculate the mother's birth year. To map at-conception in-utero taxes, we subtract an additional 12 months. The calculated in-utero (at-conception) tax includes the state-level cigarette taxes in place in the mother's birth state. We CPI-adjust these state-level cigarette taxes and report them in 2020 dollars. These state-level cigarette taxes come from the CDC State System and the Tax Burden on Tobacco.[14]

Using the revised version of the birth certificate records, we construct several measures of prenatal smoking. First, our primary measure of smoking behavior is whether the mother reports any smoking during pregnancy. This measure of prenatal smoking captures whether the mother smoked at any point during the three trimesters of pregnancy. Second, we measure whether the mother reported any smoking before pregnancy. Third, we also consider intensive margin smoking, as well as smoking patterns during each trimester (in subsequent results).

When we add the unrevised data, we have more limited information on smoking behavior. The unrevised records (1996-2008) do not record information on any past smoking or smoking during each trimester and only record a grouped indicator of any prenatal smoking. As noted above, due to the limited information on prenatal smoking in the unrevised records, we focus our main analysis on the revised records from 2009 to 2020.

4.3 Data Limitations

Three main limitations of this data exist. First, the birth certificate data only provides the mother's current residence county/state and the mother's (own) birth state. This eliminates our ability to control for cigarette taxes during the teen years in the main analysis, which has been documented as important (Friedson and Rees, 2020). While we know the mother's location during the current delivery and at their own birth, we do not know the mother's location between those endpoints (e.g., the teen years). To address this limitation, in the robustness checks, we consider the effect of teenage taxes for two different groups. First, across the main sample, and second,

[14] We also control for present-day state-level cigarette policies based on the month-year the newborn was conceived. We map contemporary cigarette taxes using the mother's residence state and the time of conception (based on the month-year of birth minus the newborn's gestational age). Present-day cigarette taxes are CPI-adjusted and reported in 2020 dollars.

across mothers whose birth state is the same as their present-day residence state. We select a sample of never-movers to eliminate measurement error due to the unknown teenage state of residence. Considering never-moving individuals is a reasonable approximation of teenage location based on Friedson et al. (2021b).

A second limitation of the data is that, even though we have information on the present-day county of residence, the birth certificate records do not report the mother's birth county. To preserve consistency in interpreting the results, we focus on state-level cigarette taxes (contemporary, teenage, and mother's in-utero) throughout the analysis.

Third, as mentioned above, the birth certificate form was revised in 2003. Because states adopted this revision in a staggered fashion over time, the data forms an unbalanced panel of states. We choose to primarily rely on the revised version of the birth certificate records for two main reasons. First, the revision provides smoking at four points in time–before pregnancy and during each trimester of the current pregnancy. Before the revision, smoking was only reported as a single measure of prenatal smoking. Second, the revision records different maternal characteristics, which are not fully reconcilable across the pre and post revision sample. Despite our focus on the revised data, we test whether relying on the revised records affects the interpretation of the main results using two checks. First, in the main results, we extend our findings to include the unrevised version of the birth certificate records. Second, in additional robustness checks, we subset to two different balanced panels by eliminating the late-revision states.[15]

4.4 Summary Statistics

Table 1 shows the summary statistics for our primary sample of first deliveries from 2009 to 2020. Smoking behavior is shown at the top of Table 1. In the sample of first deliveries, 10.5% of mothers smoked in the three months leading up to pregnancy, with 7.2% smoking prenatally. Smoking prevalence declines over the course of the pregnancy, with 6.9% of mothers smoking during the first trimester and only 5.0% smoking in the third trimester.

We inflation-adjust both present-day and at-conception in-utero taxes for the cigarette taxes, with each tax measure reported in 2020 dollars. For our primary sample of

[15] See Section C. States that revised after 2009 include Alaska, Alabama, Arkansas, Arizona, Connecticut, Florida, Georgia, Hawaii, Illinois, Louisiana, Massachusetts, Maryland, Maine, Michigan, Missouri, Minnesota, Mississippi, North Carolina, New Jersey, Rhode Island, Virginia, Wisconsin, West Virginia.

mothers, the average contemporary state-level real cigarette tax burden is \$1.5, while the mean in-utero cigarette tax is \$0.2. We also show the reported demographic characteristics of the mother. The majority of mothers have private insurance (57%), with 36% receiving Medicaid. The educational breakdowns are split between college (36%), some college (31%), and high school (26%). For racial breakdowns, most mothers are white non-Hispanic (66%), with 15.7% identifying as Hispanic and 13% identifying as black non-Hispanic. The average mother in the sample is 26 years old.

5 Empirical Strategy

We estimate the effect of higher state-level cigarette taxes during the mother's own in-utero development (in-utero cigarette taxes) on subsequent adult smoking behavior. In our primary specification, we account for time and location fixed effects as well as contemporary cigarette taxes. Formally, for individual i residing in county j and state s_c at time t who was born in state s_b this specification appears as:

$$\begin{aligned} \text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \beta \text{ In-Utero Tax}_{s_b(t-age-1)} + \mathbf{X}'_{i,j,s_c,s_b,t}\gamma + a_{s_c} + \delta_{s_b} \\ + \eta_{(t-g)} + \nu_{(t-age-1)} + \phi_{s_b}(t - age - 1) + \epsilon_{i,j,s_c,s_b,t} \end{aligned} \quad (1)$$

where $\text{Smoking}_{i,j,s_c,s_b,t}$ reflects the smoking habits of individual i residing in county j and state s_c who was born in state s_b but observed during the month-year of the present delivery $t = 2009m1, ..., 2020m12$.[16] All maternal characteristics are observed during the month-year of the delivery (t). The time at conception, $t - g$, represents the month-year of delivery (t) minus the gestational age of the newborn (g, in months) at delivery. All policy variables are based on the month-year the newborn was conceived ($t - g$).

Our main variable of interest is the state-level in-utero cigarette tax (in the mother's conception year). $\text{In-Utero Tax}_{s_b(t-age-1)}$ captures the real cigarette tax in place in the mother's (own) birth state s_b the mother's conception year ($t - age - 1$), which is based on the year of delivery, the mother's age (plus an additional 12 months), and in the mother's (own) birth state s_b.

Maternal and local policy controls are captured by $\mathbf{X}_{i,j,s_c,s_b,t}$. Demographic controls include race/ethnicity (white non-Hispanic, black non-Hispanic, Hispanic). We choose not to include education and insurance status as they may be endogeneously

[16] $t - age$ reflects the birth year of the mother, the delivery year minus the mother's age. $t - age - 1$ reflects the conception year of the mother, the delivery year minus the mother's age plus one year.

determined and represent "bad controls" (Angrist and Pischke (2008), as shown in Section 8).[17] We also control for contemporary tobacco control policies, including cigarette and e-cigarette purchasing laws with an indicator for an e-cigarette minimum legal sales age and a variable that captures the percent of residents living in areas with state or local laws restricting the sale of tobacco to people 21 years of age and older, and a control for an index of state and local indoor air laws, including restrictions on smoking and vaping in restaurants, bars, and private workplaces. In addition to the tobacco control policies, we also control for potential cigarette substitutes and complements. These controls include the state-level beer tax, state-level medical and recreational marijuana laws, state-level Medicaid expansions under the Affordable Care Act (affects smoking cessation medication (Maclean et al., 2019)), and state-level opioid prescription drug monitoring programs (PDMP). Finally, we control for the local economic climate by including controls for the county-level unemployment rate, the median county-level income, the percent of residents below the poverty line, and the highest of either the state or federal minimum wage.[18]

We include location fixed effects for the mother's current residence state, a_{s_c} and the maternal birth state δ_{s_b}. Time fixed effects include the month-year of conception, $\eta_{(t-g)}$, and the mother's year of conception $\nu_{(t-age-1)}$ (or in-utero development). Finally, we also add cohort-specific state-level linear time trends to our full specification, $\phi_s(t - age - 1)$. The time trend is based on the mother's conception year and the maternal state of birth. Linear time trends capture gradual changes in smoking prevalence by state and over birth cohorts. For instance, if we are concerned that mothers born in the 1960s will have a higher likelihood of smoking than those born in the 1990s, these linear trends will help remove remaining changes over time (and by state) that are not captured in the time and place fixed effects.[19] The regression error is represented by $\epsilon_{i,j,s_b,s_c,t}$. We cluster the standard errors at the mother's (own) birth state level.[20]

5.1 Potential Threats to Validity

Our main underlying assumption, implicit in Equation 1, is that in-utero cigarette taxes are not determined by unobserved time-varying factors that simultaneously influence the time-varying state-level prenatal smoking patterns. In other words, there

[17] Note that if education and insurance controls are added, all results remain similar, or even slightly increase in significance.

[18] The sources for these controls are included in Table A.1.

[19] While we include these trends in the main specification, we also show the results without trends and omit trends from the event studies in Section 7.

[20] We also show the main findings with the standard errors clustered at the level of the mother's residence state in robustness checks. The results are the same whether we cluster at the mother's (own) birth state or the mother's residence state.

is no omitted time-varying variable correlated with both prenatal smoking rates and a state's cigarette tax rate. For example, changing social norms may pressure individual states to pass anti-tobacco policies while also simultaneously pressuring individuals to cease smoking. While we cannot fully rule out these unobservable factors, our primary fixed effect model addresses time-invariant differences between states as well as place-invariant differences across cohorts. We also include state-by-conception year linear trends, which help to further address any gradual adjustment in smoking preferences over birth cohorts and by state.[21]

A second concern with Equation 1 is our reliance on a fixed effects specification throughout the analysis (with four sets of fixed effects). Recent literature shows that two-way fixed effects (TWFE) estimators may be biased when there is differential timing of treatment and dynamic heterogeneity in treatment effects (Goodman-Bacon, 2021; Sun and Abraham, 2020; Callaway and Sant'Anna, 2021; DeCicca et al., 2020; Baker et al., 2021). However, most suggested alternatives focus on binary treatments, and the alternatives proposed for continuous variables require a balanced panel and a clear control group (de Chaisemartin et al., 2019). In our setup, we have two complications that make it difficult to use recent estimators. First, we have a continuous treatment that adjusts each year, yielding no control group. Second, we have two sets of time and place fixed effects, which complicates achieving a balanced panel. To address the concerns regarding TWFE, in Section 7, we test whether large tax hikes (captured by a binary variable) have a similar impact on prenatal smoking to the baseline results. In this alternative approach, we implement both a TWFE approach and an alternative estimator from Sun and Abraham (2021).

6 Main Findings

Table 2 shows the link between maternal exposure to state-level in-utero cigarette taxes and the mother's later-life adult prenatal smoking. We consider whether first-generation exposure (taxes faced by the grandmother during pregnancy) can persistently reduce the second generation's (mother's) own prenatal smoking.

Table 2 Columns (1)-(3) display the results for the mother's pre-pregnancy smoking. Columns (4)-(6) present the mother's prenatal smoking. Columns (7)-(9) display the average number of cigarettes smoked per day during pregnancy, including both

[21] Reassuringly, we also test whether related state-level policies and income show correlations with prenatal smoking (as cigarette taxes) in Section 7, and the main effect appears to be tied to cigarette taxes. Another potential confounder is that worse state economic conditions may push states to raise taxes and influence who becomes pregnant, which we also test in Section 7.

extensive and intensive smoking (i.e., including zeros). Columns (10)-(12) show the average number of cigarettes smoked per day (intensive smoking, excluding zeros). Across each outcome, we display three specifications. The first column accounts for (i) the newborn's month-year of conception fixed effects (for the present pregnancy), (ii) the maternal year of conception fixed effects, (iii) the maternal state of birth fixed effects, (iv) the mother's current residence state fixed effects. The second column adds maternal and policy controls, including the real contemporary cigarette tax. Our preferred specification appears in the third column of each outcome. The third column adds maternal-birth-state-by-year linear trends (mother birth state x mother's own conception year), which account for linear changes in smoking behavior by the mother's in-utero development cohort for each birth state. All coefficients in Table 2 are presented as elasticities, and binary outcomes are estimated using a linear probability model.[22]

Table 2 reveals that higher at-conception in-utero cigarette taxes reduce later-life adult prenatal and pre-pregnancy smoking. Focusing on our preferred specification (with linear trends), a one-percent increase in the in-utero cigarette tax reduces the probability of any smoking prior to conception by 0.12 percent (Column (3)) and prenatal smoking by 0.14 percent (Column (6)). In Column (9), higher at-conception in-utero cigarette taxes also lower the quantity of cigarettes smoked during pregnancy (including zeros). Though, when we consider only the intensive measure of average cigarettes smoked (excluding zeros), there is no relationship between in-utero cigarette taxes and prenatal smoking. Maternal in-utero exposure to higher cigarette taxes only impacts the extensive margin of smoking.[23]

Overall, the baseline results suggest that higher in-utero cigarette taxes reduce prenatal smoking in adulthood. These findings indicate a potential long-term link between public policies in place during conception that affect subsequent adult health behaviors.[24]

[22] We calculate elasticities from the marginal effect at the mean of in-utero cigarette taxes. We also present the marginal effects in Table A.2.

[23] We also present the coefficients in linear terms along with the full specification (including controls) in Table A.2. The linear coefficients suggest that a $1 increase in the in-utero cigarette tax is associated with a 2.7 percentage point decline in pre-pregnancy smoking and a 2.1 percentage point decline in prenatal smoking.

[24] The magnitude of the effect is slightly smaller than estimates from the most comparable study, Friedson and Rees (2020). However, our study measures a distinct window of exposure where we consider the (direct and indirect) effects of in-utero cigarette taxes. By contrast, Friedson and Rees (2020) focuses on (direct) exposure to cigarette taxes during the teen years. Despite our smaller observed effect, higher cigarette taxes are consistently associated with a lower likelihood of smoking before and during pregnancy.

7 Robustness

To ensure the robustness of our main findings from Table 2, we present several alternative specifications. These checks include testing different event-study specifications, considering taxes at different points in the life course, adding teenage taxes to the main specification, adding various controls from the maternal birth state, checking for selection into pregnancy (by the grandmother), and testing whether the effect varies by maternal characteristics. In Appendix Section C, we also adjust to two different balanced panels, consider the effect by trimester, test for correlations between missing prenatal smoking information and cigarette taxes, and adjust the clustering of the standard errors.

7.1 Event Study

Event-study Specification. First, we explore an event-study design to consider the impact of higher cigarette taxes over the years leading up to, and following, the mother's birth year. For simplicity, we first consider whether discrete nominal tax increases near the mother's birth year affect the probability of smoking during the contemporary prenatal period. Then, we explore several variations of this approach.

For computational purposes, we use data that has been collapsed to the maternal state of birth, maternal year of birth, current residence state, and infant month-year of birth. The decision to collapse the data has little impact on the findings. The main results from Table 2 are almost identical over collapsed data (that has been properly weighted), as shown in Table A.4. Table A.4 also reveals similar results whether we use nominal or real cigarette taxes, due to the fact that inflation is largely removed by the time fixed effects.

Our primary event-study specification appears as:

$$\begin{aligned}\text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \sum_{m=-11}^{11} \beta_m \text{In-Utero Tax Increase}_{s_b,m} + \mathbf{X}'_{i,j,s_c,s_b,t}\gamma \\ + a_{s_c} + \delta_{s_b} + \eta_{(t-g)} + \nu_{(t-age)} + \epsilon_{i,j,s_c,s_b,t}\end{aligned} \tag{2}$$

where the coefficients of interest, In-Utero Tax Increase$_{s_b,m}$ capture the effect of a discrete tax increase occurring in period $m = 0$, the year the mother is born. m represents the year relative to a tax increase at time $m = 0$. More formally, m indicates each observation's year relative to the tax increase at time T, where $m = (t - age) - T$. The main effect of the cigarette tax increase is captured by mothers born in the years after the tax increase occurred, represented by $m = 0, 1, 2, ...11$. These post-periods capture the effect of tax increases occurring in the mother's birth year ($m = 0$), and beforehand.

Our sample lacks a clear control group of individuals who never experienced a cigarette tax increase (or never received treatment). Thus, we must either exclude two pre-periods or bin the endpoints to avoid collinearity (Borusyak et al., 2018; Schmidheiny and Siegloch, 2020). We choose to bin the endpoints at $m = -11$ and $m = 11$, and omit period $m = -1$. However, the findings are similar if we leave the endpoints unbinned and consider a fully saturated model.

We demonstrate our event-study design with the example state of Alabama, shown in Table A.5. From 1965-2020, Alabama experienced six increases in the state-level nominal tax rate. These year-to-year changes in the cigarette tax are displayed in Column Δ. In years with an increase in the cigarette tax, the discrete change in the tax rate also appears in period $m = 0$ (Column 0), the birth year of the mother. If there is no change in the nominal cigarette tax in a given year, Column 0 ($m = 0$) contains a zero. In the year following a tax increase, Column 1 contains the tax increase from the prior year ($m = 1$), while Column -1 captures changes that are about to occur in the next year. The left endpoint (binned at $m = -11$) captures all tax increases that will occur over the observed period. The right endpoint (binned at $m = 11$) captures all tax increases that have occurred over the observed period.

For simplicity, in our main specification, we test the impact of discrete changes in the state-level tax rate rather than changes in the real rate. For instance, if the cigarette tax is raised from 0.16 to 0.165 (in 1984), In-Utero Tax Increase$_{s_b,m}$ will be equal to 0.005 for each period m before and after the tax increase at $m = 0$. However, we present alternatives to this approach below, and the results are similar whether we use nominal changes, real changes, or inflation-adjusted discrete increases.

We choose not to include time trends in the event study, as the time trends, which are formed based on both the pre and post periods, contaminate the treatment effect (Borusyak et al., 2018). All other aspects of Equation 2 reflect Equation 1, except we consider the effect in reference to the mother's birth year (t-age) instead of the conception year (t-age-1 year).

Event-study Results. Figure 2 shows the effect of a tax hike in each period before and after the mother's birth year (period $m = 0$) on today's reported smoking during pregnancy. The top graph shows contemporary pre-pregnancy smoking, and the second graph shows smoking during pregnancy. The plotted points connected by solid lines present the coefficients over each birth year before and after the tax increase. The dashed and dotted lines show the 95% confidence intervals around the point estimates. The dark blue lines show the full specification with covariates included, and the light blue lines omit controls. The plotted vertical red line shows the excluded period -1.

In both graphs, the coefficients consistently show a flat pre-period, with a clear dip for tax increases that occurred in the birth year or prior.[25] Both measures of smoking behavior show a significant reduction in smoking over periods zero through five. The significant reduction in adult prenatal smoking appears for all tax increases occurring during the mother's birth year through four years before conception. After period five (representing four years pre-conception), the impact of the tax increase becomes statistically insignificant once again.

Event-study Alternatives. Next, we show the results are similar over alternative versions of the event study in Figures B.7-B.11. First, in Figure B.7, we show the same discrete tax increases from Table A.5, but we inflation-adjust the discrete changes in the tax rate. Second, Figure B.8 presents the event study over all changes in the real cigarette tax rate (including discrete changes and inflation-related changes). Third, Figure B.9 returns to nominal changes in the cigarette tax, reflecting Figure 2. However, in Figure B.9 we leave the endpoints unbinned and omit two pre-periods. Throughout Figures B.7-B.9, the point estimates follow a similar pattern to Figure 2.

Fourth, Figures B.10-B.11 present slightly different results. In Figure B.10, we show the results from a more traditional event study, considering a binary event-study variable that equals one the first time a state experiences a large increase in the tax rate. Formally, this appears as:

$$\begin{aligned}\text{Smoking}_{i,j,s_{c,b},t} = \alpha + \sum_{m=-39}^{34} \beta_m 1(\text{1st Large Tax Increase, >10 cents})_{s_{c,b},m} \\ + \mathbf{X}'_{i,j,s_{c,b},t}\gamma + a_{s_{c,b}} + \nu_{(t-age)} + \epsilon_{i,j,s_{c,b},t}\end{aligned} \tag{3}$$

where $\beta_m 1(\text{1st Large Tax Increase, >10 cents})_{s_{c,b},m}$ is a binary variable capturing the first case of a large tax increase in a given state. For our primary specification, we consider a large tax increase to be a cigarette tax increase larger than 10 cents. The majority of other features of Equation 3 reflect Equation 2, except for three changes. First, we collapse the data to a two-way fixed effects level: the combination of the maternal-birth state/current-residence state, and the maternal year of birth. Collaps-

[25]While we only show 10 pre and post-periods, we include 11 periods in the analysis, but we focus on the main event window in presenting our findings.

ing the data to include two sets of fixed effects allows us to use two-way fixed effects (TWFE) alternatives. In our case, because weights and controls are important, we rely on the Interaction-Weighted (IW) estimator from Sun and Abraham (2021). We include two-way fixed effects in the specification, at the level of the collapsed data. These fixed effects include the maternal-birth state/current-residence state, $a_{s_{c,b}}$, and the mother's birth year, $\nu_{(t-age)}$.

Second, we leave the endpoints unbinned and leave the event study fully saturated. Leaving the endpoints unbinned is possible in this specification as not all states experienced a large tax increase, and we have a formal control group. This control group, including states that never passed large tax increases, is included in the omitted period $m = -1$. Third, while our main event-study variable is a binary variable that captures large tax increases (greater than 10 cents), we also directly control for smaller tax increases in the specification. This added covariate will control for smaller tax increases, those 10 cents or less. Finally, standard errors are clustered at the maternal birth state-current residence state level.

Figure B.10 shows the results over the specification outlined in Equation 3. There is a clear post-period drop after large tax increases across both the IW and the TWFE specifications. The plotted points in Figure B.10 show a similar pattern to Figure 2, where the effect lasts for four periods. We also show that these results hold over larger tax increases greater than 15 cents in Figure B.11.[26]

These event study findings align with the main results, suggesting that tax increases occurring just before the mother was born have a persistent influence on later-life prenatal smoking. Together, the results suggest a key window of exposure, just before the mother is born, where higher cigarette taxes during this in-utero period influence present-day prenatal smoking. Both tax levels and discrete changes in the tax rate, occurring just before the mother is born, persist into adulthood and reduce later-life prenatal smoking.

7.2 Influence of Real Cigarette Taxes over Each Year of Life

Tax Levels at Each Age. Second, we return to our main sample and consider where in the life-course cigarette taxes have the most influence. We separately test the impact of real cigarette taxes in each year leading up to the mother's birth and during each year of life until age 15. This test considers at which age cigarette tax exposure is most important. Based on the main results, we expect the taxes just before birth to

[26]For the 15 cent increase, the endpoints range from $m = -39$ to $m = 32$.

be the most influential. Still, other critical windows of early childhood or adolescence may also impact present-day smoking behavior.

To consider the importance of cigarette taxes over the life course, we separately estimate Equation 1 over the cigarette tax for each age, starting with 15 years before the mother's birth and ending 15 years after the mother's birth year (age 15). In each specification, we replace the In-Utero $\text{Tax}_{s_b(t-age-1)}$ with a different year of life, adjusting $t - age - 1$ to begin with $t - age - 15$ and end with $t - age + 15$.[27] The results of this exercise are shown in Figure 3. Each plotted point represents a separate regression. The x-axis represents the years before and after the mother's birth year. Each positive year represents the mother's age in childhood, year zero is the mother's birth year ($t - age$), and negative values represent the years leading up to the mother's birth.

Figure 3 Panel A shows that the tax levels in the three years leading up to the mother's birth year (period zero) are the most important taxes.[28] Tax levels from the mother's childhood and early adolescence appear less important (up to age 15). The level of the real cigarette tax leading up to the mother's birth year appears to be a key factor driving present-day smoking behavior. None of the cigarette taxes throughout childhood (past age one) or the early teen years predict contemporary smoking behavior (over our cohort of focus).

Tax Increases at Each Age. Then, in Panel B, we test whether the importance of in-utero cigarette taxes arises from actual state-level changes in the tax rate, or instead, if the result is a spurious correlation with the size of the cigarette tax. In order to separate these effects, we consider whether the discrete changes in the cigarette tax affect adult prenatal smoking. These discrete changes appear in Column Δ of Table A.5 and avoid capturing gradual year-to-year changes in the tax level that arise due to inflation.

We replace the level of the in-utero cigarette tax (In-Utero $\text{Tax}_{s_b(t-age-1)}$ in our main specification, Equation 1) with the size of the increase in the nominal cigarette tax (In-Utero Tax $\text{Increase}_{s_b(t-age-1)}$). We then separately consider the effect of discrete changes in the tax rate over each year of life (separate specifications of Equation 1, as in Panel A). We begin with 15 years before the mother's birth and end with 15 years after the mother is born, or age 15.

[27] Recall that t represents the month-year of the infant's delivery $t = 2009m1, ..., 2020m12$. Age represents the mother's age at the delivery of the infant.

[28] Note that these results differ from the event-study results in Figure 2. While Figure 3 shows the mother's age as the x-axis, Figure 2's x-axis represents the year relative to the tax increase. Thus, in Figure 2 mothers born after the tax increase are shown on the positive x-axis, where we would expect the main reduction in smoking behavior to occur.

The results, shown in Figure 3 Panel B, suggest that present-day prenatal smoking (over 2009-2020) is most influenced by cigarette tax increases that occur just before the mother's birth year. In particular, increases in the cigarette tax that occur one to five years before the mother's birth year are the most important for adult prenatal smoking. Similar to Panel A, the findings confirm that exogenous increases in the level of the cigarette tax occurring just before the mother's birth year are the most important for present-day smoking behavior.

These findings align with the main findings and the event-study results, suggesting that higher cigarette taxes just before the mother's birth year are most influential in later-life prenatal smoking. The most consequential taxes include those leading up to the mother's (own) in-utero exposure rather than tax increases occurring in early childhood or adolescence. We interpret the key influence during the pre-birth period as suggestive of the importance of smoking reduction before and during pregnancy. The significance of the pre-pregnancy window also suggests that the main channel for the observed impact of in-utero cigarette taxes is likely biological rather than behavioral. These findings help to rule out other transmission channels for the main effect, such as parental role modeling. However, we acknowledge that other potential explanations for these findings exist. One possible explanation is that cigarette taxes are correlated with state economic conditions, which would affect who becomes pregnant (in the grandmother's generation) and whether those individuals smoke during pregnancy. We attempt to evaluate this explanation below in Section 7.6.

7.3 The Relative Contribution of Present-day and Teenage Taxes

Third, we reconsider the main results from Table 2 while controlling for teenage and contemporary taxes across several different specifications. We add teenage taxes to account for the fact that teenage cigarette taxes may have important effects on life-course smoking patterns. Friedson and Rees (2020); Friedson et al. (2021b,a) show that the (relatively) elastic demand for cigarettes in the teen years has long-term consequences for adult smoking.

Table A.3 demonstrates that the influence of at-conception in-utero taxes holds even when controlling for present-day taxes and taxes during the teen years.[29] In Panel A, we repeat our main findings from Table 2, adding teenage taxes (at age 13) and including present-day taxes in each specification. Higher in-utero taxes continue to be associated with a lower likelihood of smoking in pregnancy. Both higher teenage

[29] For teenage taxes, we assume the mother lives in the state of birth and assign the cigarette taxes at age 13. The results are similar for ages 14/15 and available on request.

and present-day taxes are generally linked to a *higher* likelihood of smoking in pregnancy. The only exception is in Columns (10)-(12), where higher present-day cigarette taxes reduce the average number of cigarettes smoked per day during pregnancy.

A notable limitation of the findings in Table A.3 Panel A is the measurement error introduced when we consider teenage taxes for individuals who may have moved between early childhood and the teen years. We address the potential for moving by adjusting the sample to only include never-movers (those whose residence state is the same as their birth state). These never-movers more likely reflect the correct tax regime during the teen years, as these individuals most likely did not move out of their birth state and back before their first delivery.[30] Still, even subsetting to never-movers in Table A.3 Panel B reveals similar results to Panel A. The importance of in-utero taxes continues to dominate state-level contemporary and teenage taxes.

Finally, in Panels C and D, we confirm that the findings are not driven by correlations between state-level cigarette taxes over time. In Panel C, we show the findings only including teenage taxes and in-utero taxes. In Panel D, we individually consider each separate cigarette tax (in-utero, teenage, and contemporary). These panels confirm the importance of the mother's exposure to higher in-utero cigarette taxes for later-life smoking behavior in the cohort of focus.

Overall, throughout the four panels of Table A.3, at-conception cigarette taxes appear most important in explaining present-day smoking behavior. Notably, the coefficient on in-utero cigarette taxes is stable over the specifications, while teenage and present-day taxes are associated with a higher likelihood of smoking in adulthood. As this finding for present-day and teenage taxes diverges from related work, we explore this counter-intuitive result more closely in Section 9.

7.4 Is the Effect Consistent across Maternal Characteristics and Maternal Conception Years? Heterogeneity in the Main Effect

Observable Maternal Characteristics. Fourth, we test whether the effect varies by maternal characteristics. In Table 3 Panel A, we focus on prenatal smoking and consider whether the effect varies by payment status, education, or age. The most evident relationship between in-utero cigarette taxes and smoking appears for Medicaid recipients (Column (1)), high school graduates (Column (4)), and those under 26 (Column (7)).

[30] This is a reasonable approximation based on Friedson et al. (2021b).

Maternal Conception Years. Table 3 Panel B then presents the effect of in-utero taxes by maternal conception year. Panel B shows that in-utero cigarette taxes over the 1980s and 1990s are the most influential in today's prenatal smoking. The window of maternal conception years between 1985 and 1994 (Column (7)) appears particularly important.

Gradually Adding Maternal Conception Years to the Sample. Then, Figure 4 plots the relationship between in-utero cigarette taxes and prenatal smoking, gradually adjusting the maternal conception years included. In Panel A, we start with 1965-1969 and gradually add one maternal conception year at a time (displayed on the x-axis). Panel A shows that the 1990s are a particularly key addition to the sample, with a clear relationship between prenatal smoking and in-utero cigarette taxes appearing once 1989 is added. In Panel B, we begin with 1999-2001 and gradually add years going backward in time (displayed on the x-axis). Panel B shows slightly different results than Panel A. There is a clear impact of in-utero cigarette taxes, but the effect fades once the mid-1990s are added to the sample. The relationship between in-utero taxes and prenatal smoking then reappears after 1988 is added to the data.

Overall, both Figure 4 and Table 3 show that tax hikes over the 1980s and 1990s were most influential for later-life prenatal smoking. The stronger link for younger mothers could capture several factors. First, younger mothers have a shorter time span between early-life influences and observed present-day smoking behavior. If the association between in-utero influences and adult behavior declines over the life course (Almond and Currie, 2011), then younger mothers should have the clearest remaining effects from the early-life environment. Second, in-utero cigarette tax burdens may be relatively high for these younger mothers, with the majority of the literature focusing on tax increases that occurred over the 1980s and onward.[31] Tax increases before the 1980s were smaller and may have had a more limited impact on smoking behavior.

7.5 Confounding State-level Expenditures and Tobacco Control Policies

Earmarked State-level Education Expenditures. Fifth, we rule out the possibility that the change in smoking behavior is driven by confounding public expenditures on education. If states earmarked revenue from cigarette taxes toward education expenditure, then higher cigarette taxes may impact state-level investment in education. We add per-pupil education spending as a control to our main specification in Equation 1. Specifically, we include inflation-adjusted per-pupil expenditures for pub-

[31] See Evans and Ringel (1999); Gruber and Köszegi (2001); Gruber and Zinman (2001); Bradford (2003); Colman et al. (2003); Levy and Meara (2006).

lic elementary and secondary schools from the *National Center for Education Statistics* (1959-2019).

Table A.6 shows that the importance of in-utero taxes holds even when controlling for per-pupil education expenditures over three points in the child's life course. Column (1) shows the effect of per-pupil spending in public elementary and secondary school from the mother's conception year. Column (2) shows the per-pupil expenditures on education at age five, the year children typically enter kindergarten in the U.S. public school system. Column (3) controls for per-pupil expenditures just before entry into high school or age 13. All three measures of per-pupil expenditures fail to predict lower prenatal smoking today. Even when controlling for the three measures of per-pupil expenditure on education, in-utero cigarette taxes continue to be important in explaining smoking behavior.

Other In-Utero State-level Expenditures and Wealth. Sixth, we control for related state-level expenditure, revenues, and other tobacco policies using the *State Health Policy Research Dataset (1980-2010, ICPSR 34789)*.[32] Table A.6 Columns (4)-(6) show the results controlling for other state-level expenditures, state-level revenues, as well as state-level tobacco control policies. Even when controlling for these factors, in-utero taxes continue to be independently important for smoking behavior in adulthood.

State-level Expenditure and Revenue as Outcomes. Seventh, we rule out the possibility that cigarette taxes directly affect state-level expenditure and revenue. We replace the per capita state-level expenditures and revenues as outcomes in our main specification. Generally, in-utero cigarette taxes fail to predict other state-level per capita expenditures or revenues in Table A.7. Cigarette taxes are only negatively related to per-pupil expenditure at conception, but this relationship disappears by school age (age 5 and 13). The relationship between per-pupil expenditure and in-utero cigarette taxes is also opposite of the expected magnitude, suggesting that higher cigarette taxes may not be clearly earmarked toward education. These findings add to the baseline results by ruling out confounding state-level policies and earmarked expenditure toward education. Overall, cigarette taxes at conception appear to independently impact smoking behavior in adulthood rather than being determined by related state-level policies.

[32] A notable limitation of this state policy data, is that it only starts in 1980 onward, thus our conclusions in the section are limited to cohorts born after the 1970s.

7.6 Is the Observed Effect Due to Selection into Pregnancy (by the Grandmother)?

Eighth, we evaluate whether changes in cigarette taxes are associated with differing observable characteristics of grandmothers who became pregnant between 1968 and 2001. Higher state-level cigarette taxes may be related to other state-level factors that affect who becomes pregnant, such as state economic conditions. Because our crucial window of exposure is the cigarette taxes faced by the grandmother, we evaluate selection into pregnancy over the 1960s and into the 2000s, representing the maternal conception years.

First, we use IPUMs census data from 1970 to 2000 (Ruggles et al., 2021). This data includes information on household and individual characteristics, as well as the age of the eldest child. For our main sample, we select mothers who report the age of the eldest child in the census data.[33] We then approximate the year of conception of the oldest child, as the observation year minus the child's age minus one. Then, using the year of conception of the child, we consider whether the in-utero taxes during the mother's year of conception predict the grandmother's income or education.[34] We include fixed effects for the observation state, observation year, year of conception, and the grandmother's age. We specifically control for the grandmother's age fixed effects (at observation) because older mothers should have higher income and educational attainment, and we are not observing all mothers at the same point in the life course. No other controls are included in the analysis, other than the fixed effects.

Table A.8 reveals no consistent relationship between in-utero cigarette taxes and the grandmother's characteristics. Income, college education, and fertility fail to be statistically significant in any specification. Only high school degree attainment is related to in-utero taxes. However, the relationship disappears when trends are added to the specification. These results using the IPUMs census data suggest no clear link between early-life cigarette taxes and the grandmother's observable characteristics.

Second, we use the birth certificate records extending back to 1968 to consider the grandmother's and mother's characteristics. While we do not have smoking in-

[33]This sample includes only women with children in the household through 2000, and should primarily represent grandmothers rather than the mothers in our sample. While there could be some overlap between the grandmothers considered in the IPUMS data and the mothers in our sample, this overlap would only occur for the sample where we extend records back to the 1990s (including the unrevised records). The women considered as grandmothers here should not overlap with the main sample of mothers who delivered their first child in 2009 and onward.

[34]We use data that has been collapsed to the current year, year of conception, grandmother's age, and state level using weights reported by IPUMS. In the analysis, weights are applied based on the number in each cell.

From the IPUMS data we select 1% samples, and to ensure similar weighting across birth years, when only 5% samples are available, we use Stata to select 20% of the 5% sample.

formation this far back in the data, other observable characteristics are available. We focus on the delivery characteristics of the grandmother and potential mothers (who would be observed as infants). In this data, we calculate the year of conception based on the birth year minus the reported gestation (in months).[35] We include fixed effects based on the state and year of conception. Similar to the analysis with IPUMS data, no controls are included.

Table A.9 shows some link between at-conception cigarette taxes, maternal age, and high school degree attainment. However, when state-level linear time trends are added to the specification (as in our baseline specification), the relationship disappears. Marital status is the only characteristic that is consistently related to in-utero cigarette taxes, suggesting some potential selection into pregnancies over 1968-2001. However, this selection does not appear over education, age, or income.

We also consider whether early-life cigarette taxes affect the mother's health at birth. Table A.9 reveals that higher in-utero cigarette taxes reduce instances of both low birth weight (<2,500 grams) and very low birth weight (<1,500 grams) for the cohort of mothers born from 1968-2001. The relationship between in-utero cigarette taxes and the birth weight of the mothers in our sample demonstrates the first-stage health effects of in-utero cigarette taxes. These health effects may persist throughout the life course, which is something we explore in Section 8. These initial health effects are important because while we cannot document the first-stage effects of cigarette taxes on the grandmother's prenatal smoking, we can confirm first-stage health effects on the mother as a newborn.

8 Mechanisms behind the Link between In-Utero Taxes and Prenatal Smoking

We next present two main potential mechanisms to explain why in-utero taxes are important in determining adult prenatal smoking. While we outlined several possibilities in Section 3, we focus on the channels available in the birth certificate records, adult health and human capital. From previous studies, we know that prenatal smoking adversely impacts infant health at birth and fetal brain development.[36] We also demonstrate this finding again in Table A.9, showing that in-utero cigarette taxes

[35]In cases where gestation is missing, we use eight months.
We also collapse the data to the year of conception and residence state level using the record weight reported on the birth certificate. In the analysis, weights are applied based on the number of births.

[36]See Evans and Ringel (1999); Dempsey and Benowitz (2001); Levy and Meara (2006); Thielen et al. (2008).

(faced by the grandmother) have first-stage impacts on the mother's health at birth (over 1968-2001). Here we test whether these initial health consequences of prenatal smoking during early development (proxied by in-utero tax increases) have long-term impacts on the mother's adult human capital development, socioeconomic status (SES), adult health, or third-generation infant health. Our results demonstrate the importance of higher in-utero taxes on maternal and infant health. Though we acknowledge that more than one channel may be at play, and the results presented here are speculative rather than conclusive.

8.1 Adult Human Capital Formation

First, we test whether an increase in the state-level cigarette tax near gestation affects the human capital accumulation of the mother. The mother's educational attainment is the clearest measure of adult human capital recorded on the birth certificate. Though, we also consider additional measures of SES that may indicate higher human capital, including insurance status, receipt of WIC during pregnancy, and marital status.[37] Unfortunately, we cannot consider more direct measures such as income or occupation, as this information is not provided on the birth certificate. Table 4 Panel A presents the results from Equation 1 estimated over measures of SES and human capital. Higher (real) cigarette taxes during the mother's own gestation produce inconsistent impacts on human capital. While cigarette taxes predict a higher likelihood of attaining a college degree, at the same time, terminal high school degree attainment declines.

8.2 Maternal Health Effects

Next, we consider whether in-utero cigarette taxes have second generation health impacts. Lower exposure to prenatal smoke while in-utero will have important physiological impacts on the mother. This change in maternal health would arise from both lower exposure to cigarette smoke in-utero, as well as potentially throughout childhood.

Table 4 Panels B and C show that mothers exposed to higher at-conception taxes are healthier and show improved health behaviors. Panel B Column (1) reveals lower pre-pregnancy maternal BMI, resulting from a lower likelihood of being obese or overweight (Columns (3)-(4)). Mothers exposed to higher in-utero cigarette taxes are also

[37] While marital status may not immediately appear to measure SES, individuals of low SES are more likely to have out-of-marriage births (Schneider and Hastings, 2015).

more likely to gain the recommended amount of weight during pregnancy, suggesting ongoing improvements in maternal health behaviors.

In Panel C, mothers exposed to higher in-utero cigarette taxes are less likely to develop diabetes (before or during pregnancy). However, there is no impact on hypertension or preeclampsia during or before pregnancy. Finally, higher cigarette taxes are associated with a higher likelihood of breastfeeding. The higher likelihood of breastfeeding may result from general improvements in the mother's health behaviors (as with bodyweight). Or it may be a consequence of the mother's awareness of the potential risks of nicotine exposure in breastmilk fed to the newborn. Thus, mothers who otherwise would have avoided breastfeeding due to nicotine exposure in breastmilk can breastfeed (since they are non-smokers).

8.3 Infant Health Outcomes

We conclude the mechanisms section by testing whether in-utero cigarette taxes have third-generation effects on the health of infants born to contemporary mothers. Because in-utero cigarette taxes shift behavior away from smoking for contemporary mothers (the second generation), higher taxes could impact the infant's exposure to prenatal smoking. Prior work has demonstrated the importance of contemporary cigarette taxes for infant and child health (Evans and Ringel, 1999; Levy and Meara, 2006; Simon, 2016). These studies have shown that higher cigarette taxes improve newborn and child health through a reduction in prenatal smoking. In our setting, we anticipate that in-utero cigarette taxes may affect third-generation infant health through lower prenatal smoking in the second generation.

Table 5 suggests moderate effects on infant health, with the most noticeable effects on the extreme levels of prematurity and low birth weight. Higher cigarette taxes during the mother's birth year predict a higher Apgar score, a lower likelihood of being very premature, and a lower likelihood of being very low birth weight (<1,500 grams). These results suggest that the second generation, or contemporary mother's, exposure to higher in-utero cigarette taxes has a biological link to newborn health (or third-generation exposure). A portion of the effect, especially the better Apgar scores, may be due to the importance of obesity in neonatal outcomes (Chen et al., 2010; Avcı et al., 2015). However, another portion of the effect, especially the very low birth weight effect, is likely due to the long-term impacts of lower prenatal smoking. These results indicate that higher cigarette taxes can impact the health of two generations through only indirect exposure to cigarette taxes. These findings provide additional evidence favoring a biological link between higher cigarette taxes and prenatal smoking.

8.4 Multiple Hypothesis Testing: False Discovery Rate Q-values

Due to the fact that we consider 28 different outcomes throughout the maternal and infant health mechanisms section, we briefly consider whether our findings are statistically significant by chance. We implement a test for multiple hypothesis testing by computing the sharpened False Discovery Rate (FDR) q-values, from Anderson (2008). These FDR q-values are based on the p-values for at-conception cigarette taxes in Tables 4 and 5. Table A.11 Column (1) presents the FDR q-values, and Column (2) shows the original p-values. While the q-values are generally larger than the original p-values, the results that were significant in Tables 4 and 5 remain statistically significant when using q-values.

9 Extension: Has the Relative Influence of In-Utero, Present-day, and Teenage Taxes Changed over Time?

Table A.2 and Table A.3 show that higher in-utero cigarette taxes are more influential for prenatal smoking than contemporary or teenage cigarette taxes. This finding diverges from related work, where a broad literature has demonstrated the influence of contemporary cigarette taxes on smoking behavior.[38] Recent studies have also documented the importance of teenage taxes on life-course smoking behavior (Friedson and Rees, 2020; Friedson et al., 2021b,a).

To explain the observed differences between our findings and prior work, we test whether the divergence in cigarette tax responsiveness is due to our emphasis on a younger cohort. We consider prior cohorts by adding the unrevised birth certificate records to our primary sample and expanding the delivery years from 1996 to 2020.[39] Adding these additional years of data allows us to test whether the three cigarette taxes of focus display cohort-specific effects that fade (or appear) at certain points in time. For example, the majority of mothers in our study (2009-2020) were teenagers from 2003 to 2016. Hansen et al. (2017) shows that youth smoking has been less sensitive to cigarette taxes since 2005. Similarly, Lakdawala and Simon (2017) and Markowitz et al. (2013) also demonstrate that the responsiveness of pregnant women to cigarette taxes has declined over time.

[38] See Evans and Ringel (1999); Gruber and Köszegi (2001); Bradford (2003); Colman et al. (2003); Levy and Meara (2006); Simon (2016); Adams et al. (2012).

[39] To keep the policies similar between the time periods, we only include controls for the mother's race, the state-level beer tax, and the state-level minimum wage. We also control for the revision itself with a binary variable. All other features of Figure 5 reflect the results from Equation 1, with each specification only adjusting the years included in the sample.

9.1 The Importance of Teenage and Present-day Taxes over 1996-2002

Figure 5 Panel A shows the impact of cigarette taxes on prenatal smoking over nine samples from 1996 to 2005. In each group of results, the plotted points represent estimates from Equation 1, but the specification includes all three cigarette taxes, at-conception, present-day, and teenage. Panel A begins with 1996-1997 (the unrevised data) and gradually adds one contemporary delivery year of data at a time from left to right, ending with the sample of records from 1996 to 2005 in the final column.

From 1996-1997 the results in Figure 5 Panel A show a clear negative association between prenatal smoking and teenage and contemporary cigarette taxes. Then, as we gradually add one additional year of birth certificate records at a time, the influence of contemporary and teenage taxes begins to decline. Over 1996 to 2002, higher teenage and contemporary cigarette taxes consistently reduce prenatal smoking. Starting in 2002, the importance of teenage and present-day taxes begins to fade, and all three taxes fail to predict smoking behavior after 2002. Throughout all specifications in Panel A, the mother's own exposure to higher in-utero cigarette taxes *fails* to predict prenatal smoking.

9.2 The Rising Influence of In-Utero Taxes over 2006-2020

Then, in Figure 5 Panel B, we re-focus on the delivery years included in the main sample, though we add the unrevised records and stretch the sample backward to 2002. Panel B begins with the sample of birth records from 2002 to 2020 and gradually removes one delivery year at a time, ending with the sample of first deliveries over 2012-2020. Similar to Panel A, Panel B shows the results considering at-conception taxes, contemporary taxes, and teenage taxes (age 13) together in one regression. The goal of Figure 5 Panel B is to determine when the importance of higher in-utero taxes arises in the data.

The results in Figure 5 Panel B reveal that at-conception taxes began to influence behavior around 2006. The coefficient on the mother's in-utero taxes appears weakly significant in 2006, then the relationship between at-conception taxes and prenatal smoking becomes more evident in 2007-2020 (and onward).[40] The importance of higher in-utero cigarette taxes persists through recent data, including the sample of delivery years 2012-2020. Over this period, contemporary and teenage cigarette taxes

[40]The coefficient on in-utero taxes in the 2006-2020 sample is sensitive to the inclusion of the binary variable capturing the revision as a control, and the relationship is stronger if we omit the control for the revision from the sample.

fail to predict smoking behavior and are both positively related to prenatal smoking.[41]

Overall, our findings suggest a crucial shift in the influence of real state-level cigarette taxes over the period of our study. While contemporary and teenage cigarette taxes explain smoking behavior over the 1990s (and early 2000s), this influence has dissipated in recent years, aligning with Markowitz et al. (2013); Hansen et al. (2017); Lakdawala and Simon (2017). Instead, over recent years (since 2006), in-utero taxes appear to be a more important determinant of current smoking patterns. The period of importance also aligns with in-utero exposure over the 1980s through the early 2000s, an era of effective cigarette tax policy both in the literature,[42] as well as in the cohort under consideration in Table 3. These findings suggest that higher cigarette taxes over the 1980s and 1990s may have reduced prenatal smoking for a recent generation of mothers.[43]

10 Conclusion

This study examines the long-term impact of higher in-utero cigarette taxes on adult prenatal smoking. Our study makes two important contributions. First, we document the influence of in-utero taxes on later-life adult prenatal smoking. Second, we show that the increased responsiveness to in-utero taxes (post-2006) correlates with a reduction in the effectiveness of teenage and contemporary taxes. The period where in-utero taxes are most effective corresponds to in-utero exposure over birth cohorts from the 1980s and 1990s, an era of particularly effective cigarette tax policy.

Then, we explore potential mechanisms behind the importance of at-conception cigarette taxes for adult smoking behavior. The strongest evidence indicates that higher cigarette taxes improve the health of the mother and the infant. Higher cigarette taxes faced by the maternal grandmother may permanently affect the health of adult children and grandchildren. Further, the critical exposure window appears very early in the mother's life rather than throughout childhood, again suggesting that the biological impacts of prenatal smoking may outweigh other channels such as parental

[41] In Section D we also show that the key years highlighted here coincide with changes in the average cigarette tax rate over time.

[42] See again Evans and Ringel (1999); Gruber and Köszegi (2001); Bradford (2003); Colman et al. (2003); Levy and Meara (2006); Simon (2016); Adams et al. (2012).

[43] A notable related factor that could explain the cohort effects is the selection effect of who has children (to begin with). Over time, the average maternal age at first birth has shifted up, and fertility has declined, a pattern that has accelerated since the Great Recession (Kearney et al., 2022). This change in maternal characteristics may also factor into the cohort-specific adjustments in tax responsiveness.

role modeling.[44] Put together, our findings document the intergenerational impacts of higher cigarette taxes on health and health behaviors.

Still, our findings also have several notable limitations. First, our sample focuses primarily on prenatal smoking from 2009 onward. Our conclusions may not extend to non-pregnancy-related smoking or across different time periods. Second, while we demonstrate that cigarette taxes are unrelated to missing reported information on smoking, the underlying data are self-reported, and may suffer from measurement bias. Third, while our main specification deals with many state-level confounders and state-level secular trends, and the robustness checks are reassuring (especially the event-study design), we cannot entirely rule out the possibility that unobservable factors determine both prenatal smoking and state-level cigarette taxes. Fourth, while we find evidence favoring a biological impact of early-life exposure to higher cigarette taxes and prenatal smoking, the detrimental health effects of cigarette exposure do not necessarily translate into smoking outcomes. Instead, we emphasize that there may be other closely related biological factors at play, for instance, changes in the individual's general proclivity towards nicotine-containing products (Lv et al., 2008; England et al., 2015; Romoli et al., 2019).

Despite these limitations, our findings have important broader implications and policy relevance. First, we confirm that contemporary cigarette taxes may have "lost their bite" in recent years, aligning with Callison and Kaestner (2014); Markowitz et al. (2013); Hansen et al. (2017); Lakdawala and Simon (2017); DeCicca et al. (2020). Today, prenatal smokers have relatively inelastic demand for cigarettes as compared to previous decades, which may be due to many marginal smokers quitting smoking earlier in life or never starting to begin with. Any remaining smokers are more committed, have more inelastic demand, and are thus less responsive to present-day taxes. The fact that current smokers remain committed, despite tax increases, indicates that other types of public policies and targeted interventions may be needed to further reduce prenatal smoking. One such public policy could be regulating new reduced-risk tobacco products like e-cigarettes proportionate to their risk (rather than regulating them equal to cigarettes), as a way to reduce prenatal smoking (Cooper and Pesko, 2017; Abouk et al., 2019). Another such policy could include exploring the effectiveness of smoking cessation medications at preventing prenatal smoking (Maclean et al., 2019).

Second, and related to the first point, our findings demonstrate that public policies may have cohort-specific effects. In our sample, whether individuals respond to

[44] These results align with Göhlmann et al. (2010), which places some skepticism on the role modeling effect since the timing of parental smoking cessation does not appear particularly important for the child's smoking initiation.

cigarette taxes depends on individual years of data (both infant delivery years and maternal conception years). The sensitivity of our results to different eras of cigarette tax increases indicates that tax responsiveness may be sample and cohort-dependent. While effective tax policy during the 1980s and 1990s did impact prenatal smoking over multiple generations of mothers, the same cigarette tax increases today may be less meaningful for present-day and future smoking. The changing influence of each cigarette tax–present-day, teenage, and in-utero–across cohorts makes it challenging to generalize the impact of cigarette tax policy over time.

Third, in-utero influences, such as public policies, directly impact health and persistently influence health behaviors. Direct first-generation exposure to higher cigarette taxes affects the health and health behaviors of the second generation, a group that only receives indirect in-utero exposure. Even more compelling is the persistence of indirect exposure into the third generation, where infant health is observably improved. These findings importantly add to the broader literature by documenting both the intergenerational effects of cigarette taxes, as well as the long-run influence of in-utero public policies on adult health behaviors.[45] Taken together, this study shows that higher cigarette taxes over the 1980s and 1990s may have reduced prenatal smoking for a recent generation of mothers. The importance of these taxes over multiple generations demonstrates that effective public policies can achieve health and behavior changes that last for generations.

[45]Studies in this literature include: Behrman and Rosenzweig (2004); Almond (2006); Bleakley (2007); Case et al. (2008); Case and Paxson (2009); Currie (2009); Bozzoli et al. (2009); Maluccio et al. (2009); Currie and Almond (2011); Almond et al. (2011); Beach et al. (2016); Hoynes et al. (2016); Hjort et al. (2017); Bhalotra et al. (2017); East et al. (2017); Bütikofer et al. (2019); Hoehn-Velasco (2021).

11 Tables

Table 1: Summary Statistics

	Mean	St. Dev.	Min	Max	Observations
Outcomes					
1(Smoked Pre-Pregnancy)	0.105	0.306	0.000	1.000	9,471,019
1(Smoked During Pregnancy)	0.072	0.258	0.000	1.000	9,471,125
1(Smoked-1st Trimester)	0.069	0.253	0.000	1.000	9,470,376
1(Smoked-2nd Trimester)	0.054	0.226	0.000	1.000	9,469,447
1(Smoked-3rd Trimester)	0.050	0.218	0.000	1.000	9,458,441
Cigarettes Per Day-Pregnancy (Extensive + Intensive)	0.521	2.620	0.000	98.000	9,457,632
Cigarettes Per Day-Pregnancy (Intensive)	7.409	6.819	0.333	98.000	665,498
Taxes					
At-Conception Cigarette Tax	0.222	0.136	0.000	1.110	9,474,043
Present-Day Cigarette Tax	1.488	0.997	0.070	4.940	9,474,999
Tobacco					
E-cigarette Tax Rate	0.114	0.456	0.000	3.444	9,474,999
1(County-level Tobacco 21 Law)	0.081	0.263	0.000	1.000	9,474,999
1(County-level E-cigarette MLSA)	0.027	0.163	0.000	1.000	9,474,999
County-level Index of Indoor Smoking Restrictions	0.777	0.252	0.000	1.000	9,474,999
County-level Index of Indoor Vaping Restrictions	0.141	0.321	0.000	1.000	9,474,999
Substitutes					
State-level Beer Tax	0.276	0.250	0.020	1.290	9,474,999
1(State-level Recreational Marijuana Law)	0.078	0.265	0.000	1.000	9,474,999
1(State-level Medical Marijuana Law)	0.354	0.478	0.000	1.000	9,474,999
1(State-level Mandatory Opioid PDMP)	0.963	0.188	0.000	1.000	9,474,999
Economic					
Minimum Wage	7.915	1.168	5.850	14.000	9,474,999
ACA Medicaid Expansion	0.316	0.465	0.000	1.000	9,474,999
County-level Unemployment Rate	6.326	2.712	1.100	28.900	9,474,999
County-level Median Household Income (in 1,000s)	56.901	15.568	18.860	151.806	9,474,999
County-level % of Population in Poverty	14.810	5.294	2.600	62.000	9,474,999
Characteristics					
1(Private Insurance)	0.574	0.494	0.000	1.000	9,474,999
1(Medicaid)	0.356	0.479	0.000	1.000	9,474,999
1(Self-Pay)	0.018	0.134	0.000	1.000	9,474,999
1(College)	0.361	0.480	0.000	1.000	9,474,999
1(High School)	0.256	0.436	0.000	1.000	9,474,999
1(Some College)	0.309	0.462	0.000	1.000	9,474,999
1(Hispanic)	0.157	0.364	0.000	1.000	9,474,999
1(White)	0.665	0.472	0.000	1.000	9,474,999
1(Black)	0.130	0.336	0.000	1.000	9,474,999
Maternal Age	26.016	5.483	18.000	49.000	9,474,999

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.

Table 2: Main Results–In-Utero Cigarette Taxes and Later-Life Adult Prenatal Smoking

	1(Any Pre-Pregnancy Smoking)			1(Any Prenatal Smoking)			Prenatal Per Day Cigarettes Extensive + Intensive			Prenatal Per Day Cigarettes Intensive Only		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
At-Conception Cigarette Tax	-0.1762**	-0.1732**	-0.1215***	-0.2100**	-0.2044**	-0.1371***	-0.2378***	-0.2359**	-0.1429***	-0.0090	0.0002	-0.0034
	(0.0807)	(0.0839)	(0.0403)	(0.0966)	(0.1007)	(0.0488)	(0.0900)	(0.0971)	(0.0484)	(0.0065)	(0.0070)	(0.0055)
Observations	9,470,064	9,470,064	9,470,064	9,470,171	9,470,171	9,470,171	9,456,678	9,456,678	9,456,678	665,465	665,465	665,465
Adjusted R-squared	0.053	0.069	0.071	0.040	0.053	0.055	0.026	0.035	0.036	0.026	0.037	0.038
Mean Dependent	0.105	0.105	0.105	0.072	0.072	0.072	0.521	0.521	0.521	7.409	7.409	7.409
Baseline FE	X	X	X	X	X	X	X	X	X	X	X	X
Controls		X	X		X	X		X	X		X	X
Maternal Birth State Trends			X			X			X			X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Elasticities reported. Binary outcomes estimated with a linear probability model. Baseline fixed effects include: mother's (own) birth-state fixed effects, current residence state fixed effects, the mother's conception year fixed effects, and the present delivery month-year of conception fixed effects. To calculate the mother's conception year, we subtract the mother's age plus one year from the month-year of delivery. Linear trends based on the mother's (own) birth state and mother's conception year are included in the preferred specification. At-conception cigarette taxes are the state-level in-utero cigarette taxes from the mother's (own) conception year in the mother's (own) birth state. Real cigarette taxes are CPI-adjusted and reported in 2020 dollars. Demographic controls include race/ethnicity (white non-Hispanic, black non-Hispanic, Hispanic). We choose not to include education and insurance status as they may be endogeneously determined and represent "bad controls" (Angrist and Pischke (2008), as shown in Section 8). Tobacco control policies include controls for the contemporary state-level cigarette tax, county-level Tobacco 21 laws, the county-level share of the population covered by indoor vaping restrictions, the county share of the population covered by indoor smoking restrictions in bars/restaurants and workplaces, the county-level standardized e-cigarette tax, and an indicator for whether the county has a e-cigarette minimum purchasing age. General policy controls include ACA Medicaid expansion status, the binding state-level minimum wage (whichever is higher–the state or federal minimum wage), the county-level unemployment rate, the median county-level income, the percent of the county below the poverty line, the state-level beer tax, a binary variable for state-level recreational and medical marijuana legalization, and a binary variable for state-level opioid PDMP. The sample includes only first births (nulliparous) and mothers 18-49. Birth years 2009-2020 included in the analysis. Robust standard errors clustered at the level of the mother's (own) birth state. ***, **, * represent statistical significance at 1, 5 and 10 percent levels.

Table 3: Robustness–Heterogeneous Effects
Panel A: By Maternal Characteristics

Outcome: 1(Prenatal Smoking)	Payment		Education				Age	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Medicaid	Private	Less than High School	High School	Some College	College or Higher	<26	26+
At-Conception Cigarette Tax	-0.0456***	-0.1572*	-0.0065	-0.0621***	-0.0301*	-0.0038	-0.0965***	-0.0275
	(0.0165)	(0.0850)	(0.0174)	(0.0232)	(0.0174)	(0.0275)	(0.0245)	(0.0248)
Observations	3,370,261	5,440,880	700,319	2,424,208	2,929,813	3,415,831	4,722,018	4,748,153
Adjusted R-squared	0.099	0.028	0.134	0.083	0.031	0.003	0.066	0.018
Mean Dependent	0.133	0.034	0.206	0.125	0.069	0.009	0.104	0.040
Baseline FE	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X	X

Panel B: By Maternal Conception Year

Outcome: 1(Prenatal Smoking)	Maternal Conception Year Broad Groupings				Maternal Conception Year Decades			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<1987	1987+	<1981	1981+	1965-1974	1975-1984	1985-1994	1995-2001
At-Conception Cigarette Tax	-0.0045	-0.0965***	-0.0262	-0.0948**	-0.0184	0.0056	-0.0729**	-0.0253*
	(0.0538)	(0.0248)	(0.0534)	(0.0423)	(0.1309)	(0.0489)	(0.0369)	(0.0150)
Observations	3,780,052	5,690,119	1,215,169	8,255,002	208,636	2,576,391	5,382,420	1,728,802
Adjusted R-squared	0.025	0.064	0.019	0.057	0.022	0.021	0.063	0.060
Mean Dependent	0.045	0.090	0.036	0.077	0.034	0.041	0.084	0.088
Baseline FE	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Elasticities reported. Results are from a linear probability model. Results reflect Equation 1 and Table 2, except splitting the sample by characteristics noted in the column header.

Table 4: Mechanisms–Maternal Human Capital, Health, and Health Behaviors

Panel A: Human Capital

	1(High School Or Higher)	1(Some College or Higher)	1(College or Higher)	1(Married)	1(Move States)	1(Private Insurance)	1(WIC)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
At-Conception Cigarette Tax	-0.0085**	-0.0004	0.0276*	0.0146	-0.0172*	0.0107	-0.0101
	(0.0041)	(0.0155)	(0.0144)	(0.0171)	(0.0087)	(0.0102)	(0.0135)
Observations	9,474,043	9,474,043	6,985,000	9,117,857	9,474,043	9,474,043	9,359,473
Adjusted R-squared	0.091	0.280	0.235	0.336	0.167	0.295	0.321
Mean Dependent	0.926	0.670	0.487	0.543	0.313	0.574	0.370
Baseline FE	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X

Panel B: Pre-Pregnancy BMI and Weight Gain During Pregnancy

	Pre-Pregnancy BMI	1(Under-weight)	1(Over-weight Or Obese)	1(Obese)	1(Correct Weight Gain)	1(High Weight Gain)	1(Low Weight Gain)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
At-Conception Cigarette Tax	-0.2928***	0.0007	-0.0230***	-0.0179***	0.0058***	0.0012	-0.0071***
	(0.0698)	(0.0011)	(0.0033)	(0.0028)	(0.0020)	(0.0018)	(0.0024)
Observations	9,303,325	9,303,325	9,303,325	9,303,325	9,141,849	9,141,849	9,141,849
Adjusted R-squared	0.026	0.010	0.024	0.021	0.004	0.007	0.005
Mean Dependent	26.773	0.038	0.486	0.237	0.302	0.184	0.513
Baseline FE	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X

Panel C: Maternal Health and Health Behaviors

	1(Diabetes)	1(Chronic Hyper-tension)	1(Pregnancy Hyper-tension)	1(Eclam-psia)	1(Early Prenatal Care)	1(Breast-feeding)	1(Elective Cesarean)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
At-Conception Cigarette Tax	-0.0038***	0.0005	-0.0006	-0.0001	-0.0033	0.0103*	-0.0021*
	(0.0013)	(0.0012)	(0.0007)	(0.0002)	(0.0050)	(0.0061)	(0.0012)
Observations	9,463,998	9,463,998	9,463,998	9,463,998	9,474,043	6,613,525	9,470,196
Adjusted R-squared	0.011	0.009	0.008	0.003	0.053	0.095	0.012
Mean Dependent	0.051	0.082	0.016	0.003	0.778	0.846	0.117
Baseline FE	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: OLS coefficients reported. Binary outcomes estimated with a linear probability model. Results reported for binary outcomes are from a linear probability model. Results reflect Equation 1. See Table 2 for complete notes, controls, and sample selection.

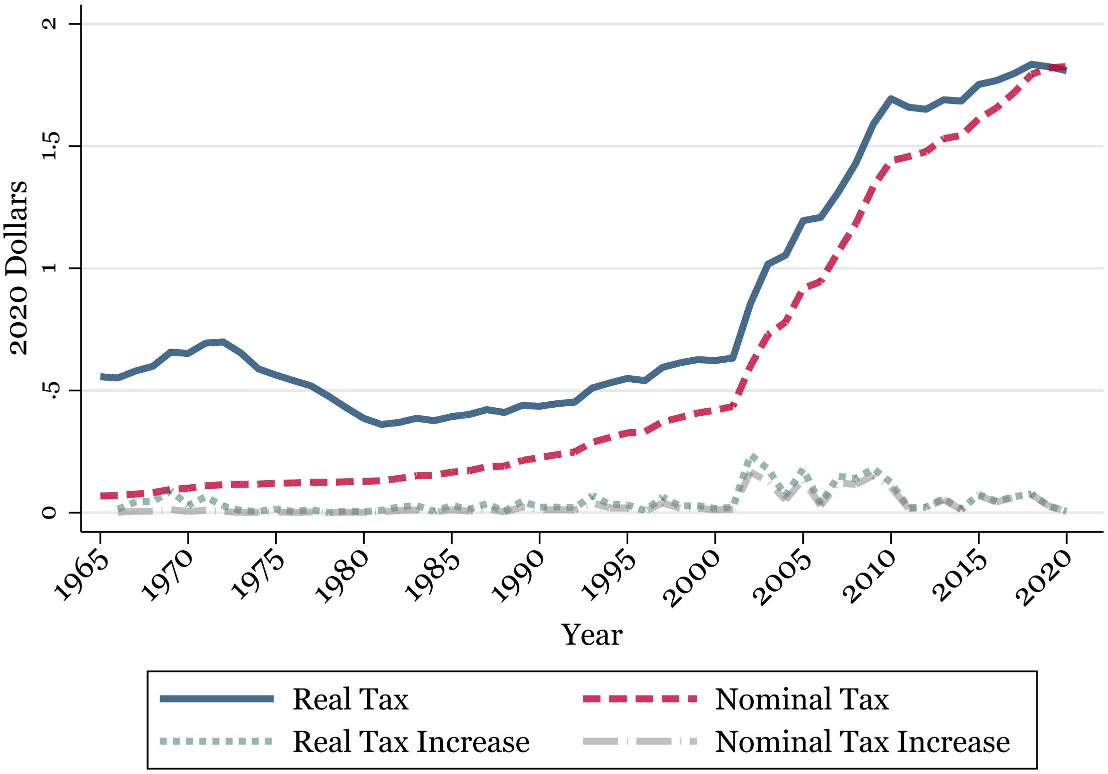
Table 5: Mechanisms–Infant Health at Birth

	1(Premature <37 Weeks)	1(Very Premature <32 Weeks)	1(Small for Gestational Age)	1(Very Small for Gestation)	1(Low Birth Weight <2,500g)	1(Very Low Birth Weight <1,500g)	5-Minute Apgar
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
At-Conception Cigarette Tax	-0.0000	-0.0011*	-0.0016	-0.0010	-0.0013	-0.0009**	0.0096*
	(0.0017)	(0.0006)	(0.0025)	(0.0016)	(0.0015)	(0.0004)	(0.0049)
Observations	9,474,043	9,474,043	9,467,485	9,467,485	9,467,486	9,467,485	9,442,952
Adjusted R-squared	0.007	0.004	0.016	0.011	0.010	0.004	0.014
Mean Dependent	0.102	0.018	0.275	0.112	0.081	0.014	8.736
Baseline FE	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: OLS coefficients reported. Binary outcomes estimated with a linear probability model. Results reported for binary outcomes are from a linear probability model. Results reflect Equation 1. See Table 2 for complete notes, controls, and sample selection.

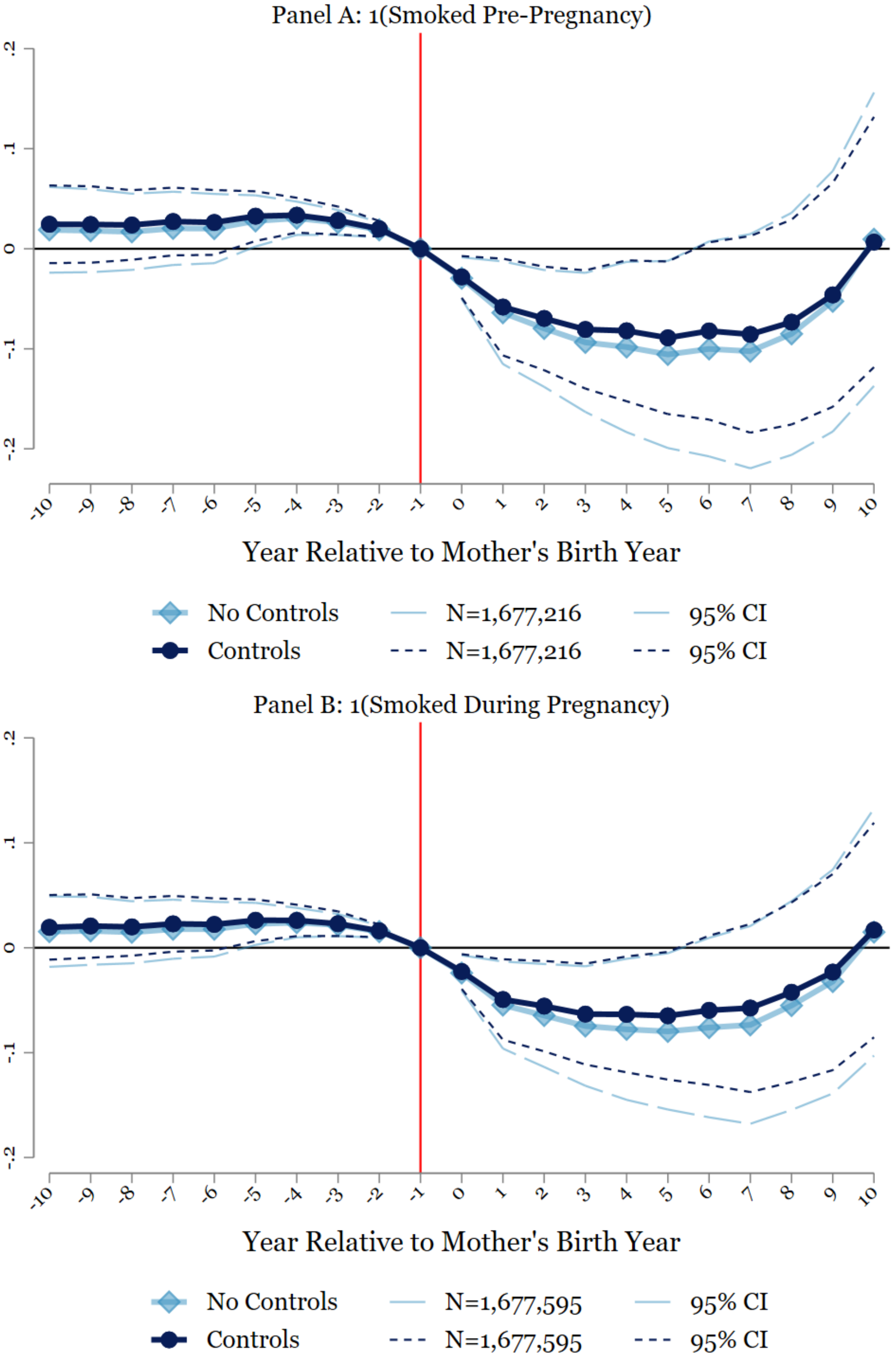
12 Figures

Figure 1: Background–Average State-level Cigarette Taxes, 1965-2020



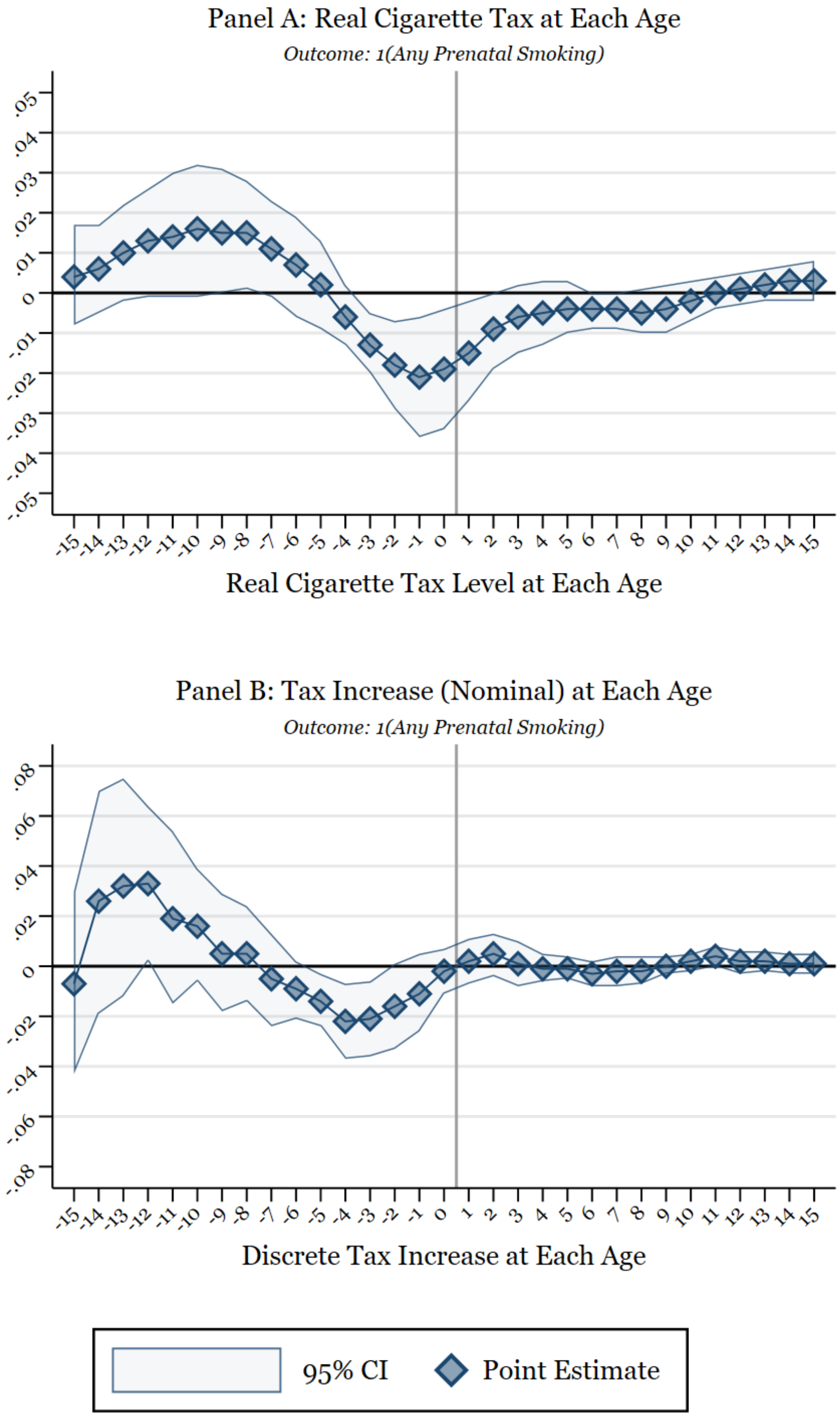
SOURCE: State-level cigarette taxes are from the CDC State System and the Tax Burden on Tobacco.
NOTES: Information presented above for the average state-level cigarette taxes. Real cigarette taxes are CPI-adjusted and reported in 2020 dollars. The green short-dashed line represents the inflation-adjusted year-over-year change in the nominal tax rate. The gray dashed line shows the year-over-year change in the nominal tax rate.

Figure 2: Robustness–Event Study over Changes in the Nominal Cigarette Tax



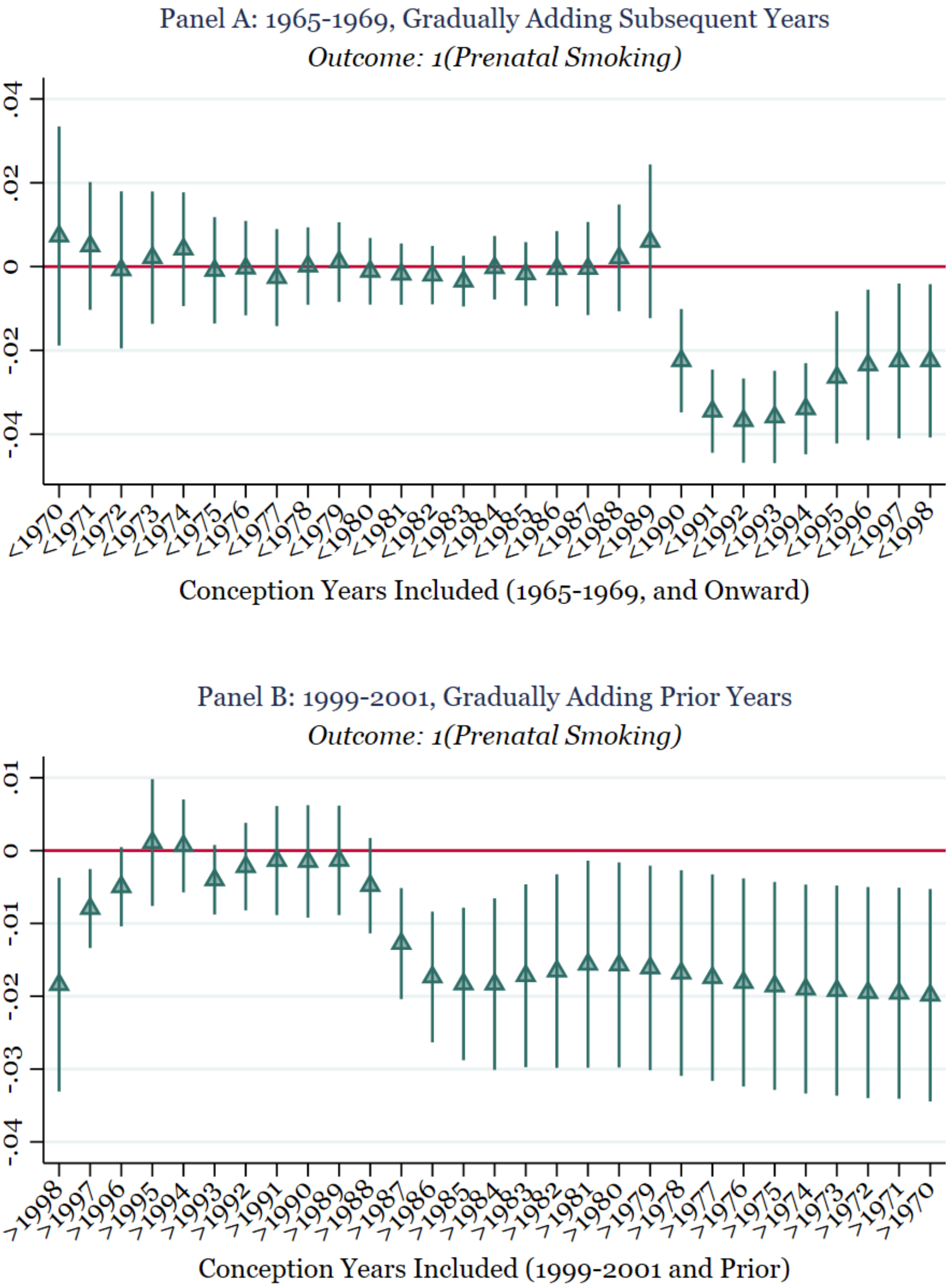
SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: OLS coefficients reported. Results are from a linear probability model. Plotted points respresent estimates from Equation 2. Solid lines represent point estimates. Dashed and dotted lines display the 95 percent confidence intervals. Excluded period is m=-1. Endpoints are binned at m=-11 and m=11. Event study represents nominal tax increases that occurred during the mother's birth year (see example in Table A.5). For the event studies, data collapsed to the current birth state, mother's birth state, maternal year of conception, month-year of the infant conception level, with weights applied based on the number of observations in each collapsed cell. Robust standard errors clustered at the mother's (own) birth state level. Baseline fixed effects include: mother's (own) birth-state fixed effects, current residence state fixed effects, the mother's conception year fixed effects, and the present delivery month-year of conception fixed effects. See Table 2 for controls and sample selection.

Figure 3: Robustness–Real Cigarette Tax Levels and Tax Increases at Each Age



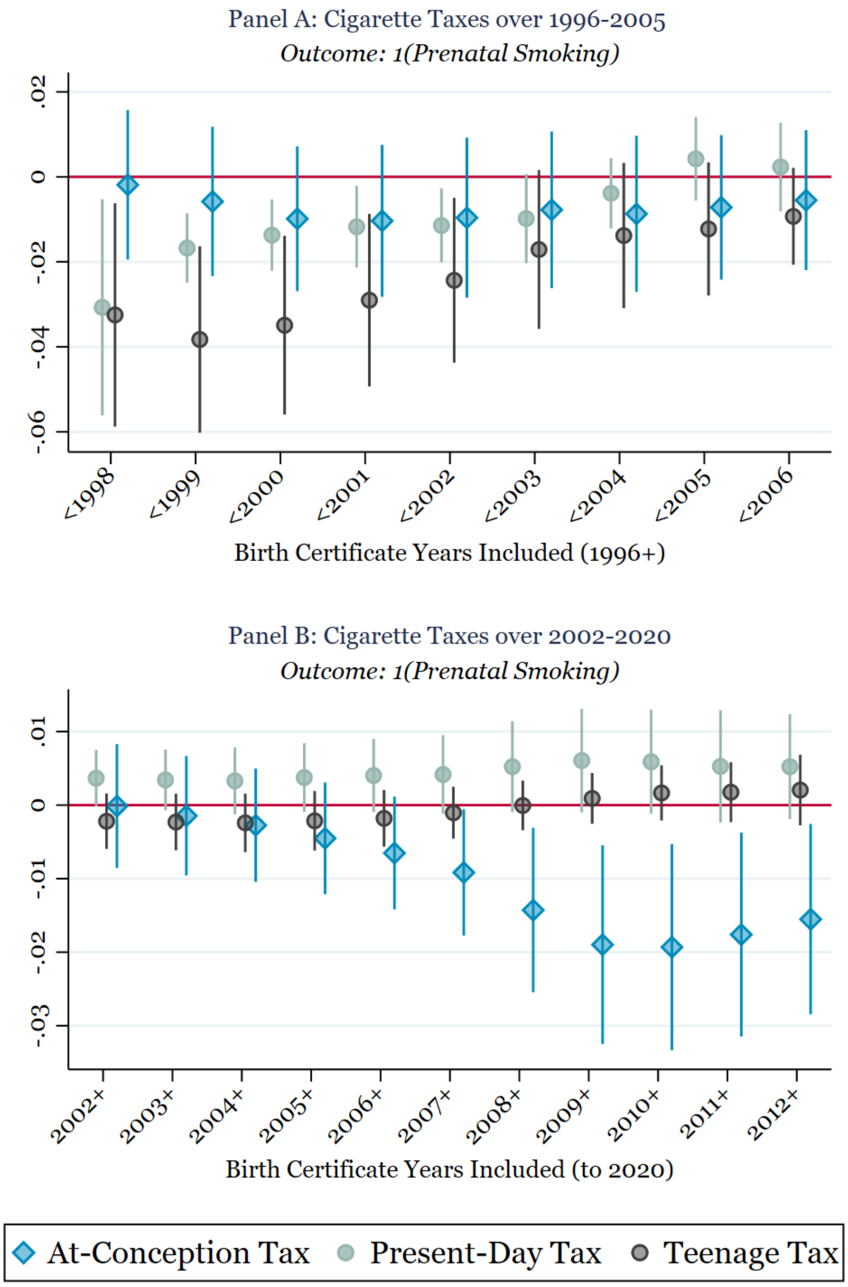
SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: OLS coefficients reported. Results are from a linear probability model. Each plotted point represents a separate estimation of Equation 1. In each specification, we only adjust the age of exposure to the real cigarette tax (or cigarette tax increase). The x-axis reflects the age of exposure, with 0 the year of birth. The line and shaded area represent 95% confidence intervals. All other features of the estimation reflect Equation 1 and Table 2.

Figure 4: Robustness–Effect by Maternal Conception Years



SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: OLS coefficients are reported. Results are from a linear probability model. Each plotted point represents a separate point estimate from Equation 1, gradually adding or subtracting maternal conception years. Lines represent 95% confidence intervals. See Table 2 for controls and sample selection.

Figure 5: Extensions–The Changing Importance of Life-Course Cigarette Taxes



SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: OLS coefficients are reported. Results are from a linear probability model. Each group of three points (at-conception, present-day, and teenage taxes) represent the full specification in Equation 1 adding teenage taxes at age 13. The sample includes nulliparous deliveries for mothers 18-49. Controls only include a subset of period-consistent controls–race/ethnicity (white non-Hispanic, black non-Hispanic, Hispanic), the state-level minimum wage, and the state-level beer tax rate. We also include a control for whether the data represents the 2003 revision (which is relevant in Panel B). Points represent the point estimates, and lines represent the 95% confidence intervals.

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Appendix for Online Publication

A Additional Tables

Table A.1: Description and Sources for Policy Variables

Variable	Source
ENDS Taxes	We use the standardized e-cigarette tax values from Cotti et al. (2021).
State-level Cigarette Tax	Cigarette taxes the state cigarette excise tax from the CDC State System: https://www.cdc.gov/statesystem/index.html and the CDC's Tax Burden on Tobacco https://chronicdata.cdc.gov/Policy/The-Tax-Burden-on-Tobacco-1970-2019/7nwe-3aj9
County-level Cigarette Tax	County-level cigarette taxes measured by the federal cigarette excise tax plus the state cigarette excise tax from the CDC State System (https://www.cdc.gov/statesystem/index.html) and the CDC's Tax Burden on Tobacco plus the local cigarette excise tax from the American Non-Smokers Rights Foundation.
County-level Tobacco 21 Laws	Percent of residents living in areas with a state or local tobacco 21 law, derived from state laws and local law information from Preventing Tobacco Addiction Foundation. US Communities with Tobacco 21 Ordinances as of September 4, 2020.
County-level E-cigarette Minimum Age Laws	An indicator for laws declaring e-cigarettes as tobacco products for purposes of establishing minimum legal sale ages at the county level from Pesko and Currie (2019).
County-level Indoor Vaping and Smoking Restrictions	A smoke-free air law index based on American Non-Smokers Rights Foundation data on states and localities banning smoking in restaurants, bars, and private workplaces. Specifically, we use the percent of the population covered under these laws in each state, weighing laws applied to bars, restaurants, and private workplaces equally, and treating partial bans (e.g., separate smoking areas) with half the weight of a full ban. We use the same method to create a parallel vape-free air law index.
County-level Unemployment Rate	The county unemployment rate from the Bureau of Labor Statistics Local Area Unemployment Statistics. Available at: https://www.bls.gov/lau/
State-level Beer Tax	The state's beer tax from Urban Institute & Brookings Institution. State Alcohol Excise Taxes. Available at: https://www.taxpolicycenter.org/statistics/state-alcohol-excise-taxes
State-level Marijuana Laws	Indicators for medical and recreational marijuana laws from Marijuana Policy Project. State Laws With Alternatives to Incarceration for Marijuana Possession. Available at: https://www.mpp.org/assets/pdf/issues/decriminalization/State-Decrim-Chart.pdf
Minimum Wage	The highest of either the state or federal minimum wage from the University of Kentucky Center for Poverty Research. (2021, Feb.). UKCPR National Welfare Data, 1980-2019. Lexington, KY. Available at: http://ukcpr.org/resources/national-welfare-data
County-level Income & Percent of Residents in Poverty	The percent of residents living below the poverty line from from the United States Census Bureau. Small Area Income and Poverty Estimates (SAIPE) Program. Available at: https://www.census.gov/programs-surveys/saipe.html
ACA	An indicator for state Medicaid expansions under the Affordable Care Act. From the Kaiser Family Foundation Status of State Action on the Medicaid Expansion Decision. Available at: https://www.kff.org/health-reform/state-indicator/ state-activity-around-expanding-medicaid-under-the-affordable-care-act/
Per Capita Expenditures (At Birth)	State Health Policy Research Dataset (SHEPRD): 1980-2010 (ICPSR 34789) available at https://www.icpsr.umich.edu/web/ICPSR/studies/34789
Per Pupil Education Spending	Current expenditure per pupil in average daily attendance in public elementary and secondary schools 1959-2019. Data before 1985 filled in with linear trends. Data estimated by the National Center for Education Statistics. Available at: https://nces.ed.gov/

Table A.2: Main Results–Full Specification

	1(Any Pre-Pregnancy Smoking)			1(Any Prenatal Smoking)			Prenatal Per Day Cigarettes Extensive + Intensive			Prenatal Per Day Cigarettes Intensive Only		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
At-Conception Cigarette Tax	-0.0390**	-0.0384**	-0.0269***	-0.0319**	-0.0310**	-0.0208***	-0.2624**	-0.2603**	-0.1577***	-0.1487	0.0033	-0.0562
	(0.0179)	(0.0186)	(0.0089)	(0.0147)	(0.0153)	(0.0074)	(0.0993)	(0.1071)	(0.0534)	(0.1074)	(0.1153)	(0.0916)
Present-Day Cigarette Tax		0.0053**	0.0061*		0.0034*	0.0042		0.0098	0.0145		-0.2362***	-0.2376***
		(0.0024)	(0.0034)		(0.0018)	(0.0027)		(0.0139)	(0.0200)		(0.0537)	(0.0588)
E-cigarette Tax Rate		-0.0007	-0.0007		0.0004	0.0001		0.0298	0.0281		0.2886***	0.2665***
		(0.0052)	(0.0072)		(0.0039)	(0.0055)		(0.0274)	(0.0372)		(0.0770)	(0.0796)
1(County-level Tobacco 21 Law)		0.0021	0.0064		0.0043	0.0076		0.0286	0.0494		-0.3657***	-0.3423***
		(0.0048)	(0.0059)		(0.0040)	(0.0049)		(0.0294)	(0.0363)		(0.1168)	(0.1215)
1(County-level E-cigarette MLSA)		-0.0198***	-0.0210***		-0.0163***	-0.0173***		-0.1209***	-0.1265***		-0.1930**	-0.1902**
		(0.0041)	(0.0047)		(0.0038)	(0.0043)		(0.0312)	(0.0349)		(0.0917)	(0.0893)
County-level Index of Indoor Smoking Restrictions		-0.0502***	-0.0525***		-0.0441***	-0.0460***		-0.4588***	-0.4705***		-0.9671***	-0.9753***
		(0.0036)	(0.0037)		(0.0043)	(0.0041)		(0.0757)	(0.0734)		(0.1910)	(0.1948)
County-level Index of Indoor Vaping Restrictions		0.0096***	0.0117***		0.0073***	0.0090***		0.0628***	0.0760***		0.0411	0.0399
		(0.0031)	(0.0035)		(0.0024)	(0.0027)		(0.0212)	(0.0248)		(0.0978)	(0.0950)
Minimum Wage		0.0057***	0.0060**		0.0044***	0.0047**		0.0358***	0.0399***		-0.0612	-0.0693*
		(0.0020)	(0.0025)		(0.0014)	(0.0018)		(0.0090)	(0.0118)		(0.0380)	(0.0373)
ACA Medicaid Expansion		0.0010	-0.0043		0.0001	-0.0050		-0.0201	-0.0612		-0.0997	-0.1439*
		(0.0049)	(0.0075)		(0.0040)	(0.0062)		(0.0328)	(0.0495)		(0.0849)	(0.0769)
County-level Unemployment Rate		0.0028*	0.0026		0.0023*	0.0022		0.0254**	0.0255*		0.0629***	0.0635***
		(0.0016)	(0.0016)		(0.0013)	(0.0013)		(0.0125)	(0.0129)		(0.0178)	(0.0181)
County-level Median Household Income		-0.0000***	-0.0000***		-0.0000***	-0.0000***		-0.0000***	-0.0000***		-0.0000***	-0.0000***
		(0.0000)	(0.0000)		(0.0000)	(0.0000)		(0.0000)	(0.0000)		(0.0000)	(0.0000)
County-level % of Population in Poverty		-0.0050***	-0.0050***		-0.0034***	-0.0034***		-0.0226***	-0.0226***		-0.0167	-0.0162
		(0.0007)	(0.0007)		(0.0006)	(0.0006)		(0.0052)	(0.0052)		(0.0158)	(0.0158)
1(Hispanic)		-0.0660***	-0.0609***		-0.0508***	-0.0468***		-0.3510***	-0.3240***		-0.6731***	-0.6772***
		(0.0066)	(0.0066)		(0.0057)	(0.0057)		(0.0422)	(0.0433)		(0.1687)	(0.1665)
1(White)		0.0064	0.0086*		0.0052	0.0069*		0.1035***	0.1130***		0.8634***	0.8642***
		(0.0048)	(0.0046)		(0.0036)	(0.0034)		(0.0204)	(0.0197)		(0.0782)	(0.0778)
1(Black)		-0.0713***	-0.0690***		-0.0501***	-0.0484***		-0.4317***	-0.4225***		-1.2365***	-1.2397***
		(0.0093)	(0.0090)		(0.0072)	(0.0069)		(0.0586)	(0.0576)		(0.1367)	(0.1365)
State-level Beer Tax		-0.0166***	-0.0192***		-0.0145***	-0.0172***		-0.1783***	-0.2090***		-0.0737	-0.0356
		(0.0038)	(0.0061)		(0.0040)	(0.0062)		(0.0411)	(0.0599)		(0.0782)	(0.0725)
1(State-level Recreational Marijuana Law)		0.0161***	0.0167**		0.0102***	0.0109**		0.0768**	0.0859**		-0.1694*	-0.1725**
		(0.0048)	(0.0063)		(0.0036)	(0.0049)		(0.0309)	(0.0390)		(0.0873)	(0.0769)
1(State-level Medical Marijuana Law)		-0.0002	-0.0025		-0.0014	-0.0032		-0.0135	-0.0282		0.1140	0.0873
		(0.0047)	(0.0067)		(0.0034)	(0.0052)		(0.0246)	(0.0368)		(0.1428)	(0.1446)
1(State-level Mandatory Opioid PDMP)		0.0024	-0.0027		0.0007	-0.0027		0.0246	0.0115		0.0320	0.0367
		(0.0048)	(0.0069)		(0.0036)	(0.0055)		(0.0279)	(0.0411)		(0.0819)	(0.0818)
Observations	9,470,064	9,470,064	9,470,064	9,470,171	9,470,171	9,470,171	9,456,678	9,456,678	9,456,678	665,465	665,465	665,465
Adjusted R-squared	0.053	0.069	0.071	0.040	0.053	0.055	0.026	0.035	0.036	0.026	0.037	0.038
Mean Dependent	0.105	0.105	0.105	0.072	0.072	0.072	0.521	0.521	0.521	7.409	7.409	7.409
Baseline FE	X	X	X	X	X	X	X	X	X	X	X	X
Controls		X	X		X	X		X	X		X	X
Maternal Birth State Trends			X			X			X			X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except displaying the OLS coefficients (instead of elasticities).

Table A.3: Robustness–Contemporary, Teenage, and In-Utero Cigarette Taxes

	1(Any Pre-Pregnancy Smoking)			1(Any Prenatal Smoking)			Prenatal Per Day Cigarettes Extensive + Intensive			Prenatal Per Day Cigarettes Intensive Only		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Main Sample, Adding Teenage and Contemporary Taxes												
At-Conception Cigarette Tax	-0.1941**	-0.1804**	-0.1193***	-0.2282**	-0.2118**	-0.1342***	-0.2551***	-0.2428**	-0.1382***	-0.0099	-0.0015	-0.0013
	(0.0823)	(0.0813)	(0.0391)	(0.0977)	(0.0975)	(0.0476)	(0.0912)	(0.0945)	(0.0474)	(0.0061)	(0.0061)	(0.0057)
Teenage (Age 13) Cigarette Tax	0.0624*	0.0559	0.0096	0.0720*	0.0640	0.0140	0.0679*	0.0596	0.0228	0.0154***	0.0166***	0.0097**
	(0.0377)	(0.0400)	(0.0217)	(0.0406)	(0.0430)	(0.0220)	(0.0392)	(0.0413)	(0.0241)	(0.0048)	(0.0041)	(0.0043)
Present-Day Cigarette Tax	0.1398**	0.0865**	0.0979*	0.1505**	0.0807**	0.0957	0.1426**	0.0331	0.0473	-0.0258*	-0.0467***	-0.0471***
	(0.0605)	(0.0386)	(0.0532)	(0.0671)	(0.0411)	(0.0608)	(0.0698)	(0.0440)	(0.0620)	(0.0154)	(0.0112)	(0.0120)
Observations	9,466,192	9,466,192	9,466,192	9,470,171	9,470,171	9,470,171	9,456,678	9,456,678	9,456,678	665,465	665,465	665,465
Adjusted R-squared	0.053	0.069	0.071	0.040	0.053	0.055	0.026	0.035	0.036	0.026	0.037	0.038
Mean Dependent	0.104	0.104	0.104	0.072	0.072	0.072	0.521	0.521	0.521	7.409	7.409	7.409
Panel B: Never Movers, Adding Teenage and Contemporary Taxes												
At-Conception Cigarette Tax	-0.1942**	-0.1897**	-0.1281***	-0.2232**	-0.2201*	-0.1421***	-0.2338**	-0.2402**	-0.1405**	-0.0032	0.0069	0.0074
	(0.0914)	(0.0958)	(0.0454)	(0.1084)	(0.1152)	(0.0542)	(0.0991)	(0.1098)	(0.0584)	(0.0083)	(0.0084)	(0.0080)
Teenage (Age 13) Cigarette Tax	0.0845**	0.0750*	0.0128	0.1015***	0.0890**	0.0180	0.0972***	0.0832*	0.0258	0.0167***	0.0186***	0.0087*
	(0.0351)	(0.0413)	(0.0238)	(0.0379)	(0.0445)	(0.0250)	(0.0367)	(0.0426)	(0.0275)	(0.0056)	(0.0055)	(0.0049)
Present-Day Cigarette Tax	0.1524*	0.0834	0.1035	0.1662*	0.0815	0.1073	0.1543*	0.0204	0.0432	-0.0309	-0.0566***	-0.0567***
	(0.0795)	(0.0545)	(0.0837)	(0.0879)	(0.0611)	(0.0985)	(0.0932)	(0.0655)	(0.0981)	(0.0189)	(0.0128)	(0.0149)
Observations	6,500,087	6,500,087	6,500,087	6,502,930	6,502,930	6,502,930	6,493,287	6,493,287	6,493,287	493,334	493,334	493,334
Adjusted R-squared	0.054	0.071	0.073	0.041	0.055	0.057	0.026	0.036	0.037	0.026	0.039	0.039
Mean Dependent	0.111	0.111	0.111	0.077	0.077	0.077	0.567	0.567	0.567	7.459	7.459	7.459
Panel C: Main Sample, Only Adding Teenage Taxes												
At-Conception Cigarette Tax	-0.1850**	-0.1797**	-0.1197***	-0.2184**	-0.2111**	-0.1346***	-0.2458***	-0.2425**	-0.1384***	-0.0108*	-0.0025	-0.0013
	(0.0766)	(0.0814)	(0.0389)	(0.0917)	(0.0977)	(0.0473)	(0.0857)	(0.0946)	(0.0472)	(0.0057)	(0.0060)	(0.0058)
Teenage (Age 13) Cigarette Tax	0.0590*	0.0554	0.0077	0.0683*	0.0635	0.0121	0.0645*	0.0594	0.0219	0.0156***	0.0171***	0.0110***
	(0.0356)	(0.0399)	(0.0223)	(0.0387)	(0.0430)	(0.0225)	(0.0379)	(0.0413)	(0.0244)	(0.0048)	(0.0041)	(0.0043)
Observations	9,466,192	9,466,192	9,466,192	9,470,171	9,470,171	9,470,171	9,456,678	9,456,678	9,456,678	665,465	665,465	665,465
Adjusted R-squared	0.053	0.069	0.071	0.040	0.053	0.055	0.026	0.035	0.036	0.026	0.037	0.038
Mean Dependent	0.104	0.104	0.104	0.072	0.072	0.072	0.521	0.521	0.521	7.409	7.409	7.409
Panel D: Main Sample, Adding Each Cigarette Tax Alone												
At-Conception Cigarette Tax	-0.1213***			-0.1371***			-0.1429***			-0.0036		
	(0.0402)			(0.0487)			(0.0483)			(0.0057)		
Teenage (Age 13) Cigarette Tax		0.0191			0.0249			0.0350			0.0111***	
		(0.0257)			(0.0262)			(0.0275)			(0.0042)	
Present-Day Cigarette Tax			0.0972*			0.0947			0.0456			-0.0482***
			(0.0537)			(0.0615)			(0.0628)			(0.0120)
Observations	9,466,192	9,467,145	9,467,145	9,470,171	9,471,125	9,471,125	9,456,678	9,457,632	9,457,632	665,465	665,498	665,498
Adjusted R-squared	0.071	0.071	0.071	0.055	0.055	0.055	0.036	0.036	0.036	0.038	0.038	0.038
Mean Dependent	0.104	0.104	0.104	0.072	0.072	0.072	0.521	0.521	0.521	7.409	7.409	7.409
Baseline FE	X	X	X	X	X	X	X	X	X	X	X	X
Controls		X	X		X	X		X	X		X	X
Maternal Birth State Trends			X			X			X			X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except including teenage taxes as an additional control. Teenage taxes are based on the state-level tax in the mother's birth state at age 13.

Table A.4: Main Results–Collapsed Specification

	1(Any Pre-Pregnancy Smoking)			1(Any Prenatal Smoking)			Prenatal Per Day Cigarettes Extensive + Intensive			Prenatal Per Day Cigarettes Intensive Only		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
At-Conception Cigarette Tax	-0.0390**	-0.0354**	-0.0263***	-0.0319**	-0.0282**	-0.0203***	-0.2624**	-0.2381***	-0.1528***	-0.1487	-0.0016	-0.0358
	(0.0179)	(0.0155)	(0.0084)	(0.0147)	(0.0127)	(0.0069)	(0.0993)	(0.0882)	(0.0493)	(0.1074)	(0.1144)	(0.0949)
Observations	1,676,489	1,676,489	1,676,489	1,676,867	1,676,867	1,676,867	1,675,573	1,675,573	1,675,573	245,902	245,902	245,902
Adjusted R-squared	0.241	0.252	0.260	0.196	0.206	0.214	0.138	0.146	0.150	0.066	0.069	0.069
Mean Dependent	0.096	0.096	0.096	0.064	0.064	0.064	0.459	0.459	0.459	7.317	7.317	7.317
Baseline FE	X	X	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X	X	X	X	X	X

Panel B: Nominal Cigarette Taxes

	1(Any Pre-Pregnancy Smoking)			1(Any Prenatal Smoking)			Prenatal Per Day Cigarettes Extensive + Intensive			Prenatal Per Day Cigarettes Intensive Only		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
At-Conception Cigarette Tax	-0.0575**	-0.0518**	-0.0408**	-0.0474**	-0.0415**	-0.0310**	-0.4055**	-0.3690**	-0.2380**	-0.2203	0.0496	-0.1527
	(0.0283)	(0.0247)	(0.0165)	(0.0234)	(0.0203)	(0.0134)	(0.1608)	(0.1435)	(0.0952)	(0.2101)	(0.2270)	(0.1791)
Observations	1,676,489	1,676,489	1,676,489	1,676,867	1,676,867	1,676,867	1,675,573	1,675,573	1,675,573	245,902	245,902	245,902
Adjusted R-squared	0.240	0.251	0.260	0.196	0.206	0.214	0.138	0.146	0.150	0.066	0.069	0.069
Mean Dependent	0.096	0.096	0.096	0.064	0.064	0.064	0.459	0.459	0.459	7.317	7.317	7.317
Baseline FE	X	X	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X	X	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except over collapsed data and showing OLS coefficients. Data collapsed to the level of the current birth state, the mother's (own) birth state, maternal year of conception, and the month-year of the infant's conception. Weights are applied based on the number of observations in each collapsed cell. Robust standard errors clustered at the mother's (own) birth state level. Panel A shows real cigarette taxes and Panel B presents nominal taxes.

Table A.5: Event Study Example: Nominal Cigarette Tax Changes for Alabama, 1965-2020

Year	**Tax**	**Δ**	**-11**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**-2**	**-1**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1965	0.07		0.555	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0	0	0	0	0	0	0	0	0
1966	0.07	0	0.555	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0	0	0	0	0	0	0	0
1967	0.1	.03	0.555	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0	0	0	0	0	0	0
1968	0.1	0	0.555	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0	0	0	0	0	0
1969	0.12	.02	0.555	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0	0	0	0	0
1970	0.12	0	0.515	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0	0	0	0
1971	0.12	0	0.515	0	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0	0	0
1972	0.12	0	0.515	0	0	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0	0
1973	0.12	0	0.515	0	0	0	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0	0
1974	0.12	0	0.51	.005	0	0	0	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0	0
1975	0.12	0	0.51	0	.005	0	0	0	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0	0
1976	0.12	0	0.51	0	0	.005	0	0	0	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0	0
1977	0.12	0	0.51	0	0	0	.005	0	0	0	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03	0
1978	0.12	0	0.51	0	0	0	0	.005	0	0	0	.04	0	0	0	0	0	0	0	0	0	0	.02	0	.03
1979	0.12	0	0.51	0	0	0	0	0	.005	0	0	0	.04	0	0	0	0	0	0	0	0	0	0	.02	.03
1980	0.16	.04	0.51	0	0	0	0	0	0	.005	0	0	0	.04	0	0	0	0	0	0	0	0	0	0	.05
1981	0.16	0	0.51	0	0	0	0	0	0	0	.005	0	0	0	.04	0	0	0	0	0	0	0	0	0	.05
1982	0.16	0	0.51	0	0	0	0	0	0	0	0	.005	0	0	0	.04	0	0	0	0	0	0	0	0	.05
1983	0.16	0	0.51	0	0	0	0	0	0	0	0	0	.005	0	0	0	.04	0	0	0	0	0	0	0	.05
1984	0.165	.005	0.51	0	0	0	0	0	0	0	0	0	0	.005	0	0	0	.04	0	0	0	0	0	0	.05
1985	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	.005	0	0	0	.04	0	0	0	0	0	.05
1986	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	.005	0	0	0	.04	0	0	0	0	.05
1987	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	.005	0	0	0	.04	0	0	0	.05
1988	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.005	0	0	0	.04	0	0	.05
1989	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.005	0	0	0	.04	0	.05
1990	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.005	0	0	0	.04	.05
1991	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.005	0	0	0	.09
1992	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.005	0	0	.09
1993	0.165	0	0.51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.005	0	.09
1994	0.165	0	0.25	.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.005	.09
1995	0.165	0	0.25	0	.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.095
1996	0.165	0	0.25	0	0	.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.095
1997	0.165	0	0.25	0	0	0	.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.095
1998	0.165	0	0.25	0	0	0	0	.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.095
1999	0.165	0	0.25	0	0	0	0	0	.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.095
2000	0.165	0	0.25	0	0	0	0	0	0	.26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.095
2001	0.165	0	0.25	0	0	0	0	0	0	0	.26	0	0	0	0	0	0	0	0	0	0	0	0	0	.095
2002	0.165	0	0.25	0	0	0	0	0	0	0	0	.26	0	0	0	0	0	0	0	0	0	0	0	0	.095
2003	0.165	0	0.25	0	0	0	0	0	0	0	0	0	.26	0	0	0	0	0	0	0	0	0	0	0	.095
2004	0.425	.26	0.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	0	0	0	0	0	0	0	0	.095
2005	0.425	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	0	0	0	0	0	0	0	.095
2006	0.425	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	0	0	0	0	0	0	.095
2007	0.425	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	0	0	0	0	0	.095
2008	0.425	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	0	0	0	0	.095
2009	0.425	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	0	0	0	.095
2010	0.425	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	0	0	.095
2011	0.425	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	0	.095
2012	0.425	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	0	.095
2013	0.425	0	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	0	.095
2014	0.425	0	0	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.26	.095
2015	0.675	.25	0	0	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	0	.355
2016	0.675	0	0	0	0	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	0	.355
2017	0.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	0	.355
2018	0.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	0	.355
2019	0.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	0	.355
2020	0.675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	.25	0	0	0	0	0	.355

NOTES: The above table shows the nominal cigarette tax, the change in the nominal cigarette tax, and the event study variables over the changes in the nominal cigarette tax from 1965 through 2020 (for Alabama). Period zero corresponds to the year of the tax increase and aligns with discrete increases shown in column Δ, which captures the year-to-year change in the nominal tax. Period -11 represents the left-binned endpoint, and captures all tax increases that have yet to occur. Period 11 represents the right binned endpoint and represents all the tax increases that have occurred (and passed through the event study).

Table A.6: Robustness–State-level Income, Education Expenditures, and Health Expenditures

	1(Any Prenatal Smoking)					
	(1)	(2)	(3)	(4)	(5)	(6)
At-Conception Cigarette Tax	-0.1282***	-0.1369***	-0.1304**	-0.1077**	-0.0980**	-0.0995**
	(0.0485)	(0.0492)	(0.0523)	(0.0491)	(0.0470)	(0.0440)
Per Pupil Education Expenditure (At Conception)	0.3572*					
	(0.1992)					
Per Pupil Education Expenditure (Age 5)		0.0568				
		(0.1870)				
Per Pupil Education Expenditure (Age 13)			-0.2996			
			(0.1860)			
P.C. Real Personal Health Expenditures (At Conception)				-4.4660		
				(2.7382)		
P.C. Real State Health Expenditures (At Conception)				4.0106		
				(2.8316)		
P.C. Hospital Beds (At Conception)				0.1280		
				(0.1354)		
P.C. Real State Expenditures (At Conception)					-0.0473	
					(0.0898)	
P.C. Taxes Collected (At Conception)					0.0057	
					(0.0771)	
P.C. State GDP (At Conception)					-0.0209	
					(0.1667)	
Poverty Rate Per 1,000 (At Conception)					-0.0597	
					(0.0463)	
1(Cigarette Advertising Ban (At Conception))						0.0054
						(0.0037)
1(Indoor Air Law (At Conception))						0.0033***
						(0.0008)
Observations	9,470,171	9,470,171	9,470,171	8,194,297	7,893,351	8,502,505
Adjusted R-squared	0.055	0.055	0.055	0.057	0.055	0.057
Mean Dependent	0.072	0.072	0.072	0.072	0.072	0.072
Baseline FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except for adding the noted controls. All expenditure values have been CPI adjusted. Expenditures for education are available for all years, but other expenditures are only available from 1980-2010.

Table A.7: Robustness–Effect of In-Utero Cigarette Taxes on State Expenditure and Revenue

	Per Pupil Expenditure Conception	Per Pupil Expenditure Age 5	Per Pupil Expenditure Age 13	P.C. Private Health Expenditure	P.C. State Health Expenditure	P.C. Hospital Beds	P.C. State Expenditure	P.C. State Taxes	P.C. State GDP	P.C. State Poverty
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
At-Conception Cigarette Tax	-0.0249***	-0.0037	0.0222	-0.0103	-0.0102	0.0074	-0.0151	0.0074	-0.0211	0.0270
	(0.0091)	(0.0114)	(0.0184)	(0.0076)	(0.0077)	(0.0052)	(0.0183)	(0.0275)	(0.0158)	(0.0231)
Observations	9,470,171	9,470,171	9,470,171	8,502,505	8,502,505	8,194,297	7,893,351	8,502,505	8,502,505	8,502,505
Adjusted R-squared	0.975	0.975	0.975	0.988	0.989	0.986	0.977	0.940	0.946	0.857
Mean Dependent	9,347.648	10,420.784	11,952.045	1,733.517	1,754.685	0.005	1,722.810	883.374	16,813.729	140.580
Baseline FE	X	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except considering expenditure as an outcome (rather than a control).

Table A.8: Robustness–Selection into Pregnancy for the Grandmother's Generation in the IPUMS Census, 1970, 1980, 1990, 2000

	Log of Personal Income		Log of Family Income		High School Educated		College Educated		Married		Children Born		White	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
At-Conception Cigarette Tax	-0.0412	-0.0171	-0.0100	-0.0070	-0.0325***	0.0087	-0.0104	-0.0053	0.0045	-0.0043	0.0338	0.0068	-0.0195	0.0075
	(0.0299)	(0.0125)	(0.0125)	(0.0069)	(0.0088)	(0.0073)	(0.0085)	(0.0039)	(0.0064)	(0.0047)	(0.0396)	(0.0330)	(0.0150)	(0.0068)
Observations	92,880	92,880	98,694	98,694	99,030	99,030	99,030	99,030	99,030	99,030	55,392	55,392	99,030	99,030
Adjusted R-squared	0.767	0.768	0.795	0.796	0.395	0.402	0.459	0.462	0.312	0.313	0.653	0.655	0.453	0.464
Mean Dependent	9.102	9.102	10.432	10.432	0.803	0.803	0.186	0.186	0.744	0.744	2.437	2.437	0.776	0.776
Grandmother Age FE	X	X	X	X	X	X	X	X	X	X	X	X	X	X
State and Year FE	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Year of Conception FE	X	X	X	X	X	X	X	X	X	X	X	X	X	X
State x Year of Conception Trends		X		X		X		X		X		X		X

SOURCE: IPUMs census data for 1970 (1%), 1980 (20% sample of 5%), 1990 (20% sample of 5%), 2000 (1%).

NOTES: Considers the relationship between in-utero cigarette taxes and the 'grandmother's' characteristics or the mother of the potential mothers in our dataset over 1970, 1980, 1990, and 2000. The year of conception is based on the observation year (1970/1980/1990/2000), minus the eldest child's age (reported in the IPUMs), minus one. The sample only includes women who report the age of the eldest child in the census data. The data is collapsed to the observation year, year of conception, grandmother's age, and state level using weights reported by IPUMS. In the analysis, weights are applied based on the number in each cell of collapsed data. Fixed effects included for the grandmother's age, state, year, and year of conception. We specifically control for the grandmother's age fixed effects (at observation) because older mothers should have higher income and educational attainment, and we are not observing all mothers at the same point in the life course. No other controls are included in the analysis other than the fixed effects. Differences in sample size are due to missing observations. A single observation captures each combination of maternal age, state, year, and year of conception. Standard errors clustered at the state level. ***, **, * represent statistical significance at 1, 5 and 10 percent levels.

Table A.9: Robustness–Selection into Pregnancy for the Grandmother's Generation in the Birth Certificate Records, 1968-2001

	Average Maternal Age		High School Educated		College Educated		Married		Birth Weight		LBW		VLBW	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
At-Conception Cigarette Tax	0.3747***	0.1110	-0.1006*	-0.0964	-0.0036	-0.0073	0.0155*	0.0299**	16.5202***	5.2251	-0.0030**	-0.0020**	-0.0008*	-0.0005*
	(0.1154)	(0.0664)	(0.0598)	(0.0753)	(0.0105)	(0.0118)	(0.0081)	(0.0116)	(5.6994)	(3.8780)	(0.0014)	(0.0010)	(0.0004)	(0.0002)
Observations	1,734	1,734	1,734	1,734	1,734	1,734	1,734	1,734	1,734	1,734	1,734	1,734	1,734	1,734
Adjusted R-squared	0.966	0.993	0.593	0.753	0.900	0.949	0.933	0.955	0.952	0.982	0.948	0.970	0.906	0.939
Mean Dependent	25.755	25.755	0.746	0.746	0.169	0.169	0.774	0.774	3,324.156	3,324.156	0.073	0.073	0.013	0.013
State FE	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Year of Conception FE	X	X	X	X	X	X	X	X	X	X	X	X	X	X
State x Year of Conception Trends		X		X		X		X		X		X		X

SOURCE: NCHS/NVSS birth certificate data for 1968-2002.

NOTES: Considers the relationship between early-life cigarette taxes and the delivery characteristics of the 'grandmother' as well as the characteristics of the mothers at birth. The birth certificate records here use earlier birth record data than what we use in our main analysis so that we can observe the grandmother's characteristics. While grandmother's smoking information is not available this far back in the data, information about grandmother's characteristics and mother's health at birth is available. For these additional years of birth certificate data, we calculate the year of conception based on the birth year minus the reported gestation (in months). If gestation is missing, we use eight months. For computational ease, the data is collapsed to the year of conception and residence state level using the weight reported on the birth certificate (weights on the birth certificate record account for the fact that early record years are only 50% samples). In the analysis, weights are applied based on the number of births in each cell. A single observation captures each combination of state and year-of-conception. Fixed effects included for the state and year of conception. No controls are included. Standard errors clustered at the state level. ***, **, * represent statistical significance at 1, 5 and 10 percent levels.

Table A.10: Mechanisms–Effect of Human Capital and Socioeconomic Status on Prenatal Smoking

	1(Any Prenatal Smoking)			
	(1)	(2)	(3)	(4)
1(College or Above)	-0.8226***			
	(0.0776)			
1(Married)		-0.8632***		
		(0.0883)		
1(WIC during Pregnancy)			0.5129***	
			(0.0653)	
1(Private Insurance)				-0.7700***
				(0.0888)
Observations	6,983,467	9,114,961	9,356,736	9,471,125
Adjusted R-squared	0.064	0.087	0.078	0.078
Mean Dependent	0.072	0.072	0.072	0.072
Baseline FE	X	X	X	X
Controls	X	X	X	X
Maternal Birth State Trends	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except for considering the relationship between socioeconomic status and smoking.

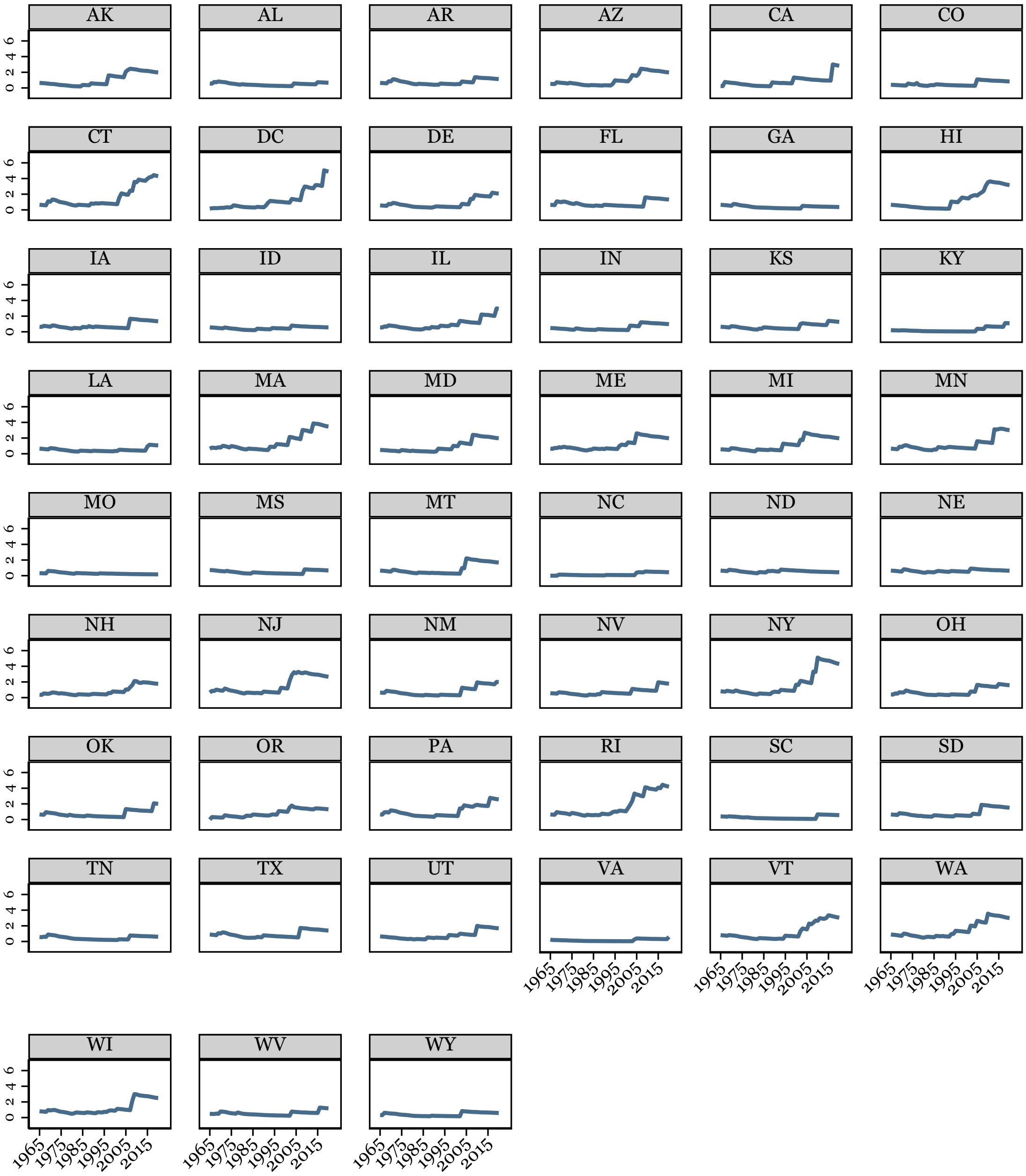
Table A.11: Multiple Hypothesis Testing: FDR Q-values

	(1)	(2)
Dependent Variable	**Q-value**	**P-value**
1(High School Graduate)	0.083	0.093
1(Some College)	0.011	0.007
1(College or Higher)	0.060	0.062
1(Married)	0.236	0.396
1(Move States)	0.054	0.052
1(Private Insurance)	0.191	0.307
1(WIC)	0.260	0.460
Pre-Pregnancy BMI	0.001	0.000
1(Underweight)	0.269	0.483
1(Overweight or Obese)	0.001	0.000
1(Obese)	0.001	0.000
1(Correct Weight Gain)	0.010	0.006
1(High Weight Gain)	0.282	0.516
1(Low Weight Gain)	0.010	0.006
1(Diabetes)	0.007	0.004
1(Pregnancy Hypertension)	0.333	0.669
1(Chronic Hypertension)	0.211	0.348
1(Eclampsia)	0.323	0.638
1(Early Prenatal Care)	0.281	0.512
1(Breastfeeding)	0.086	0.098
1(Elective Cesarean)	0.079	0.088
1(Premature <37 Weeks)	0.413	0.997
1(Very Premature <32 Weeks)	0.079	0.087
1(Small for Gestational Age)	0.281	0.513
1(Very Small for Gestation)	0.282	0.521
1(Low Birth Weight <2,500g)	0.244	0.415
1(Very Low Birth Weight <1,500g)	0.050	0.046
5-Minute Apgar	0.057	0.058

NOTES: Results from Tables 4 and 5. P-values represent original p-values for the at-conception cigarette tax from the main results. Q-values represent the sharpened False Discovery Rate (FDR) q-values (Anderson, 2008).

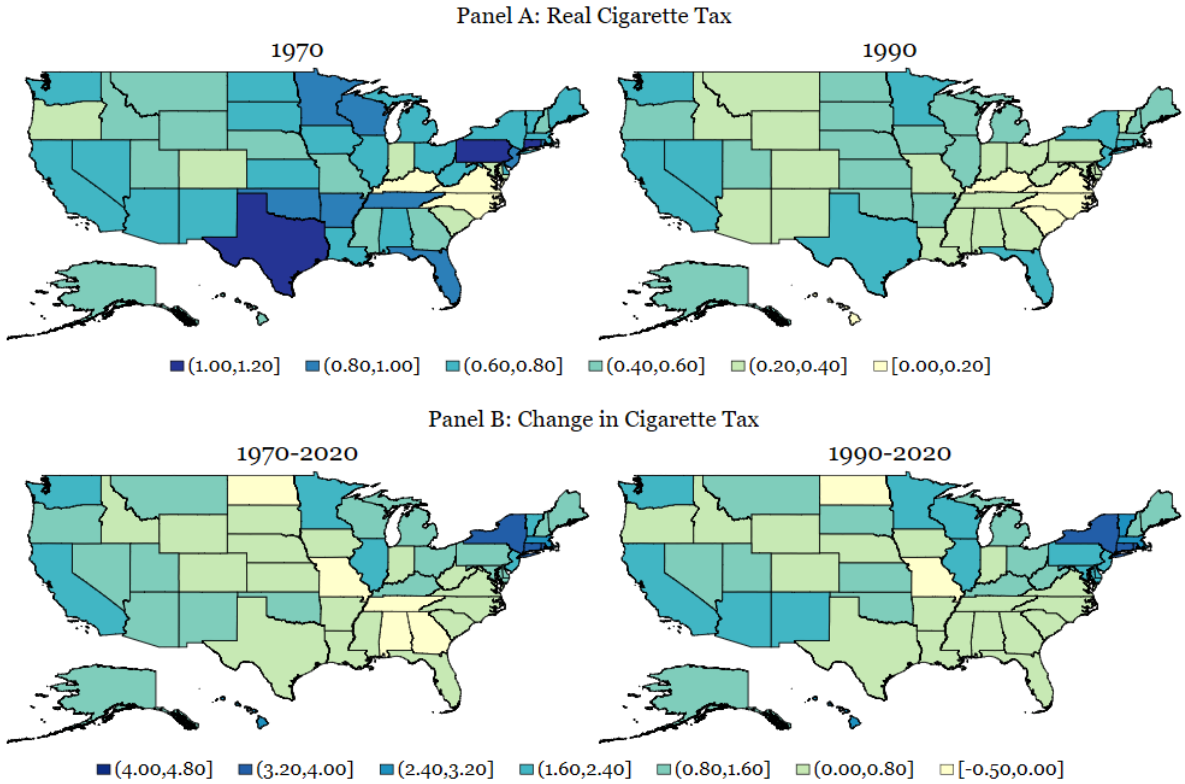
B Additional Figures

Figure B.1: Background–Real Cigarette Tax over 1965-2020, by State



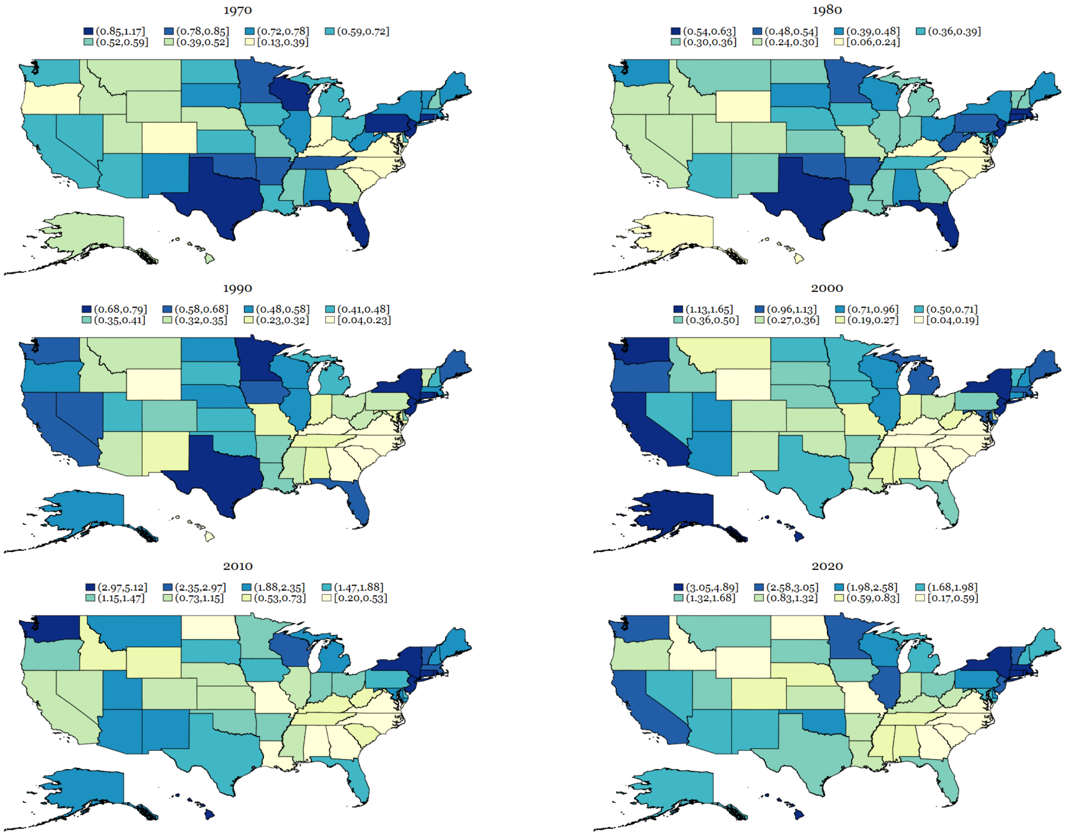
SOURCE: State-level cigarette taxes are from the CDC State System and the Tax Burden on Tobacco.
NOTES: Information presented above for real state-level cigarette taxes. Real cigarette taxes are CPI-adjusted and reported in 2020 dollars.

Figure B.2: Background–Map of Real Cigarette Taxes, 1970-2020



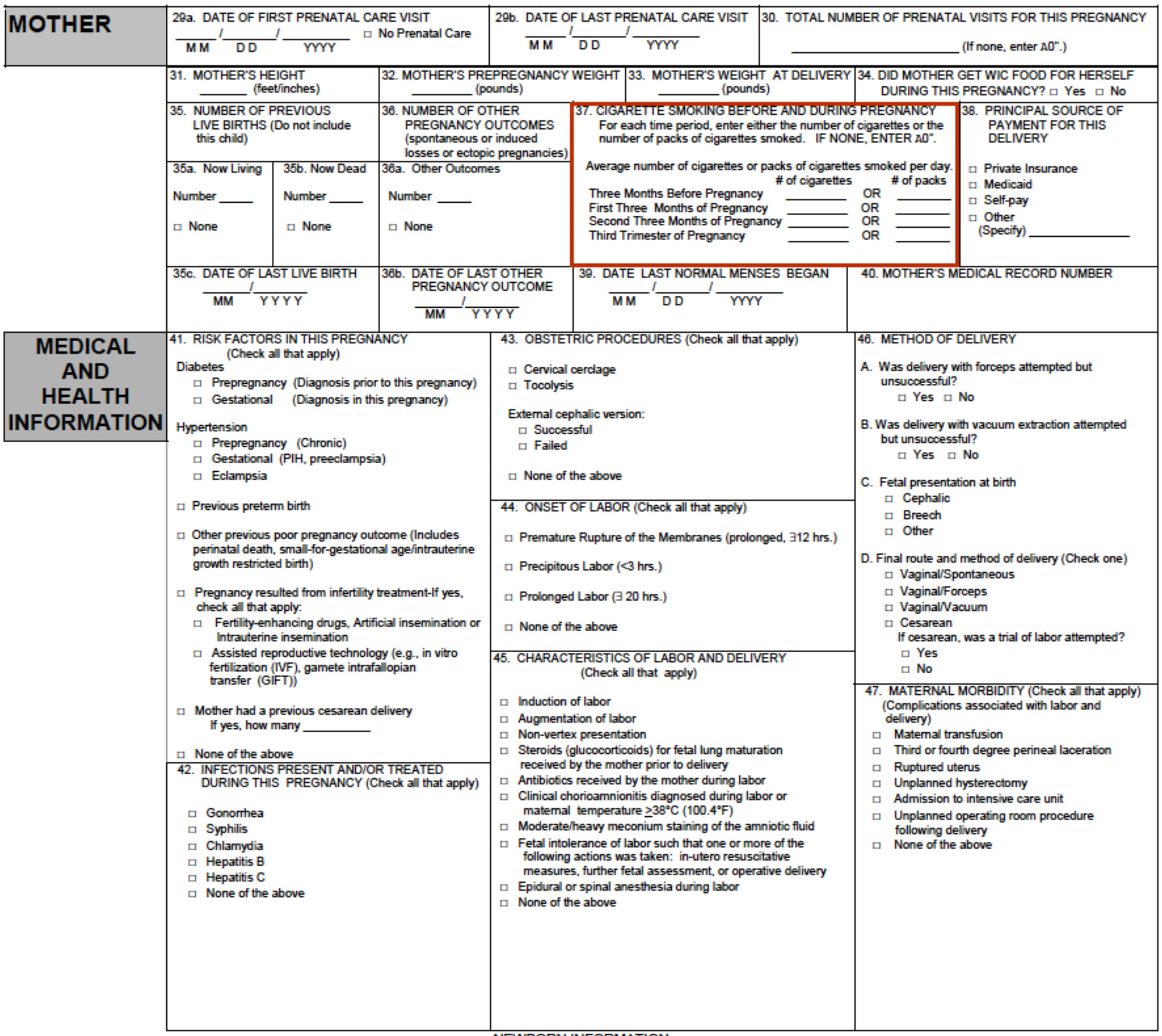
SOURCE: State-level cigarette taxes are from the CDC State System and the Tax Burden on Tobacco.
NOTES: Information presented above for the real state-level cigarette tax. Real cigarette taxes are CPI-adjusted and reported in 2020 dollars.

Figure B.3: Background–Map of Real Cigarette Tax by State, 1970-2020



SOURCE: State-level cigarette taxes are from the CDC State System and the Tax Burden on Tobacco.
NOTES: Information presented above for state-level cigarette taxes. Cigarette taxes are CPI-adjusted and reported in 2020 dollars.

Figure B.4: Data–Cigarette Question from the 2003 Birth Certificate Form



MOTHER

29a. DATE OF FIRST PRENATAL CARE VISIT
____/____/____ □ No Prenatal Care
M M D D YYYY

29b. DATE OF LAST PRENATAL CARE VISIT
____/____/____
M M D D YYYY

30. TOTAL NUMBER OF PRENATAL VISITS FOR THIS PREGNANCY
________ (If none, enter A0".)

31. MOTHER'S HEIGHT
_____ (feet/inches)

32. MOTHER'S PREPREGNANCY WEIGHT
_____ (pounds)

33. MOTHER'S WEIGHT AT DELIVERY
_____ (pounds)

34. DID MOTHER GET WIC FOOD FOR HERSELF DURING THIS PREGNANCY? □ Yes □ No

35. NUMBER OF PREVIOUS LIVE BIRTHS (Do not include this child)

35a. Now Living
Number ____
□ None

35b. Now Dead
Number ____
□ None

36. NUMBER OF OTHER PREGNANCY OUTCOMES (spontaneous or induced losses or ectopic pregnancies)

36a. Other Outcomes
Number ____
□ None

37. CIGARETTE SMOKING BEFORE AND DURING PREGNANCY
For each time period, enter either the number of cigarettes or the number of packs of cigarettes smoked. IF NONE, ENTER A0".

Average number of cigarettes or packs of cigarettes smoked per day.

	# of cigarettes		# of packs
Three Months Before Pregnancy	____	OR	____
First Three Months of Pregnancy	____	OR	____
Second Three Months of Pregnancy	____	OR	____
Third Trimester of Pregnancy	____	OR	____

38. PRINCIPAL SOURCE OF PAYMENT FOR THIS DELIVERY
□ Private Insurance
□ Medicaid
□ Self-pay
□ Other (Specify) ________

35c. DATE OF LAST LIVE BIRTH
____/____
MM YYYY

36b. DATE OF LAST OTHER PREGNANCY OUTCOME
____/____
MM YYYY

39. DATE LAST NORMAL MENSES BEGAN
____/____/____
M M D D YYYY

40. MOTHER'S MEDICAL RECORD NUMBER

MEDICAL AND HEALTH INFORMATION

41. RISK FACTORS IN THIS PREGNANCY (Check all that apply)

Diabetes
□ Prepregnancy (Diagnosis prior to this pregnancy)
□ Gestational (Diagnosis in this pregnancy)

Hypertension
□ Prepregnancy (Chronic)
□ Gestational (PIH, preeclampsia)
□ Eclampsia

□ Previous preterm birth

□ Other previous poor pregnancy outcome (Includes perinatal death, small-for-gestational age/intrauterine growth restricted birth)

□ Pregnancy resulted from infertility treatment-If yes, check all that apply:
□ Fertility-enhancing drugs, Artificial insemination or Intrauterine insemination
□ Assisted reproductive technology (e.g., in vitro fertilization (IVF), gamete intrafallopian transfer (GIFT))

□ Mother had a previous cesarean delivery
If yes, how many ______

□ None of the above

42. INFECTIONS PRESENT AND/OR TREATED DURING THIS PREGNANCY (Check all that apply)

□ Gonorrhea
□ Syphilis
□ Chlamydia
□ Hepatitis B
□ Hepatitis C
□ None of the above

43. OBSTETRIC PROCEDURES (Check all that apply)

□ Cervical cerclage
□ Tocolysis

External cephalic version:
□ Successful
□ Failed

□ None of the above

44. ONSET OF LABOR (Check all that apply)

□ Premature Rupture of the Membranes (prolonged, ∃12 hrs.)

□ Precipitous Labor (<3 hrs.)

□ Prolonged Labor (∃ 20 hrs.)

□ None of the above

45. CHARACTERISTICS OF LABOR AND DELIVERY (Check all that apply)

□ Induction of labor
□ Augmentation of labor
□ Non-vertex presentation
□ Steroids (glucocorticoids) for fetal lung maturation received by the mother prior to delivery
□ Antibiotics received by the mother during labor
□ Clinical chorioamnionitis diagnosed during labor or maternal temperature ≥38°C (100.4°F)
□ Moderate/heavy meconium staining of the amniotic fluid
□ Fetal intolerance of labor such that one or more of the following actions was taken: in-utero resuscitative measures, further fetal assessment, or operative delivery
□ Epidural or spinal anesthesia during labor
□ None of the above

46. METHOD OF DELIVERY

A. Was delivery with forceps attempted but unsuccessful?
□ Yes □ No

B. Was delivery with vacuum extraction attempted but unsuccessful?
□ Yes □ No

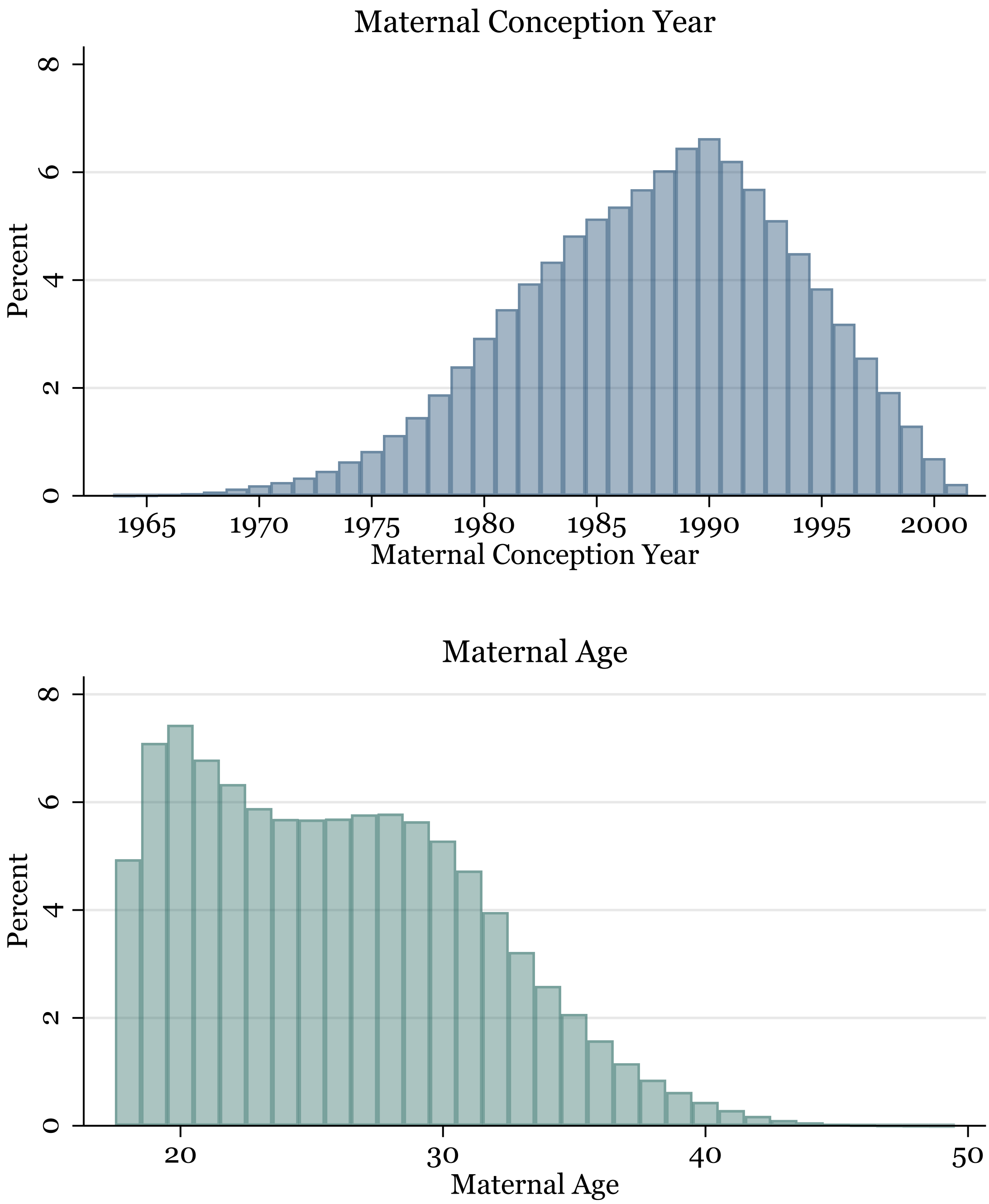
C. Fetal presentation at birth
□ Cephalic
□ Breech
□ Other

D. Final route and method of delivery (Check one)
□ Vaginal/Spontaneous
□ Vaginal/Forceps
□ Vaginal/Vacuum
□ Cesarean
If cesarean, was a trial of labor attempted?
□ Yes
□ No

47. MATERNAL MORBIDITY (Check all that apply) (Complications associated with labor and delivery)
□ Maternal transfusion
□ Third or fourth degree perineal laceration
□ Ruptured uterus
□ Unplanned hysterectomy
□ Admission to intensive care unit
□ Unplanned operating room procedure following delivery
□ None of the above

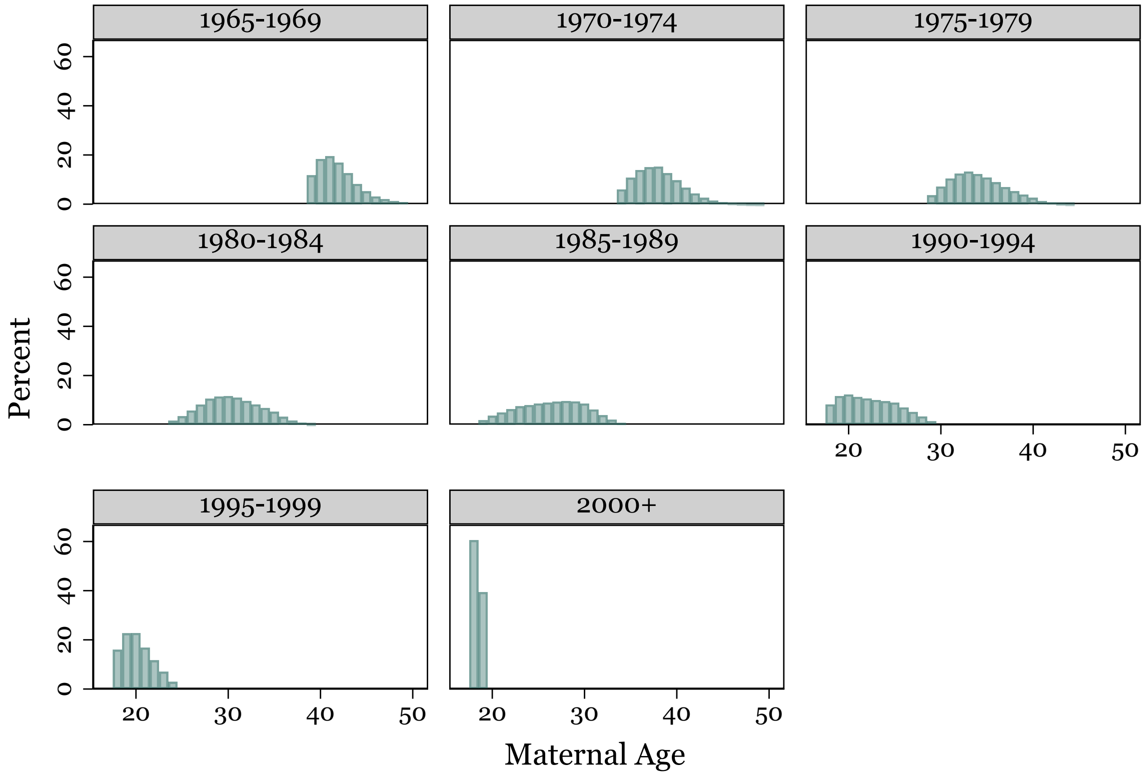
SOURCE: U.S. Standard Certificate of Live Birth, 2003 (https://www.cdc.gov/nchs/data/dvs/birth11-03final-ACC.pdf)

Figure B.5: Data–Distribution of Maternal Conception Years and Maternal Age



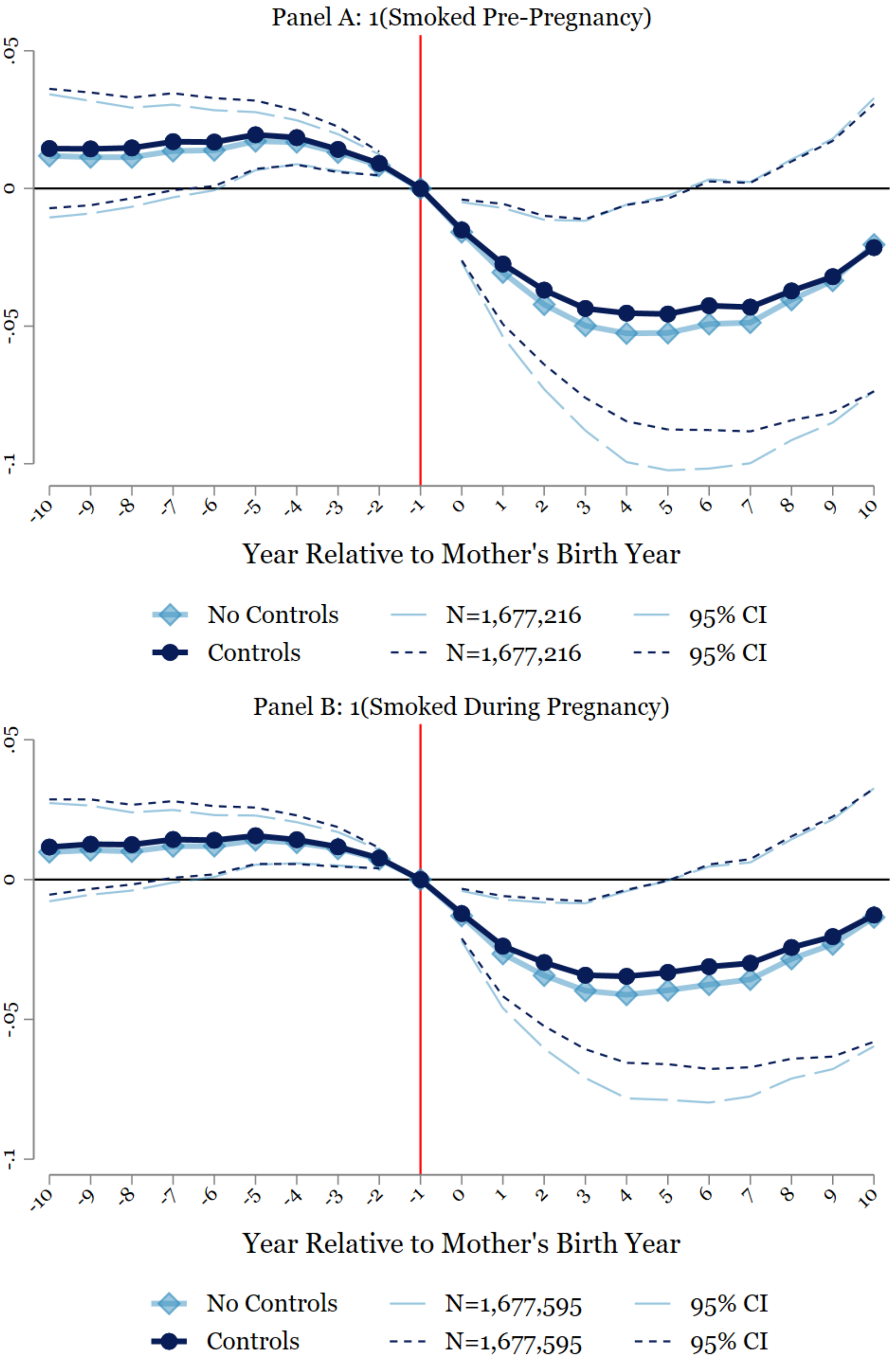
SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.

Figure B.6: Data–Distribution of Maternal Age by Maternal Conception Years



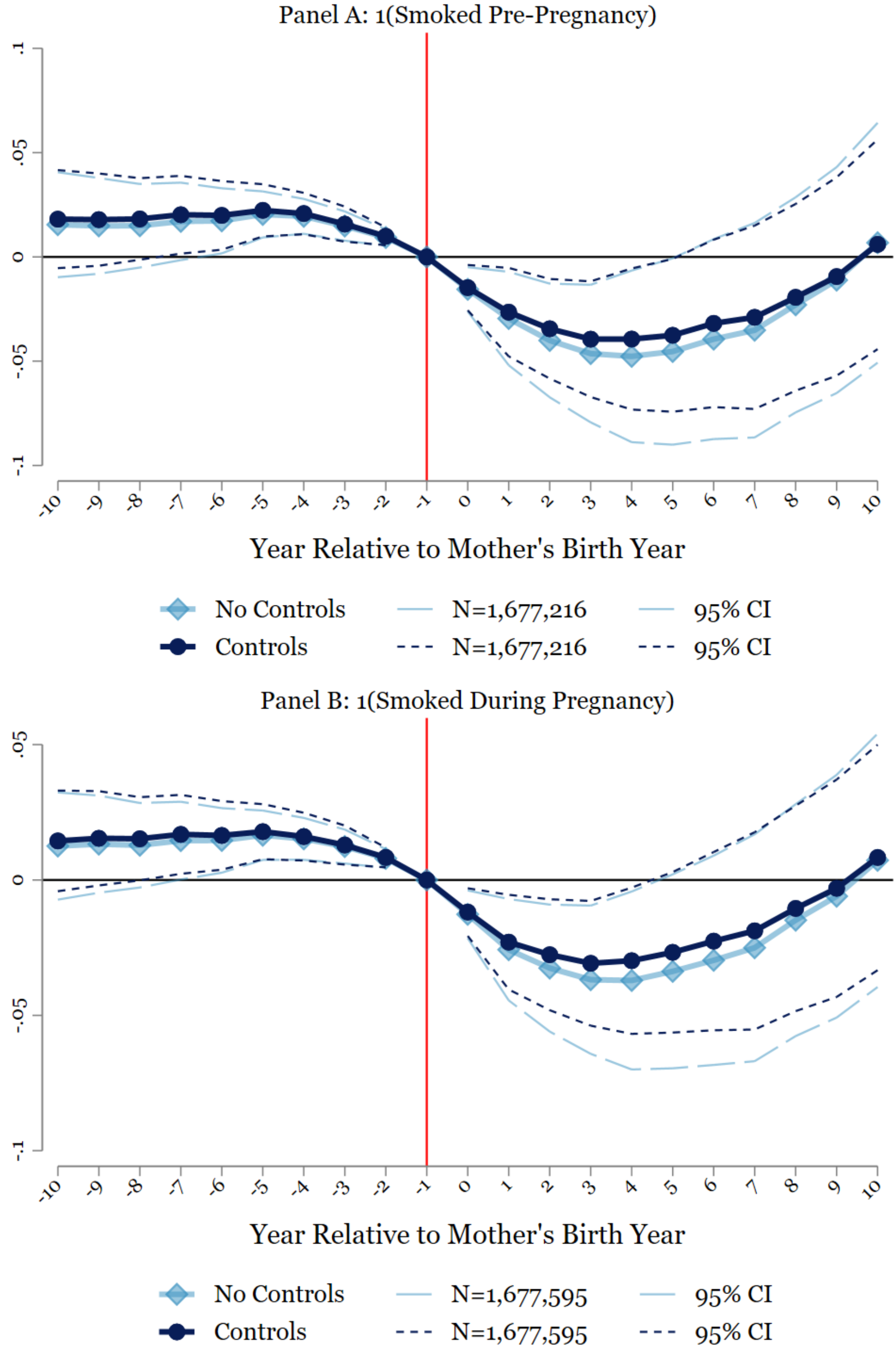
SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.

Figure B.7: Robustness–Event Study over Inflation-Adjusted Changes in the Nominal Cigarette Tax



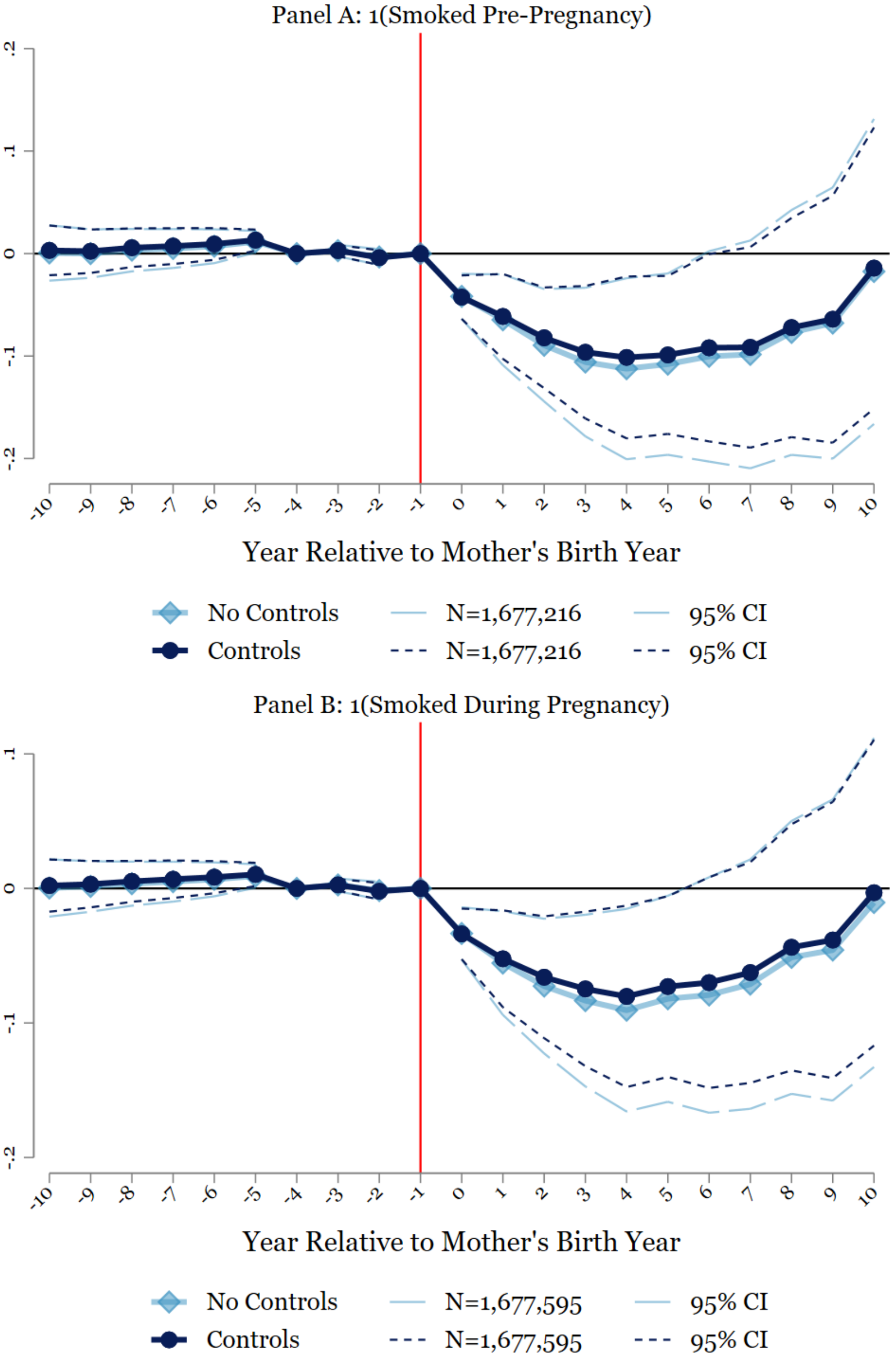
SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Reflects Figure 2, except inflation-adjusting nominal changes in the cigarette tax. In other words, CPI-adjusting the discrete changes in the nominal tax rate (inflation-adjusting the changes in the nominal tax rate in Table A.5).

Figure B.8: Robustness–Event Study over Changes in the Real Cigarette Tax



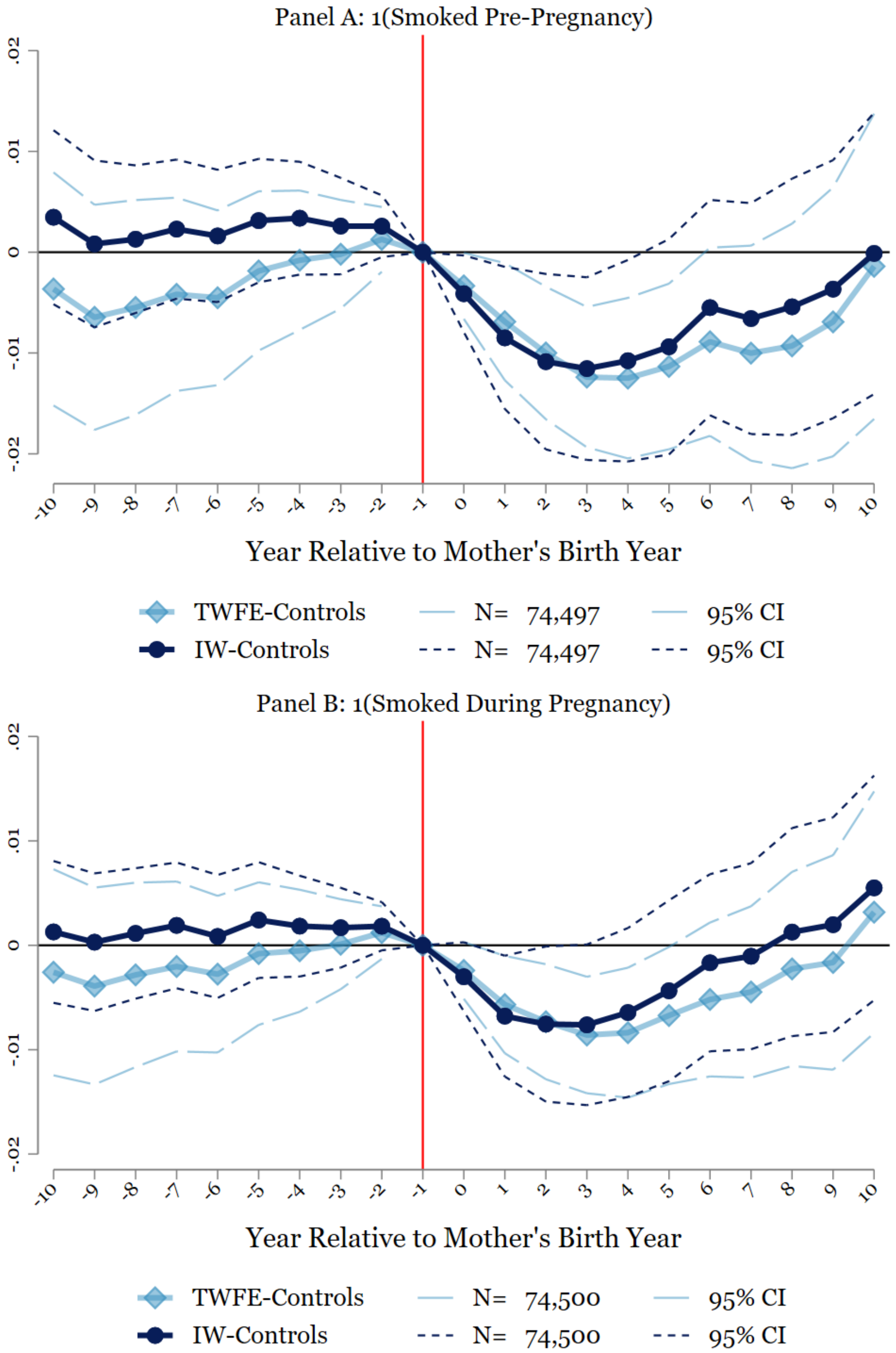
SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Reflects Figure 2, except using all changes in the real cigarette tax from year-to-year (both changes due to inflation and discrete jumps in the tax).

Figure B.9: Robustness–Event Study over Changes in the Nominal Cigarette Tax



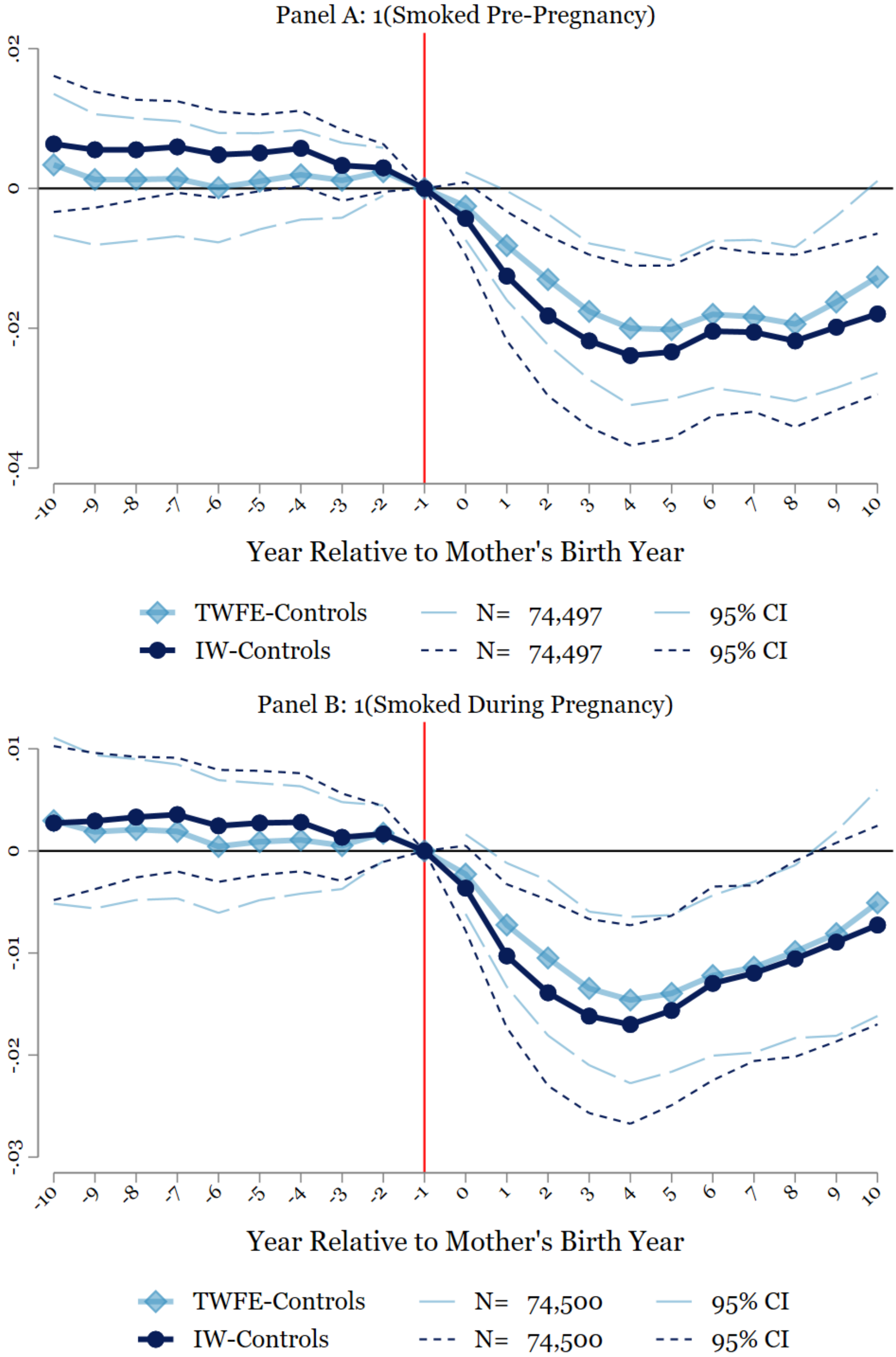
SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Reflects Figure 2, except leaving endpoints unbinned and omitting two pre-periods, $m = -1$ and $m = -4$.

Figure B.10: Robustness–Event Study over Discrete Changes in the Nominal Cigarette Tax, Indicator for Tax Increase >10 Cents



SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: The plotted point estimates are coefficients on event-study style dummy variables. The dummy variables capture the first time a state experiences a large jumps in the nominal tax rate, or an increase larger than ten cents. Both the two-way fixed effects (TWFE) specification and the Interaction-Weighted (IW) estimator from Sun and Abraham (2020) shown. Here, because some states never passed large tax increases, we have a never-treated control group, and we leave the endpoints of the event study unbinned. The excluded period is $m = -1$. In the event-study, we add controls for tax increases 10 cents or smaller. The data is collapsed to a two-way fixed effects level: the combination of the maternal-birth state/current-residence state, and the maternal birth year. Weights applied based on the number of observations in each collapsed cell. Fixed effects included for the combination of the maternal birth state-current residence state level, and the maternal birth year. Standard errors clustered at the maternal birth state-current residence state level.

Figure B.11: Robustness–Event study over Discrete Changes in the Nominal Cigarette Tax, Indicator for Tax Increase >15 Cents



SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Reflects Figure B.10 except considering the first case of a state-level tax increase larger than 15 cents (with a binary event-study variable), and controlling for tax increases 15 cents or smaller.

C Remaining Sensitivity Checks

We perform several remaining robustness checks on our main results from Table 2. First, we show that the findings are consistent for both the extensive and intensive margin of smoking behavior over each trimester. The results over the first, second, and third trimester, presented in Table C.1, closely resemble the baseline effect on prenatal smoking. The magnitude of the reduction in smoking is higher in the second and third trimesters than in the first trimester.

Second, a limitation of our main sample is the unbalanced panel created by the 2003 birth certificate revision. The birth certificate revision that occurred in 2003 was not adopted by all states until 2015. Table C.2 Panel A shows the balanced panel of states from 2009 onward, omitting 23 states.[46] Table C.2 Panel B presents the balanced panel 2012 ad onward, omitting 12 states.[47] The findings in both Panels A and B suggest that in-utero cigarette taxes maintain their importance for later-life smoking behavior, even after restricting to different balanced panels. The coefficients are similar in magnitude and statistical significance in the adjusted specifications.

Third, Table C.3 presents alternative clustering of the standard errors. In our main results, we cluster the standard errors at the mother's birth state level (baseline, in Columns (1)-(3)). But the results are similar if we cluster the standard errors at the mother's residence state level (Columns (4)-(6)).

Fourth, we show that cigarette taxes are not systematically linked to missing smoking information on the birth certificate records. Because smoking is a self-reported measure, missing observations may be non-random. We replace missing prenatal smoking information as our main outcome in Table C.4, and show that lack of reporting is not differentially linked to in-utero cigarette taxes. However, a limitation of this analysis is that we cannot fully rule out misreporting in the birth records, something documented in the literature (Howland et al., 2015; Abouk et al., 2019).

[46]States that revised after 2009 include Alaska, Alabama, Arkansas, Arizona, Connecticut, Florida, Georgia, Hawaii, Illinois, Louisiana, Massachusetts, Maryland, Maine, Michigan, Missouri, Minnesota, Mississippi, North Carolina, New Jersey, Rhode Island, Virginia, Wisconsin, West Virginia.

[47] The 2012 balanced panel omits Alaska, Alabama, Arkansas, Arizona, Connecticut, Hawaii, Maine, Michigan, Mississippi, New Jersey, Rhode Island, and West Virginia.

Table C.1: Robustness–Detailed Smoking Behavior by Trimester

	1(Smoked)			Number of Cigarettes Extensive + Intensive			Number of Cigarettes Only Intensive		
	(1) 1st Trimester	(2) 2nd Trimester	(3) 3rd Trimester	(4) 1st Trimester	(5) 2nd Trimester	(6) 3rd Trimester	(7) 1st Trimester	(8) 2nd Trimester	(9) 3rd Trimester
At-Conception Cigarette Tax	-0.1400***	-0.1467***	-0.1470***	-0.1443***	-0.1411***	-0.1405***	-0.0008	0.0020	-0.0020
	(0.0503)	(0.0512)	(0.0517)	(0.0497)	(0.0484)	(0.0459)	(0.0052)	(0.0057)	(0.0067)
Observations	9,469,422	9,468,493	9,457,487	9,469,422	9,468,493	9,457,487	649,786	510,915	473,537
Adjusted R-squared	0.055	0.047	0.044	0.036	0.030	0.027	0.028	0.027	0.029
Mean Dependent	0.069	0.054	0.050	0.699	0.469	0.399	10.188	8.687	7.976
Baseline FE	X	X	X	X	X	X	X	X	X
Controls	X	X	X	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except for considering the effect by trimester.

Table C.2: Robustness–Balanced Panel of States

Panel A: Balanced Panel 2009+

	1(Any Pre-Pregnancy Smoking)			1(Any Prenatal Smoking)			Prenatal Per Day Cigarettes Extensive + Intensive			Prenatal Per Day Cigarettes Intensive Only		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
At-Conception Cigarette Tax	-0.2940***	-0.3177***	-0.1662***	-0.3620***	-0.3879***	-0.2020***	-0.3805***	-0.4168***	-0.2105***	0.0007	0.0070	-0.0059
	(0.0761)	(0.0794)	(0.0188)	(0.0920)	(0.0978)	(0.0243)	(0.0905)	(0.0987)	(0.0275)	(0.0086)	(0.0092)	(0.0083)
Observations	6,056,101	6,056,101	6,056,101	6,056,876	6,056,876	6,056,876	6,050,157	6,050,157	6,050,157	434,218	434,218	434,218
Adjusted R-squared	0.061	0.077	0.079	0.048	0.061	0.063	0.032	0.041	0.042	0.030	0.042	0.042
Mean Dependent	0.107	0.107	0.107	0.073	0.073	0.073	0.536	0.536	0.536	7.462	7.462	7.462
Baseline FE	X	X	X	X	X	X	X	X	X	X	X	X
Controls		X	X		X	X		X	X		X	X
Maternal Birth State Trends			X			X			X			X

Panel B: Balanced Panel 2012+

	1(Any Pre-Pregnancy Smoking)			1(Any Prenatal Smoking)			Prenatal Per Day Cigarettes Extensive + Intensive			Prenatal Per Day Cigarettes Intensive Only		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
At-Conception Cigarette Tax	-0.2424***	-0.2357***	-0.1602***	-0.2866***	-0.2755***	-0.1867***	-0.3338***	-0.3263***	-0.2132***	-0.0091	-0.0012	-0.0152*
	(0.0810)	(0.0830)	(0.0280)	(0.0943)	(0.0966)	(0.0312)	(0.0892)	(0.0934)	(0.0332)	(0.0115)	(0.0105)	(0.0086)
Observations	6,742,426	6,742,426	6,742,426	6,742,251	6,742,251	6,742,251	6,731,142	6,731,142	6,731,142	426,641	426,641	426,641
Adjusted R-squared	0.050	0.065	0.067	0.036	0.048	0.050	0.023	0.031	0.032	0.026	0.037	0.038
Mean Dependent	0.095	0.095	0.095	0.065	0.065	0.065	0.469	0.469	0.469	7.401	7.401	7.401
Baseline FE	X	X	X	X	X	X	X	X	X	X	X	X
Controls		X	X		X	X		X	X		X	X
Maternal Birth State Trends			X			X			X			X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except for considering a balanced panel of states. States that revised after 2009 include Alaska, Alabama, Arkansas, Arizona, Connecticut, Florida, Georgia, Hawaii, Illinois, Louisiana, Massachusetts, Maryland, Maine, Michigan, Missouri, Minnesota, Mississippi, North Carolina, New Jersey, Rhode Island, Virginia, Wisconsin, West Virginia.

Table C.3: Robustness–Alternative Clustering of the Standard Errors

Outcome: 1(Prenatal Smoking)	Baseline - Cluster Mother Birth State			Cluster Mother Residence State		
	(1)	(2)	(3)	(4)	(5)	(6)
At-Conception Cigarette Tax	-0.1371***			-0.1371***		
	(0.0488)			(0.0402)		
Teenage (Age 13) Cigarette Tax		0.0267			0.0267	
		(0.0255)			(0.0207)	
Present-Day Cigarette Tax			0.0947			0.0947
			(0.0615)			(0.0799)
Observations	9,470,171	9,471,125	9,471,125	9,470,171	9,471,125	9,471,125
Adjusted R-squared	0.055	0.055	0.055	0.055	0.055	0.055
Mean Dependent	0.072	0.072	0.072	0.072	0.072	0.072
Baseline FE	X	X	X	X	X	X
Controls	X	X	X	X	X	X
Maternal Birth State Trends	X	X	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except for showing alternative clustering of standard errors.

Table C.4: Robustness–In-utero Cigarette Taxes and Missing Smoking Information on Birth Certificate

	1(Any Pre-Pregnancy Smoking)	1(Any Prenatal Smoking)	Prenatal Per Day Cigarettes Extensive + Intensive	Prenatal Per Day Cigarettes Intensive Only
	(1)	(2)	(3)	(4)
At-Conception Cigarette Tax	-0.0503	-0.0503	-0.0501	0.0102
	(0.0342)	(0.0342)	(0.0342)	(0.0148)
Observations	9,889,990	9,889,990	9,889,990	9,889,990
Adjusted R-squared	0.459	0.460	0.445	0.055
Mean Dependent	0.042	0.042	0.044	0.933
Baseline FE	X	X	X	X
Controls	X	X	X	X
Maternal Birth State Trends	X	X	X	X

SOURCE: Natality Detailed File - NVSS/CDC. See Table A.1 for complete data sources.
NOTES: Results reflect the same specification as presented in Table 2, except considering the likelihood of missing smoking information.

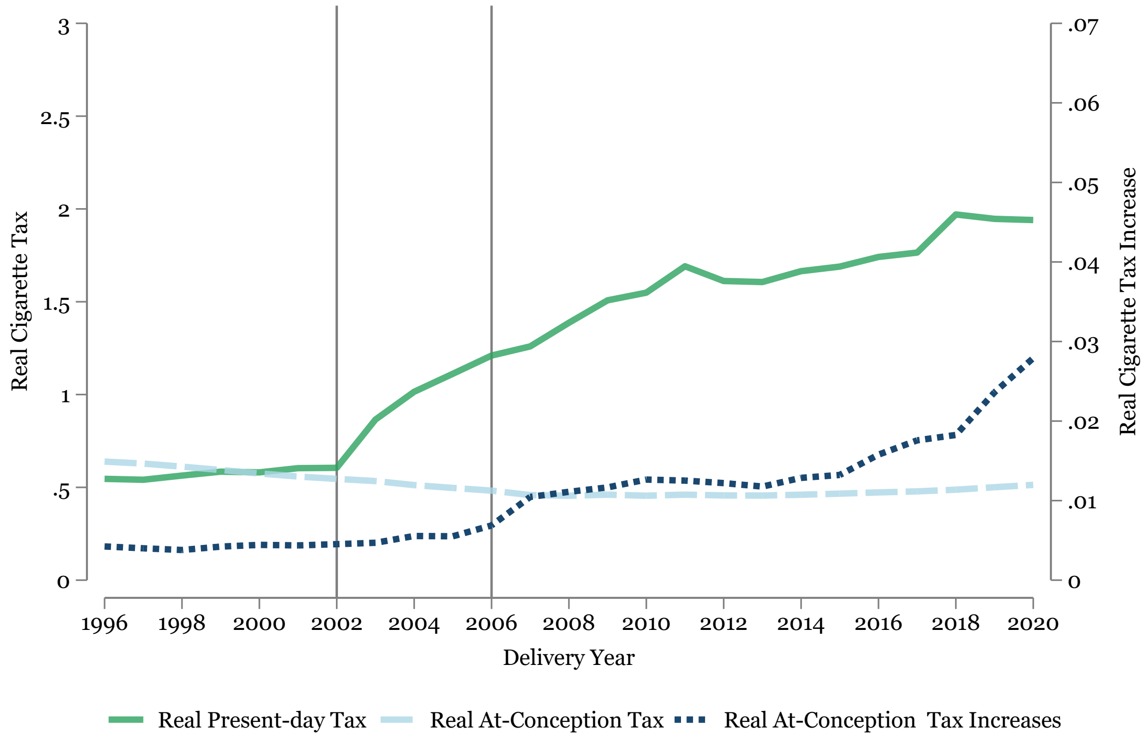
D Change in Cigarette taxes Over Time

We also show that the level of cigarette taxes has changed over delivery years (1996-2020) in Figure D.1. Beginning in 2002, present-day cigarette taxes undergo a steady increase. This period of present-day tax increases coincides with the declining significance of contemporary cigarette taxes. Simultaneously, real at-conception in-utero cigarette taxes gradually decline due to inflation.

Figure D.1 also reveals a notable increase in the inflation-adjusted in-utero tax increases for mothers giving birth after 2006 (navy short-dashed lines). The navy blue dashed line represents the weighted average of all in-utero tax hikes (i.e., the tax hike at the later-life mother's own conception point) for each delivery year, capturing the average inflation-adjusted discrete nominal changes in the cigarette tax.[48] These at-conception tax increases show clear growth after 2006, which may explain the greater sensitivity to at-conception cigarette taxes for the cohort of mothers delivering after 2006.

[48] These tax increases plotted in Figure D.1 represent the tax increases considered in the event study, Figure 1, and Figure 3. In this graph, we take the weighted average tax increase across the delivery years, representing the average tax increase across all mother's conception years for each delivery year. For example, for 2020, this value of $0.07 says that the average mother was conceived during a state-year with a tax increase of $0.07. These years of conception are as far back as 1970 for the oldest mother giving birth in our sample and as recently as 2001 for the youngest mother giving birth in our sample of adults.

Figure D.1: Extensions–Average Present-day and In-Utero Cigarette Taxes over Delivery Years 1996-2020



SOURCE: State-level cigarette taxes are from the CDC State System and the Tax Burden on Tobacco.
NOTES: Information presented based on the the weighted average cigarette taxes. Real cigarette taxes are CPI-adjusted and reported in 2020 dollars. Present-day taxes refer to contemporary taxes in place at the infant's conception. At-conception taxes refer to the mother's in-utero taxes. Real-at-conception tax increases refer to the inflation-adjusted nominal increases in the cigarette tax, for tax increases occurring in the year before the mother was born.