Taxing for Health: The Enduring Benefits of In Utero Cigarette Tax Exposure on Adult Health

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***Abstract**: Cigarette taxes have been shown to reduce maternal smoking and enhance birth outcomes. However, it is still uncertain whether these effects persist into adulthood. This study investigates the effects on adult health outcomes of exposure to higher cigarette taxes while in utero. Utilizing a generalized difference-in-difference methodology and analyzing a rich dataset spanning births from 1968 to 1994, I find that a 10-cent higher cigarette tax while individuals were in utero leads to a significant 1.8 percentage point reduction in the likelihood that the treated individuals (evaluated at ages 25 to 35) ever experienced health conditions such as asthma, lung disease, heart disease, or heart attacks. The examination of mechanisms underscores pathways through parental smoking behavior during pregnancy, birth outcomes, childhood health, smoking behavior in adolescence and adulthood, cognitive ability, educational attainment, and age of first childbirth for treated individuals. The study contributes to the burgeoning literature on early-life determinants of health and enriches our understanding of the complex interplay between cigarette policies and long-term health, with implications for policymakers and public health interventions.*

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Maternal smoking and exposure to second-hand smoke during pregnancy have long been known to be harmful to unborn babies. Tobacco smoke is a deadly mix of more than 7,000 chemicals and can damage the growing brain, lungs, arteries, and other delicate tissues (United States Department of Health and Human Services (USDHHS), 2010). It is also the largest preventable cause of low birth weight, which is one of the best predictors of health in later life (Black et al., 2007; Case et al., 2005; Currie, 2009; McEvoy and Spindel, 2017). Governments have adopted a series of policies and regulations such as cigarette taxes, smoking bans in public places, youth access

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restrictions, warning labels on tobacco packaging, and bans on advertising, to fight against smoking and improve public health. Among them, cigarette taxes are viewed as the single most effective policy (WHO, 2015).

Researchers have found causal evidence that cigarette taxes reduce maternal smoking during pregnancy (Adams et al., 2012; Bradford, 2003; Colman et al., 2003; Lien and Evans, 2005) and that in utero exposure to cigarette taxes improves infant and childhood health (Evans and Ringel, 1999; Lien and Evans, 2005; Tominey, 2007; Patrick et al., 2016; Simon, 2016). Yet, very little is known about the effect of in utero exposure to cigarette taxes on long-term human capital accumulation. Because smoking is a behavior commonly linked to low socioeconomic status, and because cigarette smoke could be one channel of the intergenerational transmission of poor health and human capital outcomes, the long-term effect of in utero exposure to cigarette tax has profound implications for policymakers and public health interventions.

This paper explores the impact of in utero exposure to cigarette taxes on adult health. I employ a general difference-in-difference approach that allows me to control for unobserved heterogeneity at both the year and state level. In addition, I apply an event study on a specific period to show the discrete impact of in utero exposure to cigarette tax hikes. Considering the recent criticism that a two-way fixed effect estimator could be biased in the case of heterogeneous treatment effects (Callaway et al. 2021; De Chaisemartin and D'Haultfoeuille, 2020), I adopt a staggered DID estimator that is valid in the presence of such heterogeneity (De Chaisemartin and D'Haultfoeuille, 2020). This allows me to estimate the effect on adult health of exposure to different discrete in utero cigarette tax levels.

I make use of the Panel Study of Income Dynamics (PSID) data spanning from 1968 to 2019. This dataset offers vital information on family backgrounds at the year of birth, childhood health and ability assessment, smoking behavior, and various other adult outcomes. I investigate the mechanisms underlying long-term health effects, such as the impact of taxes on parental smoking behavior during pregnancy, childhood cognitive and noncognitive ability, smoking behavior in adolescence and adulthood, educational attainment, and the age of first childbirth among individuals who were treated in utero. To investigate the underlying mechanisms, I also make use of the PSID-Child Development Supplements (PSID-CDS) data and the publicly available Vital Statistics Natality files.

I find that exposure to higher cigarette taxes while in utero significantly improves health in adulthood. A 10-cent higher tax that is in effect at the time of birth reduces the probability that individuals aged 25-35 have any of several health conditions (asthma, lung disease, heart disease or heart attack) by around two percentage points. This effect corresponds to eight percent of the mean, indicating a substantial reduction in the population who suffer from any of these conditions. Furthermore, the results suggest that the size of the beneficial health effect is increasing as people age. The results of the event study show that even third trimester exposure to a cigarette tax hike improves long-term health significantly. The results from the staggered DID estimator also support my findings. The results are stable across subgroups along key dimensions of demographic characteristics, family background, and different cohorts. The findings are also robust to a number of specification tests.

I then proceed to explore the underlying mechanisms behind the long-term health effects. Using the PSID, I find that higher cigarette taxes reduce the probability of parental smoking, especially for parents who are about to have a baby, a result I then confirm using the Natality data. Moreover, higher cigarette taxes during the in utero period improve birth outcomes measured using average birth weight, average gestational age, average APGAR score, low APGAR score rate, very low birth weight rate, and preterm delivery rate. In addition, higher cigarette taxes during the in utero period are associated with better physical and mental health in childhood (between ages 6 and 12), higher cognitive ability, a higher likelihood of obtaining a college or higher degree, a lower probability of smoking, and reduced smoking intensity for smokers in both adolescence and adulthood. Lastly, I offer evidence that higher cigarette taxes during the in utero period are associated with postponed age of first childbirth for individuals who were treated in utero, which is positively correlated with better health (Lee and Park, 2020; Shadyab et al., 2017).

To the best of my knowledge, this paper is the first to investigate the *long-run* impact of early-life exposure to cigarette taxes on health. Most previous studies in the field focus on contemporaneous impacts of cigarette taxes, such as the association between cigarette taxes and pregnant women's smoking behavior (Adams et al., 2012; Bradford, 2003; Colman et al., 2003; Lien and Evans, 2005), the association between cigarette taxes in early life and infants' and children's health (Evans and Ringel, 1999; Lien and Evans, 2005; Patrick et al., 2016; Simon, 2016), and the association between cigarette taxes in early life and educational attainment of adolescents (Settele and Ewijk, 2018). In the study most closely related to mine, Hoehn-Velasco et al. (2021) find that, when girls who were exposed to cigarette taxes in early life grow up, they have lower rates of pre-pregnancy and prenatal smoking and are less likely to be overweight or obese during pregnancy. These are the only adult health outcomes or behaviors of which I am aware that have been studied in terms of the effects of early-life exposure to cigarette taxes.

This paper also contributes to the literature on the long-run impacts of early life environment[2]. These studies provide evidence that early life environments are critical for the development of human capital. Earlier, much of this literature exploited variation from natural disasters and disease (Almond, 2006; Barreca, 2010; Lindeboom et al., 2010). More recently, studies have looked at policy experiments such as the Earned Income Tax Credit (EITC), food stamps, the supplemental nutrition program for Women, Infant and Children (WIC), and alcohol availability (Bastian and Michelmore, 2018; Hoynes et al., 2016; Hwang, 2019; Nilsson, 2017). I extend the literature by examining the impact of a policy that is inexpensive to implement and generates new revenues. Moreover, most policy experiments usually happen within a short period of time, but people are exposed to cigarette taxes for a much longer duration, which allows us to compare the effect of exposure to cigarette taxes at different periods of the lifecycle. My findings reveal that in utero exposure to cigarette taxes has a greater impact on adult health than exposure to cigarette taxes in childhood or adulthood.

Finally, this study has important policy implications. First, this research underscores the enduring impact of early-life policy interventions, suggesting that, when evaluating the benefits of various interventions, policymakers should consider not just immediate outcomes but also longer-term effects. Second, given that in utero cigarette taxes are found to have significant long-term health benefits, governments could consider increasing these taxes. Third, the link between higher cigarette taxes while in utero and improved physical and mental health, cognitive ability, higher

[2] See, e.g., Currie (2009) and Almond and Currie (2011) for reviews of this literature.

education, and reduced smoking in both adolescence and adulthood suggests that such tax policies should be a critical component of broader public health strategies. Lastly, my findings suggest that early-life environments play a crucial role in the development of human capital. Policymakers therefore might investigate other potential early-life interventions that could yield similar long-term benefits. For example, there could be potential in studying the long-term effects of taxes on other harmful substances, such as alcohol or sugary beverages, and their association with health and developmental outcomes.

The remainder of the paper is structured as follows. Section I summarizes the medical literature on the effects of exposure to tobacco smoke during pregnancy and the economic literature on the effects of cigarette taxes. Section II presents the theoretical framework. Section III describes the data and Section IV presents the empirical model. Section V shows the results. I conclude in Section VI.

I. Background and Previous Research

Maternal smoking during pregnancy is harmful to unborn babies. According to the Surgeon General's reports, "the nicotine in cigarettes may cause constrictions in the blood vessels of the umbilical cord and uterus, thereby decreasing the amount of oxygen available to the fetus. Nicotine also may reduce the amount of blood in the fetal cardiovascular system" (USDHHS, 2004, p.564). Moreover, smoking during pregnancy can cause tissue damage in the unborn baby, particularly in the lung and brain (USDHHS, 2010). Maternal smoking during pregnancy leads to worse birth outcomes. Infants born to mothers who smoke during pregnancy are more likely to be small for gestational age and have a lower average birth weight than infants born to women who do not smoke during pregnancy; low birth weight, in turn, is associated with increased risk for neonatal, perinatal, and infant morbidity and mortality. Environmental tobacco smoke (ETS) is also harmful to the fetus. Compared to infants born to women who are not exposed to ETS, infants born to women who are exposed to ETS during pregnancy may have a small decrease in birth weight and a slightly increased risk for intrauterine growth retardation. The timing of exposure is important. Smoking in the third trimester is particularly detrimental, while infants of mothers who stop smoking by the first trimester have birth weights and body measurements comparable with those of mothers who do not smoke (USDHHS, 2001).

Some studies further suggest that maternal smoking during pregnancy is associated with health and behavior problems in later life. Children whose mothers smoked during pregnancy are at a higher risk for a wide range of problems such as overweight, asthma, lung disease, attention deficit hyperactivity disorder, and behavioral problems (Gilliland et. al., 2000; Gilliland et. al., 2001; Milberger et. al. 1996; Oken et. al., 2008). Associations also have been found between maternal smoking during pregnancy and substance abuse and criminal outcomes in adulthood (Brennan et. al., 1999).

Moreover, maternal smoking during pregnancy, after controlling for postnatal smoking, increases the risk that children will smoke and develop nicotine dependence when they grow up (Biederman et. al., 2017; Kandel et. al., 1994; Lieb et. al., 2003). Smoking leads to health problems and harms nearly every organ of the body (USDHHS, 2014). Young people who smoke are at risk of addiction to nicotine, reduced lung growth and lung function, and early cardiovascular damage (CDC, 2012). The risk increases when smoking continues for many years. Smoking can cause more severe health conditions such as lung disease, heart disease, stroke, cancer, diabetes, and chronic obstructive pulmonary disease, while it increases risk for tuberculosis, certain eye diseases, and problems of the immune system (USDHHS, 2014).

However, maternal smoking during pregnancy is preventable. Prevention policies such as cigarette taxes, smoking bans in public places, youth access restrictions, and warnings about the dangers of tobacco have been adopted by governments. Among them, raising taxes on tobacco is the single most effective way to reduce smoking. There are several reasons for this. Higher tobacco taxes and prices reduce consumption and promote quitting; a tax increase is inexpensive to implement; taxation is especially effective in reducing tobacco use by young people, who are very price sensitive; and a tax increase generates new revenues, which can support tobacco control and other health initiatives (WTO, 2015).

Economic literature has provided causal evidence that cigarette taxes improve children’s health at birth. Using data from the 1989-1992 Natality files, Evans and Ringel (1999) find that a one-cent increase in real cigarette tax during the conception month (in 1982-4 dollars) leads to a reduction of around 0.08 percentage points in the smoking rate for pregnant women and an increase of around 0.21 grams in birth weight, a finding largely supported by the literature (Adams et al., 2012; Bradford, 2003; Colman et al., 2003; Lien and Evans, 2005; Patrick et al., 2016).

Moreover, economists have found that cigarette tax during pregnancy has impacts on children in later life. For the medium-term effect, using data from the National Health Interview Survey (NHIS), Simon (2016) finds that a one-dollar higher real tax during the first month of the third trimester leads to a 10 percent decrease in sick days from school and around a 5 percent decrease in the probability of having two or more doctor visits per year, for children born from 1988 to 2009. Settele and Ewijk (2018) find that higher cigarette taxes during pregnancy improve educational attainment for children born between 1988 and 1998 with mothers who have less than high school education. These studies suggest that the effects of cigarette tax during pregnancy on health in childhood and educational attainment in adolescence can be mediators for long-term health effects. For the long-run effect, Hoehn-Velasco et al. (2021) find that a one-percent higher cigarette tax during the in utero period reduces the probability of any smoking prior to conception for pregnant women by 0.21% and reduces the probability of prenatal smoking by 0.24%. They also find that higher cigarette taxes are associated with a lower pre-pregnancy BMI and a lower likelihood of developing diabetes before or during pregnancy.

My work makes important contributions to this literature by providing the first empirical evidence on the *long-term* health effects of exposure to higher in utero cigarette taxes.

II. Theoretical Framework

Cunha and Heckman (2007) provide a theoretical framework for the production of an individual's human capital. Their model provides theoretical evidence on how cigarette taxes in the prenatal period could have long-term health impacts. Human capital refers to cognitive ability, noncognitive ability, and health condition. Denote an individual's human capital at period t as $\theta_t \equiv (\theta_t^C, \theta_t^N, \theta_t^H)$, where θ^C refers to cognitive ability, θ^N refers to noncognitive ability, and θ^H refers to health condition. Based on Cunha and Heckman (2007), I model human capital as being produced by parental characteristics, investment, and environment (I add the environment to the original Cunha-Heckman model in order to understand the impact of cigarette tax). Each period's human capital depends on the capital in the previous stage, investment in human capital, environmental quality in the previous stage, and parental characteristics. Let h denote parental characteristics, I_t denote the investment at period t, and E_t denote the environmental quality at period t. The human capital at period $t+1$ is presented by

$$\theta_{t+1} = f_t(h, \theta_t, I_t, E_t). \qquad (1)$$

The human capital θ_{t+1} increases with investment and environment in the last period – that is, $\frac{\partial f_t}{\partial I_t} > 0$ and $\frac{\partial f_t}{\partial E_t} > 0$. Repeatedly substituting Equation (1) for θ_{t-1}, θ_{t-2},…, the human capital at period $t+1$ can be written as a function of parental characteristics, initial human capital, environmental quality, and investments in all the past periods from the in utero period to period t.

$$\theta_{t+1} = m(h, \theta_1, E_1, \dots, E_t, I_1, \dots, I_t). \qquad (2)$$

This framework captures three features: the "sensitive and critical period", "self-productivity", and "dynamic complementarity" in the development of children's human capital (Cunha and Heckman, 2007).

The "sensitive period" refers to periods that are more important than others in producing certain kinds of human capital. The "critical period" refers to the single period that is most effective in producing a particular kind of human capital. For example, the prenatal period is a sensitive period for the development of the brain and lungs and other organs. This implies that the in utero environment has a larger effect than the later-life environment in human capital development, i.e., $\frac{\partial f_t}{\partial E_1} > \frac{\partial f_t}{\partial E_s}$ where $s > 1$.

"Self-productivity" suggests that individuals with higher human capital are more productive and accumulate more capabilities. For example, emotionally stable children are more focused on learning activities and accumulate more human capital, i.e., $\frac{\partial f_t}{\partial \theta_t} > 0$. This characteristic indicates that the difference in human capital expands over time if all other factors stay the same.

Another feature of capability development captured by the model is "dynamic complementarity." That is, individuals with higher human capital gain a higher return from investment and environmental improvement. For example, healthy children can be more productive in learning activities compared to children with attention deficit/hyperactivity disorder (ADHD), i.e., $\frac{\partial^2 f_t}{\partial \theta_t \partial I} > 0$. This feature indicates that the difference in human capital expands faster with investment or environmental improvement.

Cigarette taxes can lead to two distinct outcomes. On the one hand, they tend to decrease smoking behaviors. On the other hand, for individuals heavily addicted to cigarettes, who may have a reduced response to cigarette taxes, higher taxes may result in increased expenditures on cigarettes. Consequently, whether exposure to higher cigarette taxes during pregnancy is beneficial is a question that requires empirical investigation. Previous studies indicate that, generally, the first effect, which is the reduction in smoking, prevails. Research has demonstrated that higher cigarette taxes reduce smoking behavior for pregnant women, thus leading to an improved uterine environment during pregnancy. Denote the in utero period to be period 1, that is $\frac{\partial E_1}{\partial CigTax_1} > 0$. Because the uterine environment has a strong effect on the development of critical organs such as the brain and lungs, as well as the general health of the fetus, cigarette taxes during pregnancy directly affect human capital in early life, i.e. $\frac{\partial \theta_2}{\partial CigTax_1} = \frac{\partial f_1}{\partial E_1} \cdot \frac{\partial E_1}{\partial CigTax_1} > 0$. The effect lasts over time because individuals with higher early-life human capital are more productive in accumulating later-period capability according to the "self-productivity" theory. The corresponding inequality is $\frac{\partial \theta_t}{\partial CigTax_1} = \frac{\partial f_{t-1}(\theta_{t-1}, I_{t-1}, E_{t-1}, G)}{\partial CigTax_1} = \frac{\partial f_{t-1}}{\partial \theta_{t-1}} \cdot \frac{\partial \theta_{t-1}}{\partial CigTax_1} = \frac{\partial f_{t-1}}{\partial \theta_{t-1}} \cdot \frac{\partial f_{t-2}}{\partial \theta_{t-2}} \cdots \frac{\partial f_1}{\partial \theta_1} \cdot \frac{\partial \theta_1}{\partial CigTax_1} > 0$. The effects could even be strengthened as individuals with higher early-life human capital gain higher returns from investment and environmental improvement according to the "dynamic complementarity" theory, i.e. $\frac{\partial^2 \theta_t}{\partial CigTax_1 \partial I_s} = \frac{\partial f_{t-1}}{\partial \theta_{t-1}} \cdot \frac{\partial f_{t-2}}{\partial \theta_{t-2}} \cdots \frac{\partial f_s}{\partial I_s} \cdot \frac{\partial f_s}{\partial \theta_s} \cdots \frac{\partial f_1}{\partial \theta_1} \cdot \frac{\partial \theta_1}{\partial CigTax_1} > 0$. Moreover, in utero cigarette taxes may indirectly affect investment in later periods, if poor initial health requires increased expenditures of money and time on health care, which reduce the budget and time available to invest in human capital development (I). The theoretical model implies that increasing cigarette taxes in early life affects individuals' initial human capital; the effect can last long into adulthood and can get stronger with age.

Cigarette taxes in childhood, adolescence, and early adulthood may also have effects on health in adulthood. However, the effect should be smaller than the effect of in utero cigarette tax, according to the "sensitive period" theory, i.e. $\frac{\partial f_t}{\partial CigTax_1} = \frac{\partial f_t}{\partial E_1} \cdot \frac{\partial E_1}{\partial CigTax_1} > \frac{\partial f_t}{\partial Cigtax_s} = \frac{\partial f_t}{\partial E_s} \cdot \frac{\partial E_s}{\partial CigTax_s}$, assuming that the effect of cigarette taxes on the environment does not change over time, i.e. $\frac{\partial E_1}{\partial CigTax_1} = \frac{\partial E_s}{\partial CigTax_s}$.

I borrowed Cunha and Heckman (2007)'s theoretical framework to explore how cigarette taxes might affect long-term human capital accumulation. The framework yields three primary forecasts. Firstly, exposure to in utero cigarette taxes directly improves the environment and enhances human capital in early life. Moreover, the early life effect persists into adulthood and may expand over time due to the properties of self-productivity and dynamic complementarity. Lastly, because the in utero period is a sensitive period for physiological development, exposure to cigarette taxes in this period exhibits a larger impact on human capital accumulation than cigarette taxes in later life.

III. Data

A. Cigarette Taxes

Cigarette taxes can be implemented by federal, state, and municipal governments. Because federal cigarette tax rarely changes and municipal cigarette taxes are not common, I focus on state excise taxes. Figure 1 shows the variation of state cigarette taxes between 1968 and 1994. States in the tobacco belt, such as North Carolina, Virginia, Kentucky, and South Carolina, have the lowest state cigarette taxes. Conversely, Connecticut, New Jersey, Minnesota, Florida, and Massachusetts tend to impose relatively high state cigarette taxes. I trim the states with very high or low average state cigarette taxes to test the robustness of the results. During the sample period, the average *nominal* state cigarette tax increased from \$0.08 in 1968 to \$0.27 per pack in 1994. The smallest increment was 1 cent, and the largest increment (in Washington D.C. in 1993) was 33 cents. The average *real* state cigarette tax in this period in 2020 dollars[3] varies between \$0.37 and \$0.71. There were 186 increases in real state cigarette tax during the period. Among them, 63% were

[3] All the values below are 2020 dollars without further notation.

equal to or greater than 10 cents. The largest change was an increase from 31 cents in 1992 to 90 cents in 1993 in Washington D.C. The average cigarette tax during 1968 and 1994 was 50 cents, while the average price for a pack of cigarettes before taxes was $2.5.

B. Panel Study of Income Dynamics (PSID)

PSID is a longitudinal household survey that started in 1968 with a nationally representative sample of around 5,000 families in the United States. It surveyed household heads and spouses and their offspring annually from 1968 to 1997 and then biennially from 1997 on.

Three unique features of the PSID make it the perfect dataset for this study. Firstly, for respondents in PSID, I have detailed family background information, including the educational level of the mother, whether the mother was older than 35 when she gave birth, gender and marital status of the household head, number of children in the family, and the family income-Census needs standard ratio[4] in the year of birth. Moreover, in 1999, the PSID started collecting health information and therefore can provide detailed information on health status and health behavior for the household heads and spouses. In addition to health in adulthood, I have other adult performance information, such as education and fertility, for the individuals I study.

C. PSID-Child Development Supplement Data

I utilize PSID's Child Development Supplement (CDS) data for the analysis of the effect of cigarette taxes on health and cognitive ability in childhood, as well as smoking behavior in adolescence. CDS data is available for 1997, 2001, 2007, 2014, and 2019, providing valuable information on child development for children aged 0 to 17. I can therefore use the CDS data to explore the effect of early-life exposure to cigarette tax on childhood development as one potential underlying mechanism. The CDS started in 1997, and information was gathered on children between ages 0 and 12. For each PSID family, data was gathered for CDS on one or two eligible children. These children were followed in the surveys in 2001 and 2007 until they turned 18. In the CDS ongoing waves in 2013 and 2019, data was gathered on all the children aged 0 to 17 in

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[4] According to the PSID codebook, the Census needs standard is a poverty threshold by size of family, the number of persons in the family under 18, and the age of the householder; it is taken from the Census Bureau's website. The ratio can be seen as an adjusted measure of family income.

the PSID families. CDS collects information on chronic physical conditions, including anemia, allergies, asthma, diabetes, ear disease, hearing difficulty, eye disease, and obesity,[5] and chronic neurological, psychiatric, or behavioral conditions, including seizure disorders, autism, speech problems, learning disabilities, behavioral disabilities, and hyperactivity for children between ages 0 and 18. I generate four health indices based on these health conditions: 1) whether the child has any chronic physical condition; 2) whether the child has any chronic neurological or psychiatric condition; 3) how many chronic physical conditions the child has; and 4) how many chronic neurological or psychiatric conditions the child has. CDS also collects cognitive ability information, including scores on Woodcock-Johnson tests taken by children between ages 6 and 18, and collects information on smoking behavior for adolescents between ages 12 and 18.

D. *Vital Statistics Natality Files*[6]

I also use the US Natality birth data maintained by the National Center for Health Statistics (NCHS) from 1969 to 1994 to study the effect of cigarette taxes during pregnancy on the maternal smoking rate[7] and birth outcomes. Birth outcomes include average birth weight, very low birth weight rate (birth weight < 1500 gram), average gestational age, preterm delivery rate (gestational age < 28 weeks), average APGAR score, and low APGAR score rate (APGAR score < 7). I do not include data from 1968 because limited information was recorded in 1968. Natality birth data record information collected from state birth certificates, including birth year, birth month, birth state, birth order, and the age, race, marital status, and educational level of the mother. I generate cell-level outcome variables following Baughman and Dickert-Conlin (2009).

E. *Sample Selection*

The main sample consists of household heads and spouses aged 25-35 who were born to PSID families between 1968 and 1994.[8] This age range was selected based on several considerations. One reason is that most respondents assumed the roles of household heads or spouses after the age of 25. Moreover, individuals born in 1968 were first posed health-related questions at the age of

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[5] The question about obesity was not asked in 1997.

[6] The individual level Natality birth data from 1969-1994 can be downloaded from the website: https://www.nber.org/research/data/vital-statistics-natality-birth-data.

[7] The data on smoking behavior during pregnancy is not available in the Natality Files until 1989.

[8] Other members of the household are not included because the PSID only collects health information from the household heads and spouses.

31 in 1999 (when the PSID started collecting health information, and when household heads and their spouses were first queried about whether a medical professional had ever diagnosed them with asthma, lung disease, heart disease, or heart attack). Therefore, any upper age limit below 31 would exclude the 1968 cohort. By setting the upper limit at 35, I ensure that this 1968 cohort had three opportunities to participate in the survey between the ages of 25 and 35. This flexibility is crucial given that some became household heads or spouses after the age of 31 and may not have consistently participated in the PSID survey. This relatively narrow age range is chosen so that I can focus on an age group where health conditions exhibit limited variability. However, I have conducted robustness checks with different age ranges and the results are robust.

Only individuals born to PSID families after 1968 (the first year of the PSID data) are included in the sample because I need information on birth state and family background at birth. Additionally, because the latest released PSID survey at the time of writing this paper is the 2019 wave, individuals born after 1994 (and therefore younger than 25 in 2019) are excluded from the main sample.

In the process of refining the sample, I adhered to a systematic series of steps to ensure that the most relevant observations were included. Initially, I retained observations of household heads and spouses born to families in the 1968 sample between 1968 and 1994, who were between the ages of 25 and 35. This resulted in a sample size comprising 5,791 unique IDs. Further refinement involved removing those observations that were not part of at least one survey conducted by PSID during the ages of 1 to 18, narrowing the sample to 5,645 unique IDs. Next, any observation lacking a complete record of state of residence between the ages of 1 to 18 was excluded. The primary rationale was the inability to ascertain the cigarette tax during the birth year, even if I assumed that they did not relocate before turning 18. This step led to a slight reduction in the sample size to 5,644 unique IDs. Essential demographic information was also crucial for the analysis. Hence, observations were excluded if data were unavailable on race, the age of the mother at birth, or the mother's educational background. This brought the sample down to 5,609 unique IDs. Because health conditions are integral to my study, observations lacking information on specific health conditions (asthma, heart attack, heart disease, and lung conditions) were removed, resulting in 5,418 unique IDs. Finally, to ensure the accuracy and relevance of the data, observations without clear information on the state of residence between the ages of 25 and 35 were dropped. Consequently, the final sample encompassed 5,402 unique IDs originating from 1,494 families surveyed in 1968.

The CDS sample consists of children born between 1989 and 2013. I exclude those born after 2013, because they were under age six during the most recent CDS survey conducted in 2019. Children born prior to 1989 were not considered for this study either, primarily because the question concerning obesity was introduced only in the 2001 survey. By that time, those born before 1989 were already older than 12. My analysis specifically targets the health conditions observed between ages 6 and 12, aiming to focus on a period when health conditions are relatively consistent across the age group.

F. Sample Statistics

Table 1 offers a comprehensive view of the weighted summary statistics for the estimation sample. Each observation in the sample is a unique individual. Upon analyzing the data, it becomes evident that approximately 24% of the sampled individuals had experienced at least one of the health conditions – asthma (18%), lung disease (7%), heart disease (2%), or heart attack (1%) – when they were surveyed between the ages of 25 and 35.

Demographically, the sample paints a diverse picture. Nearly half of the sample are male (48%). White individuals account for 81% of the sample, followed by Black individuals at 17%. The average age at which they were last surveyed during the 25 to 35 age bracket is 32 years. Eighteen percent were born to mothers aged over 35. Maternal education also provides interesting insights: 21% of the sampled individuals were born to mothers who hadn't completed high school. In contrast, 60% had mothers with educational attainments spanning from high school to some college, and 19% had mothers with a college degree or a more advanced educational background.

Diving deeper into familial structures, 14% hailed from female-headed households, whereas 84% were born into two-parent families. The order of birth also plays a role in the analysis: 59% represent the eldest child in their family, 24% hold the position of second child, and the remaining 18% are either the third child or born later in the birth order. The average family income at the time of birth, measured as a ratio of the Census needs standard budget, stood at 3.56 (i.e., nearly four times the poverty level).

Shifting the focus to policy and economic indicators, several data points emerge. The average in utero cigarette tax, which is determined either at the close of the third trimester or at the birth month, is calculated at $0.50. By the time these individuals reached 25, the average cigarette tax had increased to $1.21. Concurrently, the average state minimum legal age for tobacco product purchases was 17.89.

Economic indicators during the year of birth reveal that the state beer tax per 31 gallons was $53.28, the state wine tax per gallon was $2.51, and the state spirit tax per gallon was $31.20. The state minimum wage, on average, equaled $5.75. Other financial parameters include an average marginal income tax rate of 5.63%, a per capita GDP of $38,830, and an array of benefits: the average maximum Earned Income Tax Credit (EITC) was approximately $1,402 per year, the Child and Dependent Care Tax Credit (CDCTC) hovered around $2,530, and the Aid to Families with Dependent Children/Temporary Aid to Needy Families (AFDC/TANF) benefit was roughly $907 per month. The health infrastructure, as represented by the total number of hospital beds, was 48.56 thousand on average. Lastly, the average state expenditure for Medicaid and similar programs stood at about $2,807,000.

IV. Empirical Strategy

A. Difference-in-difference

We utilize a generalized difference-in-difference approach with continuous treatment. The main specification for the baseline model is as follows:

$$y_{isym} = \alpha + \delta_1 CigTax_{sym} + \delta_2 CigTax_{s,age25} + X_{isym}\beta_1 + Z_{sy}\beta_2 + \lambda_y + \eta_s + \varepsilon_{isym}. \quad (3)$$

The term y_{isym} refers to the health outcomes, measured during adulthood, for individual *i* born in state *s* in year *y* and month *m.* The main explanatory variable is $CigTax_{sym}$, which captures the real state cigarette tax in state *s* at birth. Birth time refers to the birth year-month; as noted above, cigarette smoking has the strongest effect on birth outcomes during the last trimester of pregnancy (England et al., 2001; Bernstein et al., 2005). $CigTax_{s,age25}$ captures the real cigarette tax in individual i's state of residence when s/he is 25.

The term X_{isy} represents a vector of individual-level characteristics, including gender, race (white and nonwhite), age squared at survey year, and family background at birth year, including the educational level of the mother (dropout, high school or some college, college and beyond), whether the mother was over 35 when she gave birth to the individual, gender of the household head, marital status of the household head, number of children in the family, and family income-Census needs standard ratio.

The term Z_{sy} represents a vector of state-level covariates at birth year, including minimum legal age for purchasing tobacco products, alcohol taxes (including tax rates for beer, spirits, and wine), social welfare benefits (including EITC benefit, CDCTC benefit, and AFDC/TANF benefits), economic status and policies (including the minimum wage, the maximum marginal income tax rate, and per capita GDP), and health care investment (including state expenditure for Medicaid and similar programs and the number of hospital beds). These state-level covariates also affect children's early-life environment and long-term health outcomes.

The terms λ_y and η_s are birth year and birth state fixed effects, respectively. The birth year fixed effect controls for factors that change each year, such as the size of the cohort and public awareness about the harm of cigarette smoking. The state fixed effect controls for relatively time-invariant state characteristics, such as culture and climate.

I use the average PSID longitudinal weights during ages 1 to 18 in the estimation and cluster the standard errors by state of birth to account for unobserved correlation of the error terms within states.

The analysis relies on two sources of variation: cross-state variation in cigarette taxes in a particular year and within-state changes in cigarette taxes over time. We use state-level cigarette taxes as the treatment variable for several reasons. Firstly, the state-level cigarette tax affects the cost of consuming cigarettes in a given state; this could, in turn, influence the smoking behavior or exposure to secondhand smoke of pregnant women. Thus, there is a plausible causal relationship between state-level cigarette taxes and in utero exposure to tobacco smoke. Secondly, the variation in cigarette taxes at the state level is exogenous to the specific individual within states. Finally, a Two-Way Fixed Effect (TWFE) approach enables us to control for unobserved heterogeneity at both the year and state level. This helps address potential sources of bias, such as omitted variable bias, which could arise if we only examined the relationship between parental smoking behavior (or tobacco smoke in the environment during pregnancy) and adult health for the grown children at the individual level. However, it is still possible that the cigarette taxes are endogenous and could bias the results. We address these issues in the next section.

B. Threat to Identification

The identification depends on the exogeneity of cigarette taxes, conditional on the individual-level and state-level controls. The literature has explored what drives an increase in cigarette taxes. Originally, legislatures enacted tobacco taxes primarily to boost state revenue. As the public awareness of the harm of smoking and second-hand smoke grew, states have also employed taxes to reduce cigarette consumption (Gruber, 2001). However, considering that legislation usually take years to happen, it is unlikely that a cigarette tax increase is correlated with a sudden shift of public awareness (Gruber and Köszegi, 2001).

Another potential concern is whether changes in state cigarette taxes are influenced by state demographics, economic policies, or economic conditions that also impact health conditions. For example, if states with more highly educated people tend to adopt higher cigarette taxes, and if cigarette taxes tend to have a larger impact on better-educated people, then estimates of the effect of cigarette tax on health would be biased upward. If states with higher per capita GDP tend to adopt higher cigarette taxes, and if cigarette taxes tend to have a smaller impact on people with higher income, then estimates of the effect of cigarette tax on health would be biased downward. If states raise cigarette taxes to finance public health care or public welfare programs which improve public health, then estimates of the effect of cigarette tax on health would be biased upward.

To address these concerns, I conduct formal tests to examine the correlation between state cigarette taxes and state demographics, economic policies, and economic conditions. Table 2 presents the results of regressing the cigarette tax on the state-by-year characteristics (including percent male, percent white, percent married, percent high school or some college, percent with college or higher education, average age, state per capita GDP, state minimum wage, state marginal income tax rate, maximum AFDC/TANF benefit, maximum EITC benefit, maximum CDCTC benefit, number of hospital beds, state expenditures for Medicaid and similar programs, state beer/wine/spirits excise tax, and minimum legal age for purchasing tobacco products), controlling for state fixed effects and year fixed effects. Overall, the results suggest that a state's cigarette excise tax is correlated with its beer excise tax at the 10% level. However, the cigarette tax is not correlated with other state covariates, and these state-level variables cannot predict state cigarette taxes.[9] In addition, considering that all these factors may be correlated with public health, I control for them in the models to mitigate any potential biases.

Another threat to identification is sample selection bias – the potential bias due to the sample being endogenously selected by cigarette tax. If a cigarette tax affects fertility or the probability of entering the sample, the health effect could be endogenous. That is, the health effect could be a result of the fertility effect or the sample I use. Table 3 shows that the cigarette tax is not statistically significantly correlated with the probability that a woman aged 20 to 39 gave birth to a baby in the same year or the following year, regardless of the gender of the baby. Table 4 further shows that, for all the individuals born to PSID families between 1968 and 1994, in utero cigarette tax is not statistically significantly correlated with the probability of being included in the sample. These results suggest that selection bias is unlikely to be an issue for this study.

In addition, the effect of in utero cigarette tax could be biased upward if cigarette tax levels at different times are correlated; that is, in utero cigarette taxes could be correlated with the cigarette taxes to which people are exposed in later years. To mitigate this concern, I control for cigarette taxes at age 25 in the baseline model. I further conduct various specification tests, including controlling for cigarette taxes from other periods in later life. The results are robust.

D. Staggered Difference-in-Difference Estimator

[9] I also regressed each state covariate in time t+1 on cigarette tax at time t while controlling the full set of other state-level covariates to see whether the cigarette tax affects future state-year characteristics. The results show that state cigarette tax does not have a significant effect on state-year characteristics in the next year. Please see detailed results in table A1.

There is a potential for bias in the presence of heterogeneous treatment effects for the difference-in-difference with continuous treatment with two-way fixed effect estimator (Callaway et al., 2021). Hence, I have chosen to employ the staggered Differences-in-Differences estimator for a non-binary ordered treatment, known as DID_M, as proposed by de Chaisemartin and d'Haultfoeuille (2020). This estimator maintains its validity even when treatment effects vary across time or different groups. However, it does come with certain limitations.

Firstly, there is a bias-variance trade-off between DID_M and the TWFE estimator as DID_M often has a larger variance than that of TWFE estimator. Secondly, the DID_M estimator requires that, for each pair of consecutive dates, there exist groups whose treatment remains constant to act as control groups. Consequently, it cannot accommodate treatments such as the real cigarette tax that fluctuates from year to year. To address this, I have opted for a discrete treatment approach, specifically using discrete cigarette tax levels rather than real cigarette tax values to establish control groups that have stable treatment. It's important to strike a balance in the number of discrete levels; too many might put a restrict on the number of observations for control groups, while too few might result in limited number of switchers between these levels. I create seven distinct tax tiers for cigarettes by rounding the cigarette tax by 20 cents. That is, the first tier ranges from 0 to 10 cents, while the subsequent tiers go from 10 to 30 cents, then from 30 to 50, and so on, with the highest tier spanning 110 to 130 cents. Lastly, there is a constraint on the number of control variables that can be included in the model. Excessive control variables can inflate the standard error, which may affect the model's precision.

While the DID_M estimator is resilient against heterogeneous treatment effects, it's important to use caution because of the bias-variance trade-off, the requirement for groups with constant treatment within consecutive dates, and other constraints. By including the DID_M estimator as a robustness check, I aim to ensure the reliability of my findings and to assess the consistency of results between the TWFE and the staggered DiD approaches. This dual approach allows for a comprehensive evaluation of treatment effects while acknowledging the strengths and limitations of each method.

V. Results

I start by presenting the results on the instantaneous effect of cigarette tax on smoking behavior. I then present the main results on the effects of changes in cigarette taxes during childhood on health as adults, followed by heterogeneity of the effect and robustness tests. I further investigate the potential mechanisms/mediators and, lastly, I discuss the size of the effect.

A. Impact of Cigarette Tax on Smoking

Because smoking behavior was surveyed in 1986 and from 1999 on in the PSID, I use data from these years to estimate the effects of cigarette tax on smoking rates for household heads and spouses in the reproductive ages from 20 to 39. The results are shown in Table 5. Note that observations in this sample are not necessarily parents of individuals in the main sample. Column 1 of Table 5 shows that a 10-cent higher cigarette tax reduces the probability of smoking by 2 percentage points, which is significant at the 10% level and around 8% of the mean.

The sample for column 2 of Table 5 is a subsample of that for column 1 and consists of household heads and spouses who were aged 20-39 and had a newborn within two years after the year when the question on smoking behavior was asked. Column 2 shows that a 10-cent increase in cigarette tax reduces the probability of smoking by 2.9 percentage points, which is significant at the 5% level and corresponds to 15% of the mean. This result indicates that the tax effect could be even stronger for household heads and spouses who had a baby within that two-year period.

The sample for column 3 is a subsample of column 1 and only includes parents of individuals in the main sample. The result shows that a 10-cent increase in cigarette tax reduces the probability of smoking by 10 percentage points, which corresponds to 35% of the mean. The relatively large magnitude (compared to columns 1 and 2 in Table 5) could be because around one-fifth of the sample are from 1986, when both the price of cigarettes and cigarette taxes were relatively low, and people may have been more sensitive to the increase of cigarette tax at that time.

Estimates with Natality data support this finding. Column 5 of Table 11 shows that a 10-cent higher cigarette tax during the in utero period is associated with a decrease of 1.6 percentage points in the smoking rate of the mother during pregnancy, which corresponds to 9% of the mean.

B. Main Results

Table 6 presents the effect of exposure to in utero cigarette tax on health in adulthood. I use two health outcome indices as the main measures of long-term health in adulthood. Health outcome index A is a binary variable that equals one if the individual has any of the following conditions: asthma, lung disease, heart disease, or heart attack. I choose these four health conditions because respiratory and cardiovascular conditions are the main problems caused by exposure to cigarette smoke (USDHHS, 2001; 2004).[10] Health outcome index B is the number of these health conditions that individuals have. Columns in Table 6 progressively add controls, including birth year and birth state fixed effects, demographics, family background at birth, and different state-level covariates. The results are stable, with the coefficients ranging from -1.3 to -1.8 percentage points for health outcome index A and -0.018 to -0.021 for health outcome index B. With the full set of controls, a 10-cent higher in utero cigarette tax reduces the probability of having any of those conditions between ages 25 and 35 by around 1.8 percentage points and reduces the number of conditions the individual has between age 25 and 35 by around 0.02. Effects on both indices correspond to 7-8% of their means, respectively, indicating a substantial reduction in the probability of suffering from the four health conditions which are most related to exposure to smoking. The preferred model is the model corresponding to the last column.

Once I control for the cigarette tax during the in utero period, cigarette tax at age 25 has a much smaller effect on adult health. For example, a 10-cent higher cigarette tax at age 25 decreases the probability of having any of those four health conditions between age 25 and 35 by around 0.2 of a percentage point, which is only about 1% of the mean. The effect on the number of health conditions is statistically significant, but only at the 10% level.

Table 7 shows the regression results for the individual components of the two indices and the effect on adult health status in different age ranges. The magnitude of the health effect increases as individuals age. For health status during ages 35 to 45, a 10-cent higher cigarette tax while in utero reduces the probability of having any of those four health conditions by 2.8 percentage points and reduces the number of health conditions by 0.04; both estimates are larger than their counterparts

[10] Health conditions available in PSID include high blood pressure, diabetes, heart attack, heart disease, stroke, arthritis, cancer, psychosis, obesity, lung disease, asthma, learning disorder, and other physical and mental conditions.

for ages 25 to 35. For ages 25 to 35, the main driver is the effect on asthma, while for ages 35 to 45, the main drivers are the effects on asthma and lung disease. Figure 2 and Table A2 further shows that the magnitude of the beneficial effect of in utero cigarette tax on health status increases with age when I examine age ranges from 25 to 30, 30 to 35, 35 to 40, and to 40 to 45.

Table 8 shows the results from the staggered DID_M Estimator. A one-level higher cigarette tax during the in utero period (a 20 cent increase on average) causes a 3.9 percentage point reduction in the probability of having any of the four health conditions. This is close to the value from the TWFE estimation, where a 10 (20) cent increase in cigarette tax while in utero is associated with a 1.8 (3.6) percentage points reduction in the probability of ever having any of the four health conditions. Figure 3 shows the comparison between the TWFE estimation and the DID estimator after adjusting the unit of cigarette tax to 20 cents per pack for the TWFE estimation.

C. *Heterogeneity by Subgroups*

Socioeconomic status (Ekblad et al., 2014; Rumrich et al., 2019) and educational attainment (Gould et al., 2017) are primary predictors for smoking during pregnancy. In addition, the effect of early life environment may be different across genders (Nilsson, 2017). For these reasons, I explore the heterogeneity of cigarette tax effects by the respondents' race, gender, mother's education, family economic status, and parents' marital status at the time of birth. Table 9 and Figure 4 show the heterogeneous effects of cigarette taxes. The result is largely robust across subgroups. The effect is relatively larger for males, which is consistent with literature showing that males suffer more from an adverse environment in early life (Nilsson, 2017). There is an opposing effect observed within the subgroup born to single-parent families, where a higher in utero cigarette tax is associated with an increased likelihood of experiencing health conditions in later life. This phenomenon may be attributed to persistent nicotine addiction for single mothers. The coefficient for the subgroup born to mothers with an educational level of college or above has a wide confidence interval, likely because of the very small size of this group[11].

D. Robustness Checks

[11] The sample size for the subgroup born to mothers with a college degree or above is 754.

Columns 2 and 6 in Table 10 show the robustness of the health effect of in utero cigarette taxes while controlling for cigarette tax in later life. Friedson (2021) finds that increasing the average cigarette tax during adolescence (between ages 14 and 17) reduces the probability of adult smoking, which could improve health status in adulthood. Building on this finding, I control for average cigarette taxes during adolescence. The result shows that controlling for average cigarette tax in adolescence does not change the baseline results on the health effects of exposure to cigarette tax while in utero. The average cigarette tax in adolescence does improve health status in adulthood, as shown by Friedson (2021), although the effect is insignificant in my empirical setting. In columns 3 and 7, I control for both average cigarette tax between ages 1 and 13 and average cigarette tax between ages 14 and 17. The effect of cigarette taxes during the in utero period is the same as in the baseline model. The average cigarette taxes in the two childhood periods improve health status in adulthood, although the effects are insignificant.

Because the timeframe in the study lasts for more than two decades, I check whether the effect is consistent over time by dividing the sample into two subsamples by median birth cohort: people born between 1968 and 1980 and people born between 1981 and 1994. The results in columns 4 and 8 show that there is no significant difference in the health effect of cigarette taxes during the in utero period for people born in these different decades.

As noted above, the effect of exposure to cigarette smoking is strongest in the third trimester (USDHHS, 2001). Figure 5 shows that the results are robust if I change the explanatory variable from the cigarette tax at the end of the third trimester to the cigarette tax at the beginning of the third trimester (as in Simon (2016)), the average cigarette tax during the third trimester, or the average cigarette tax during the whole period. In Figure 5, I also compare the effects of in utero cigarette tax at the end of the third trimester, the average cigarette tax in the first two years of life, and the average cigarette tax in the first six years of life. Compared to the cigarette tax during the in utero period, increasing the average cigarette tax in the first two years of life or in the first six years of life has about the same effect on health in adulthood. This indicates that the effect of the average cigarette taxes in the first several years of life could be mainly driven by the effect of the cigarette tax during the in utero period. However, I am cautious in interpreting this result because an increase in cigarette tax in birth year usually means the cigarette tax remains high in the following years.

One concern regarding our specification is the potential influence of outlier states, specifically those with exceptionally high or low levels of cigarette taxes within our sample. We assess the robustness of our coefficient estimates concerning this aspect by progressively excluding states with average cigarette taxes at both the upper and lower extremes at the 5th, 10th, 15th, 20th, and 25th percentiles. Consequently, this process retains the middle 90 percentiles, 80 percentiles, 70 percentiles, 60 percentiles and 50 percentiles when trimming the top and bottom percentiles. In Figure 6, the first (and largest) coefficient estimate (shown in red) represents our preferred specification. The coefficient remains relatively stable in the trimming process. However, the confidence interval expands because this exercise mechanically constrains the variation in causality that would be required to estimate the coefficient of interest. Nevertheless, even with this limitation, the coefficient estimate remains statistically significant when we exclude the top and bottom 25th percentiles.

Table A3 shows that the results are robust across different sampling weights. I further test the robustness of the baseline model to include state-specific linear time trends. In this way, the identifying variation in cigarette tax comes from tax changes within states over time that deviate from the linear trend. Table A4 shows that the results are robust when controlling the state-specific linear time trends.

Table A5 compares the estimated coefficients and the corresponding odds ratio from OLS regression and logit/ordered logit regression. The odds ratio from the two regressions is similar and further supports the robustness of the results.[12] The results from logistic regression show that the odds ratio of having any health condition over having no health condition, associated with a 10-cent increase in cigarette tax, is 0.9 times the corresponding odds ratio without the 10-cent increase in cigarette tax. In other words, people have 10% lower odds ($0.9 - 1 = 0.1$) of having one of the health conditions in response to a 10-cent higher cigarette tax while in utero.

[12] The convergence is not achieved for heart attack.

E. Effect of Discrete Levels of Cigarette Taxes

I use cigarette tax bins instead of continuous cigarette tax to explore the effect of discrete levels of cigarette taxes. The estimation model is

$$y_{isym} = \alpha + \sum_j \delta_j \, Cigtax\ bin_{sym,j} + \gamma Cigtax_{s,age25} + X_{isy}\beta_1 + Z_{sy}\beta_2 + \lambda_y + \eta_s + \epsilon_{isym} \quad (5)$$

where $Cigtax\ bin_{sb,j}$ is equal to 1 if the cigarette tax during an in utero month falls in the jth bin. The bins range from \$0 to \$1.5 with an increment of \$0.30 (cigarette taxes range from \$0 to \$1.31). Other variables are the same as in Equation (3).

Figure 7 shows the effects of discrete levels of cigarette taxes during the in utero period. It shows that the magnitude of the in utero cigarette tax effect on the two health indices is increasing with the cigarette tax levels. This indicates that the health effect increases in the cigarette tax, at least within the range of \$0 to \$1.31.

F. Mechanisms

1) Effect on Birth Outcomes

Birth weight is one of the best proxies for infant health (Conley et al., 2006). It is also one of the best predictors for later life health (Black et al., 2007; Case et al., 2005; Currie, 2009), educational and labor market outcomes (Johnson and Schoeni, 2007; Behrman and Rosenzweig, 2004; Currie and Hyson, 1999), and life expectancy (Van den Berg et al., 2006; Oreopoulos et al., 2008). Public health professionals have identified maternal smoking during pregnancy as the largest risk factor for low birth weight that can be modified by behavior (Almond et al., 2005; Kramer, 1987; Shiono and Behrman, 1995) and cigarette tax can effectively reduce the likelihood that infants are born with low birth weight (Almond et al., 2005; Evans and Ringel, 1999; Lien and Evans, 2005).

Because information on birth weight is not available for every individual in the PSID, I use the Natality birth data from 1969 to 1994[13] to estimate the effect of in utero cigarette tax on birth outcomes. Natality birth data not only provide birth weight, but also information on other measures of birth outcomes, such as gestational age, Apgar score, and maternal smoking behavior during pregnancy. Following Baughman and Dickert-Conlin (2009), I divide birth records into cells by

[13] We do not use data from 1968 because it does not have information on marital status and education.

state, year, the birth order of the child, and the age range, race, educational level, and marital status of the mother.[14] The birth outcomes I measure are average birth weight, average gestational age, average Apgar score, rate of very low birth weight (<1500g), rate of preterm delivery (gestational weeks<28), rate of low Apgar score (<6), and rate of maternal smoking for each cell. The results in Table 11 show that a higher cigarette tax in the year of birth improves all these birth outcomes, although the effects on average birth weight and gestational age are statistically insignificant.

2) Health in Childhood

Table 12 provides suggestive evidence that exposure to cigarette tax while in utero affects health outcomes in adulthood by affecting health status in childhood. The sample consists of 4,260 children born between 1989 and 2013 and surveyed by the CDS. The result shows that a 10-cent higher cigarette tax while in utero reduces the probability of having any physical health condition (anemia, allergies, asthma, diabetes, ear disease, hearing difficulty, eye disease, or obesity) by 0.4 percentage points; reduces the number of those physical health conditions by 0.010; reduces the probability of having any neurological, psychiatric, or developmental condition (seizure disorder, autism, speech problem, learning disability, behavioral disability, or ADHD) by 0.3 percentage points (albeit statistically insignificant); and reduces the number of neurological, psychiatric, or developmental conditions by 0.008 for children between ages 6 and 12. These effects count for no more than 3 percent of the mean, smaller than those for adult health status, indicating that the positive health effect of in utero exposure to a higher cigarette tax increases with age. However, I am careful in interpreting these results because the sample used for the analysis on health effects in childhood is different from that used in the main analysis on health effects in adulthood and the outcome measures are not exactly the same.[15]

3) Smoking Behavior in Later Life

Maternal smoking during pregnancy increases the risk that the older and adult child will become a smoker and dependent on nicotine (Biederman et. al., 2017; Kandel et. al., 1994; Lieb et. al., 2003). My findings are consistent with this literature and show that higher cigarette taxes while in

[14] Baughman and Dickert-Conlin (2009) do not use the marital status of mothers to generate the cells, possibly because they study the effects of the EITC on fertility, and EITC likely influences marital decisions. She does, however, conduct subgroup analysis by marital status.

[15] Only 629 individuals are in both samples.

utero indeed reduce smoking behavior in later life. Columns 1 and 2 in Table 13, using the CDS data, show that a 10-cent higher cigarette tax while in utero reduces the probability of smoking by 0.5 percentage points for adolescents aged 12 to 18 and reduces the frequency of smoking in the month before the interview by around four days for those adolescents who smoke. These account for 6% and 23% of the means, respectively.

The results also show that a higher cigarette tax during the in utero period reduces smoking behavior in adulthood (Table 13, columns 3 and 4, based on the main PSID data). A 10-cent higher in utero cigarette tax reduces the probability of ever smoking by 1.6 percentage points and reduces the number of cigarettes smoked per day by 0.66 for smokers at age 35, both coefficients corresponding to around 5% of their means.[16]

However, reducing smoking behavior is not the only channel through which in utero cigarette tax affects health in adulthood. Table 14 shows that higher in utero cigarette taxes reduce health problems in adulthood even for people who never smoke. This is the case whether I look at the probability of having any of the listed health conditions, the number of those health conditions, or the probabilities of having each of those health conditions. However, the magnitudes of these effects are smaller than the effect for the whole sample, which includes both smokers and nonsmokers.

4) Cognitive Ability and Educational Attainment

Cognitive ability and educational attainment are other channels through which cigarette taxes while in utero can affect health outcomes in adulthood. First, education shapes access to a wide array of material and non-material resources, including income, secure neighborhoods, and healthier lifestyles (Link and Phelan, 1995). These factors can either safeguard or enhance one's health. Secondly, education enhances individuals' knowledge, skills, reasoning abilities,

[16] When the information at age 35 is not available, we use data from the age closest to 35. Figure A1 shows the heterogeneous effects on smoking behavior in adulthood. Similar to the heterogeneous effects on the health condition indices, the effect on smoking behavior in adulthood is also relatively larger for individuals who are white, male, from families that were not in poverty at the time of their birth, and who had married parents at the time of their birth, compared to their counterparts.

effectiveness, and a diverse range of other aptitudes that can be harnessed to produce health (Mirowsky, 2017).

Table 15 provides suggestive evidence that a higher cigarette tax while in utero improves cognitive ability in childhood. Cognitive ability is measured by scores of Woodcock-Johnson tests taken by children between ages 6 and 18. The scores are comparable between different ages. The first three columns show that a 10-cent higher in utero cigarette tax statistically significantly reduces the probability of getting a low score[17] in reading by 0.7 percentage points and improves the probability of getting a medium score by 0.8 percentage points. The last three columns show that a 10-cent higher in utero cigarette tax statistically significantly reduces the probability of getting a low score in math by 0.7 percentage points and improves the probability of getting a high score by 0.7 percentage points.

Columns 1 and 2 of Table 16 report estimates for the highest grade completed and the probability of having a college degree or above. A 10-cent higher in utero cigarette tax increases the highest grade completed by 0.04 and increases the probability of having college or above degree by around 1.4 percentage points, although only the latter is statistically significant.

5) Age at First Childbirth

Table 17 shows that a 10-cent higher cigarette tax while in utero delays the age at first childbirth by 0.17 years. There is a positive correlation between postponement of the first childbirth and health (e.g., Einiö et al., 2019; Lee and Park, 2020; Shadyab et al., 2017). The finding that higher cigarette taxes while in utero delay the age at first childbirth could explain some of the adult health results reported above. However, there are no significant effects for the male subsample and female subsample.

In Figure 8, I have collected evidence for several mechanisms in which the outcome variables are binary, aiming to illustrate the mechanism underlying the long-term effect more clearly.

[17] For both math and reading, I classify scores below percentile 33.3 as low, scores between percentile 33.3 and percentile 66.7 as medium, and scores higher than 66.7 as high.

G. *Discussion of the Effect Size*

A 10-cent higher cigarette tax while in utero is about 20% of the mean. The main results indicate that, for adults aged 25-35, a 10-cent higher cigarette tax while in utero reduces the probability of ever having any of the following health conditions – asthma, lung disease, heart disease, or heart attack – by 1.8 percentage points. This corresponds to an effect size of 8% of the mean of the probability of ever having any of those conditions. The 10-cent higher tax reduces the probability of ever having asthma by 1.7 percentage points, which corresponds to 9% of the mean, and reduces the probability of ever having lung disease by 0.7 percentage points, which corresponds to 6% of the mean.

These findings are in line with previous literature. Table 18 presents a detailed comparison of the estimated effect sizes with scaled effect sizes in previous literature that are comparable to the results. Hoehn-Velasco et al. (2021) is the only study that investigated the long-term effect of cigarette taxes during the in utero period. That study shows that a 10-cent in utero cigarette tax significantly reduces the probability that a woman will be overweight or obese during pregnancy by 0.4 percentage points, which corresponds to an effect of 1% of the mean. Simon (2016) estimated the effect of in utero cigarette tax on health conditions in childhood, and found that a 10-cent higher in utero cigarette tax significantly reduces the probability of children ages 2 to 17 having asthma by 0.8 percentage points, which corresponds to 14% of the mean. The effect sizes are not exactly the same because the outcome variables are not the same or are measured at different ages, and there are differences in sample characteristics and average cigarette tax. However, it is safe to say that my findings are consistent with previous literature.

I want to emphasize that the estimates are based on relatively modest cigarette tax rates between 1968 and 1994, with an average tax of 0.50. Therefore, I cannot straightforwardly extend the estimates to predict the impact of cigarette taxes outside of this tax rate range.

I also compare the estimated long-term effects of cigarette taxes while in utero with the long-term effects of changes in other aspects of the in utero environment. Hoynes et al. (2016) find that access to the food stamps program in childhood (from no exposure to full exposure starting in utero and continuing until age five) reduces metabolic syndrome by 0.3 of a standard deviation, while my study finds that a 10-cent higher cigarette tax during the in utero period reduces the probability of having asthma, lung disease, heart disease or heart attack by 0.04 of a standard deviation. Hwang (2019) finds that a one-year exposure to the WIC program in early life reduces the probability of having asthma in adulthood by 3.7 percentage points, while my study finds that a 10-cent higher cigarette tax while in utero reduces the probability of having asthma by 1.8 percentage points. With a linear extrapolation, a 10-cent increase in cigarette tax while in utero is equivalent to about a half-year exposure to the food stamps program or WIC program.

H. Conclusion and Discussion

In this study, I investigate the effects of the level of the cigarette tax during the in utero period on long-term health outcomes in adulthood. I find that exposure to higher cigarette taxes while in utero leads to better health in adulthood and that the effects strengthen with age. My findings resonate with a robust body of literature that underscores the effects of early-life exposure on a spectrum of health parameters in the long run.

By delving into the multifaceted mechanisms at play, I have established a compelling case for the role of birth outcomes, health in childhood, smoking behavior in later life, cognitive ability, educational attainment, and age at first childbirth as pathways through which cigarette taxes while in utero affect health in adulthood.

The significance of my study lies in its comprehensive approach to unraveling the intricate web of effects stemming from early-life exposure to higher cigarette taxes. The identification of various mechanisms and their interconnectedness showcases the complexity of the relationship between exposure at birth and adult health, offering valuable insights for both researchers and policymakers.

My research is not without limitations. The main sample spans birth cohorts from 1968 to 1994, a period marked by relatively modest year-to-year fluctuations in state cigarette tax rates. As such, the estimates may not fully encapsulate the repercussions of more recent and substantial tax hikes. This presents an avenue for future exploration – to scrutinize the long-term ramifications of significant tax increases in the modern context and over a larger range of values, in order to enhance our understanding of the dynamic interplay between tax policies and health outcomes.

In conclusion, my study provides a comprehensive and illuminating assessment of the profound and enduring consequences of higher cigarette taxes during the in utero period for health outcomes in adulthood. By further uncovering the underlying mechanisms, my research contributes to the evolving discourse on early-life policy interventions and their far-reaching implications for public health and well-being.

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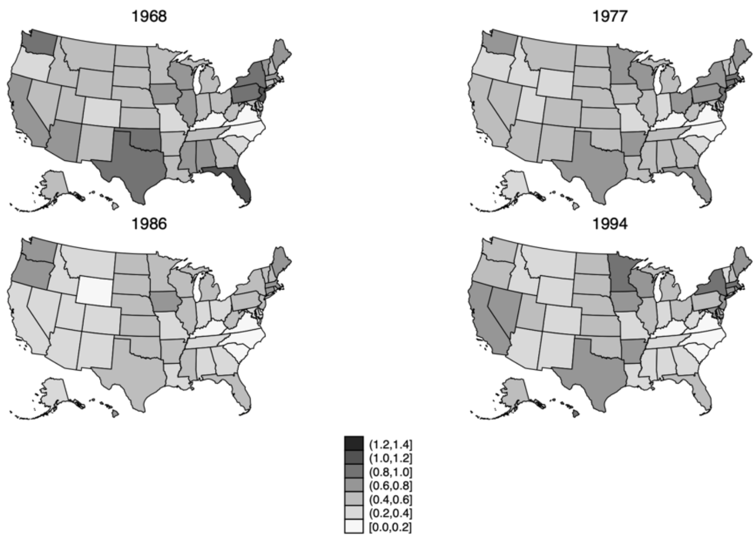
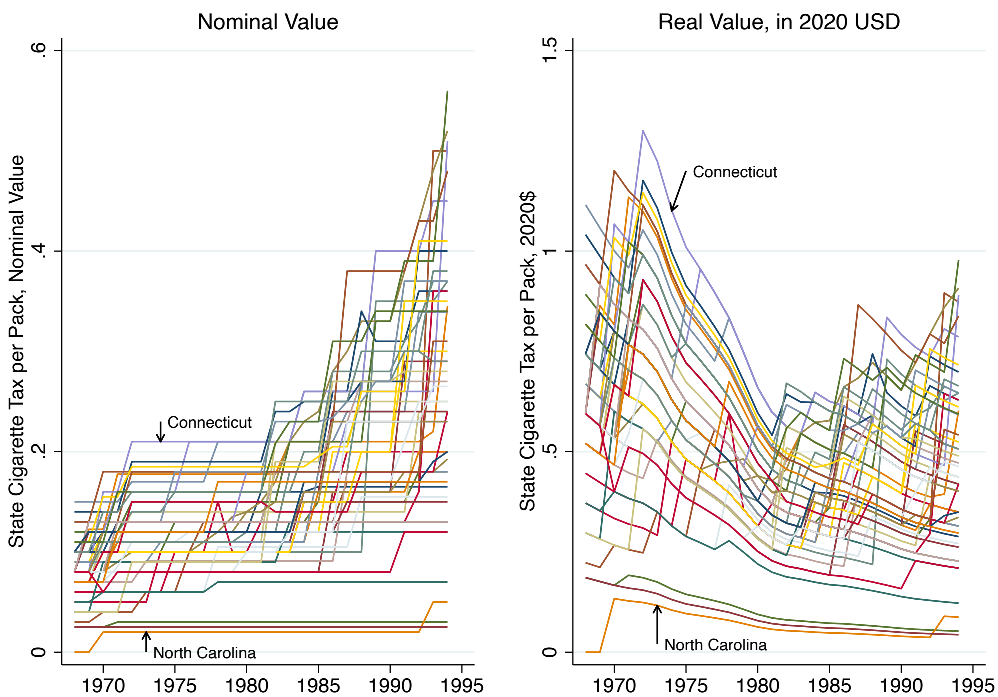
Figure 1: State Cigarette Taxes per Pack

(a) Real Value over Time



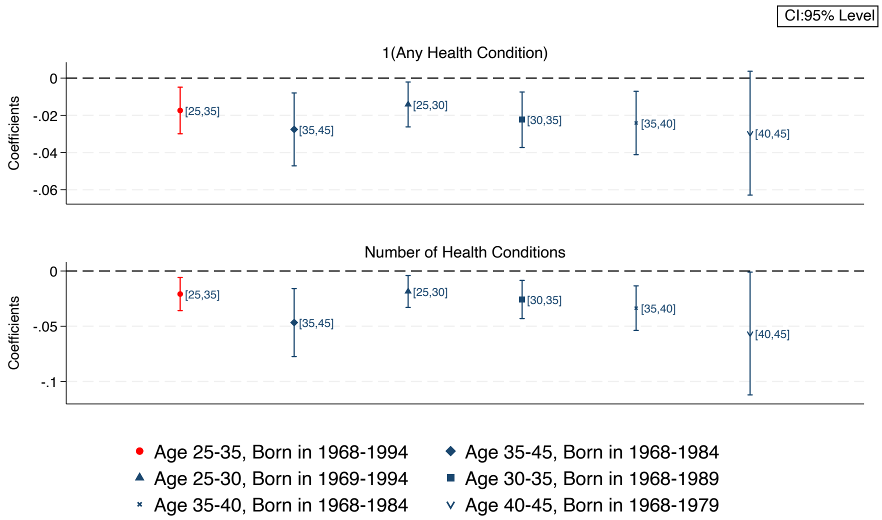
Source: Author's calculation. The data for cigarette taxes is obtained from *The Tax Burden on Tobacco*, and CPI data is sourced from the U.S. Bureau of Labor Statistics.
Note: Figure shows the state cigarette tax per pack for all 50 states and the District of Columbia.

(b) Cigarette Tax per Pack, 1968 to 1994, Nominal Value and Real Value in 2020 Dollar



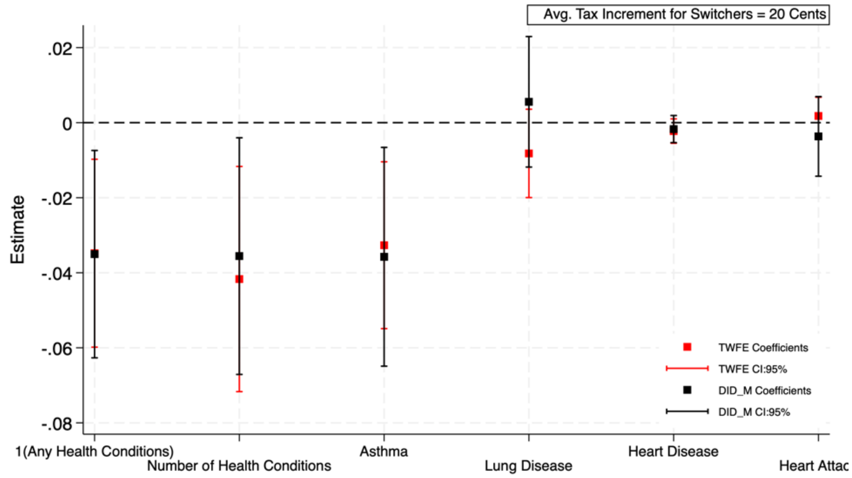
Source: Author's calculation. The data for cigarette taxes is obtained from *The Tax Burden on Tobacco*, and CPI data is sourced from the U.S. Bureau of Labor Statistics.
Note: Figure shows the state cigarette tax per pack for all 50 states and the District of Columbia.

Figure 2: Effects of Early-life Cigarette Tax on Health Status in Adulthood Across Age Groups



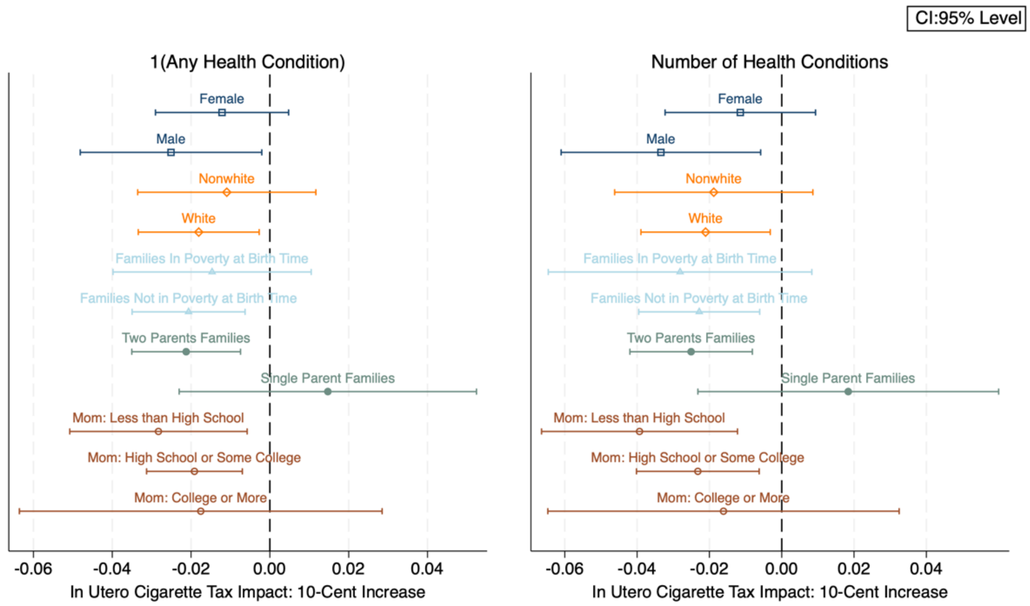
Note: Each coefficient is from a separate regression. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are health status of individuals during specific age range. In utero cigarette tax refers to the state cigarette tax in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Confidence interval at 95%.

Figure 3: Comparing Two-way Fixed Effects and Staggered Difference-in-Difference Estimation



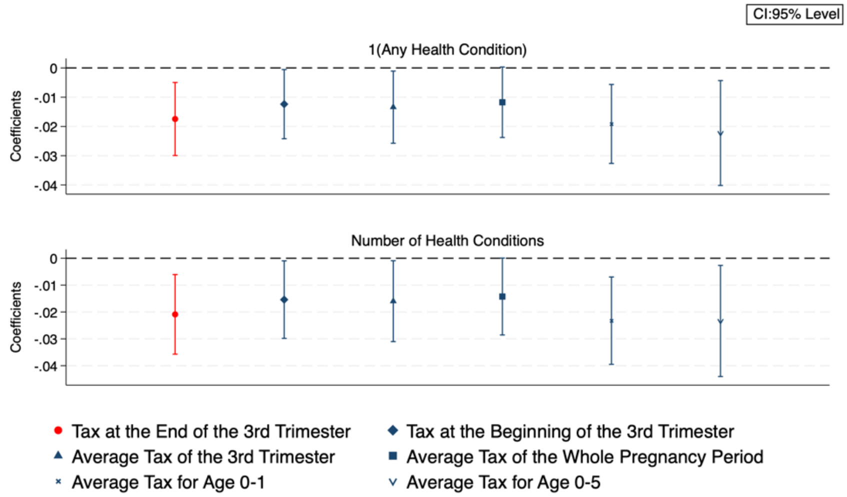
Note: Each coefficient represents a distinct estimation. Staggered DID estimation, as proposed by de Chaisemartin and d'Haultfoeuille (2020), is applied to ordered treatments. For ease of comparison, the unit of the cigarette tax is adjusted to 20 cents, and confidence intervals are calculated at the 95% level.

Figure 4: Subgroup Analysis



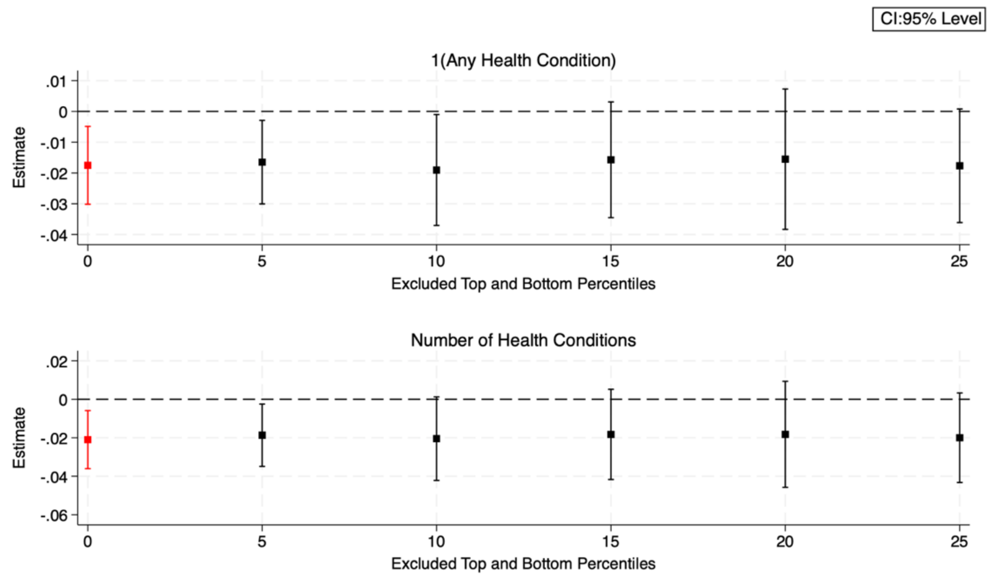
Note: Each coefficient is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Mother's educational level is categorized as less than high school (if highest grade < 12), high school/some college (if highest grade 12-15), and college or above (if highest grade ≥ 16). For the economic status subgroups, "in poverty" families are defined as families with income less than or equal to 1.5 times Census need standard. Outcome variables are health status at ages 25-35. In utero cigarette tax refers to the state cigarette tax in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors are clustered by state of birth. Confidence interval at 95%.

Figure 5: Robustness Check, Alternative Measurements for In Utero Cigarette Taxes



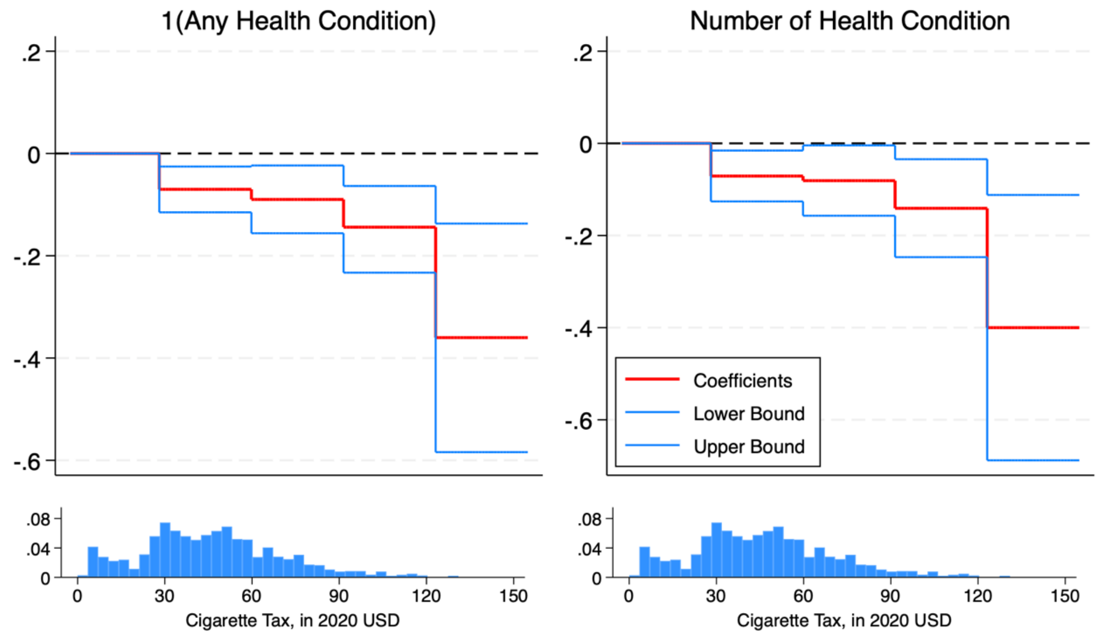
Note: Each coefficient is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at ages 25-35. Taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors are clustered by state of birth. Confidence interval at 95%.

Figure 6: Robustness Check, Trimming Percentiles by the Average State Cigarette Taxes



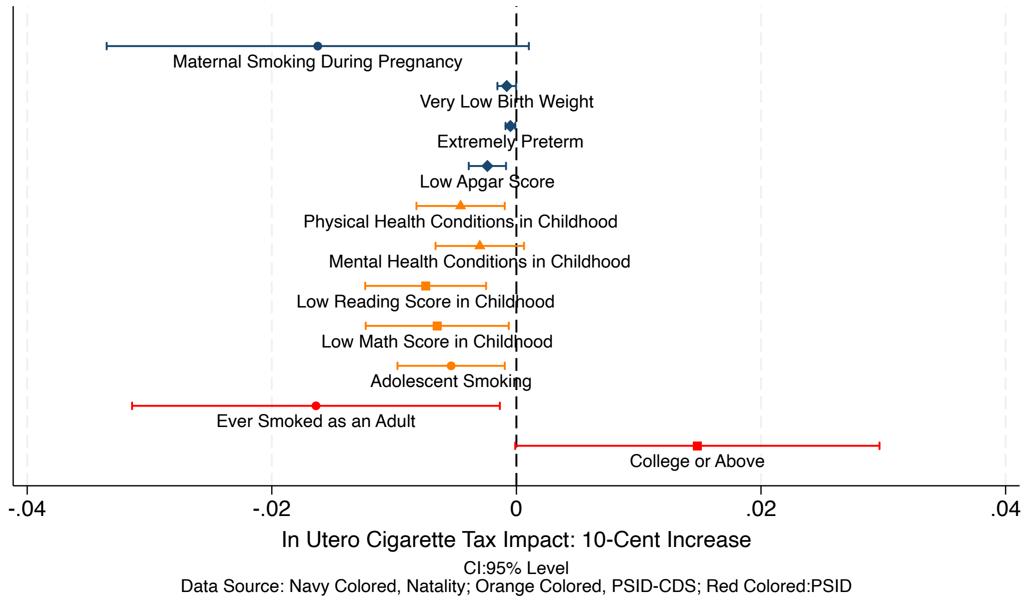
Note: Coefficients were estimated by sequentially trimming states with average cigarette taxes in the bottom and top percentiles during 1968-1994. Each coefficient is from a separate regression. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at ages 25-35. In utero cigarette tax refers to the state cigarette tax in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors are clustered by state of birth. Confidence interval at 95%.

Figure 7: Effects of Discrete Levels of Cigarette Taxes



Note: The top two figures represent results from distinct regression analyses. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at ages 25-35. The explanatory variables are five discrete levels of in utero cigarette taxes (ranging from 0-30, 30-60, 60-90, 90-120, and 120-150 cents), with the reference level being 0-30 cents. Cigarette taxes are cpi-adjusted and reported in 2020 dollars. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors are clustered by state of birth. Confidence interval at 95%.

Figure 8: Mechanism Analysis



Note: Each coefficient is from a separate regression. All the outcome variables are dummy variables. In utero cigarette tax refers to the state cigarette tax in the birth state at the year-month of birth. Taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. The navy colored results are estimated with data from Natality Files. The orange colored results are estimated with PSID-CDS data. The red colored results are estimated with PSID data. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Standard errors are clustered by state of birth. Confidence interval at 95%.

Table 1: Summary Statistics

	Mean	Std. Dev.	Min	Max
Health outcomes between ages 25-35				
Any health condition = 1[a]	0.24	0.43	0	1
# of Health condition[b]	0.28	0.53	0	3
Asthma = 1	0.19	0.39	0	1
Lung disease = 1	0.07	0.25	0	1
Heart disease = 1	0.02	0.14	0	1
Heart attack = 1	0.00	0.07	0	1
Demographics				
Birth year	1981.20	7.20	1968	1994
Male	0.48	0.5	0	1
White	0.81	0.39	0	1
Black	0.17	0.37	0	1
Other race	0.03	0.16	0	1
Age	32.43	2.97	25	35
Family background at birth year				
Mother's age > 35	0.18	0.39	0	1
Mother less than high school education	0.21	0.41	0	1
Mother high school or some college education	0.60	0.49	0	1
Mother college or above education	0.19	0.39	0	1
Female-headed household	0.14	0.35	0	1
Married parents	0.84	0.37	0	1
First kid	0.59	0.49	0	1
Second kid	0.24	0.43	0	1
Second+ kid	0.18	0.38	0	1
Income to needs ratio	3.56	2.66	0	25.05
Taxes and regulations				
In-utero Cigarette Taxes (2020$)	0.50	0.23	0	1.31
Cigarette tax at age 25 (2020$)	1.21	0.98	0.04	5.00
Minimum legal age for purchasing tobacco products	17.89	0.86	15	24
Substitutes				
State-level beer tax per 31 gallon (2020$)	53.28	28.71	20.28	231.37
State-level wine tax per gallon (2020$)	2.51	3.44	0.34	47.21
State-level spirit tax per gallon (2020$)	31.20	28.71	0	107.83
Economic, welfare and medical policie/conditions				
Minimum wage (2020$)	5.75	3.49	0	13.42
Maximum income marginal tax rate	5.63	4.10	0	21.8
Per capita GDP (1,000, 2020$)	38.83	7.65	21.00	148.47
EITC benefit (2020$)	1,402.32	912.53	0	6,621.93

CDCTC benefit (2020$)	2,530.95	1,575.97	0	7,483.37
AFDC/TANF benefit (2020$)	907.03	380.11	171.11	2158.94
Number of hospital beds (1,000)	48.56	37.47	1.30	206.4
Welfare vendor payment for medical (1,000,2020$)	2807.07	3467.70	0	24999.96
# Observations	5402			

Note: Author's tabulations of 1968-2019 PSID. Main sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys.State cigarette taxes are obtained from *The Tax Burden on Tobacco*. The minimum legal age for purchasing tobacco products is collected through Nexis Uni database. Alcohol taxes are from the Alcohol Policy Information System. The minimum wage is from the U.S. Department of Labor. The maximum income marginal tax rate is from the Council of State Governments. The per capita GDP is calculated with state GDP from the U.S. Bureau of Economic Analysis and state population from the U.S. Census Bureau and Fred Economic Data. The EITC benefit is from the National Bureau of Economic Research. The CDCTC benefit is collected through the Nexis Uni database and Hein Online database. The AFDC/TANF benefit is from legislative history references from U.S. Government Publishing Office. The number of hospital beds and welfare vendor payment for medical are from the U.S. Census Bureau.

[a] 1(Any health condition) = 1 if the individual has any of the following diseases: asthma, lung disease, heart disease, and heart attack.

[b] # of health condition = the number of diseases the individual has out of asthma, lung disease, heart disease, and heart attack.

Table 2: Correlation between State Cigarette Taxes and State-Level Demographic, State Economic Policies, and State Economic Conditions

	Cigarette Tax at time *t* (1)	Cigarette Tax at time *t*+1 (2)	Cigarette Tax at time *t*+2 (3)
State Covariates at time *t*			
Male	-0.009	-0.025	-0.032
	(0.067)	(0.061)	(0.062)
White	-0.025	0.001	0.002
	(0.086)	(0.080)	(0.079)
Married	0.049	0.037	0.015
	(0.034)	(0.035)	(0.035)
High School or Some College	0.005	-0.051	-0.052
	(0.080)	(0.080)	(0.086)
College or Higher Education	-0.014	-0.069	-0.087
	(0.086)	(0.101)	(0.105)
Age	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
State per capita GDP	0.000	0.001	0.002
	(0.002)	(0.002)	(0.002)
State Min. Wage	0.000	-0.000	0.000
	(0.003)	(0.003)	(0.003)
State Income MTR	-0.003	-0.004	-0.004
	(0.004)	(0.005)	(0.004)
State Max. AFDC/TANF Benefit	0.030	0.057	0.079
	(0.055)	(0.056)	(0.060)
State Max. EITC	-0.007	0.007	0.008
	(0.028)	(0.038)	(0.047)
State Max. CDCTC	0.016	0.019	0.025
	(0.019)	(0.018)	(0.017)
State Hospital Beds	0.001	0.000	-0.000
	(0.002)	(0.002)	(0.002)
State Welfare Vendor Payment for Medical	-0.004	-0.001	0.000
	(0.011)	(0.011)	(0.011)
State Beer Excise Tax	0.002*	0.002*	0.002*
	(0.001)	(0.001)	(0.001)
State Wine Excise Tax	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
State Spirit Excise Tax	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
Minimum legal age for purchasing tobacco products	0.007	0.008	0.006
	(0.008)	(0.009)	(0.010)
R-squared	0.814	0.812	0.806
Prob>F	0.332	0.143	0.191
State Fixed Effect	Y	Y	Y
Year Fixed Effect	Y	Y	Y
N		1281	

Note: Each column is a separate model. All the covariates are aggregated to the state-year level. We use data from 1968-1994. State FE and State FE are controlled in the model. Standard errors clustered on state are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 3: Endogeneity Check I, The Impact of Exposure to Cigarette Taxes on Fertility

	1(Have a Newborn in Year t/t+1) (1)	1(Have a Boy in Year t/t+1) (2)	1(Have a Girl in Year t/t+1) (3)
Cigarette Taxes, *t* (10 cents)	0.027	0.020	0.006
	(0.022)	(0.020)	(0.015)
Observations	68,259	68,259	68,259
R-squared	0.107	0.062	0.069
Y-mean	0.254	0.150	0.149
Std. Dev. Of Y	(0.435)	(0.357)	(0.356)
Birth Year FE	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes
Interview Year FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
State covariates at Time *t*	Yes	Yes	Yes

Note: Each column is from a separate regression. We use PSID data from 1968-1994. The sample consists of females at ages 20-39. Estimates are weighted using PSID family longitudinal weights. Cigarette tax is the cpi-adjusted cigarette tax in the resident state and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect, birth state fixed effect and interview year FE. Individual demographic controls include gender, race, marital status, educational level, number of kids, age of youngest kid, and age square. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at year *t*. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 4: Endogeneity Check II, Survival Bias

	1(Be a Household Head/Spouse between ages 25-35)
In-utero Cigarette Taxes (10 cents)	-0.003
	(0.006)
Observations	11,148
R-squared	0.089
Y-mean	0.586
Std. Dev. Of Y	(0.493)
Cigarette Tax at Age 25	Yes
Birth Year FE	Yes
Birth State FE	Yes
Individual Controls	Yes
Family Background at Birth	Yes
State Controls	Yes

Note: The sample consists of individuals born into PSID families between 1968-1994. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variable is if the individual becomes a household head or spouse between ages 25-35, in other word, if the individual is in our main sample. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender and race. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 5: Contemporary Effect,The Impact of Exposure to Cigarette Taxes on Smoking Behavior

	1(Smoke Now)		
	Individuals Aged 20-39	Individuals Aged 20-39 and with Newborns in year *t/t+1*	Individuals Aged 20-39 Whose Children in Main Sample
	(1)	(2)	(3)
Cigarette Taxes, *t* (10 cents)	-0.020*	-0.029**	-0.095***
	(0.011)	(0.012)	(0.023)
Observations	37,036	6,155	4,140
R-squared	0.136	0.184	0.174
Y-mean	0.246	0.199	0.270
Std. Dev. Of Y	(0.431)	(0.399)	(0.444)
Year FE	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes
State covariates at Time *t*	Yes	Yes	Yes
Smoke Bans at Time *t*	Yes	Yes	Yes
Educational Level	Yes	Yes	Yes

Note: Each column is from a separate regression. The sample of first column consists of household heads and spouses aged 20-39 in PSID survey in 1986 and post-1999 (smoking behavior is only surveyed in these years). The sample of the second and third column is subsample to the sample of first column. The sample of the second column contains household heads and spouses who had newborn at year *t/t+1* and aged 20-39 in PSID survey in 1986 and post-1999. The sample of the third column contains household heads and spouses aged 20-39 whose children contained in our main sample in PSID survey in 1986 and post-1999. Estimates are weighted using the PSID longitudinal weight. Outcome variables are smoke behaviors of individuals. Cigarette tax refers to the state cigarette tax in the individual's resident state. It is cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include interview year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, educational level, and age square. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include smoke bans, the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at year *t*. Standard errors clustered on state of residence are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 6: The Long-Term Effects of In-utero Cigarette Tax Exposure on Adult Health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outcome:1(Any Health Condition)								
In-utero Cigarette Taxes (10 cents)	-0.013*	-0.014*	-0.014*	-0.014**	-0.013**	-0.014**	-0.015**	-0.018***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Cig. Taxes at Age 25 (10 cents)	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**	-0.002*	-0.002*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	5,402	5,402	5,402	5,402	5,402	5,402	5,402	5,402
R-squared	0.035	0.041	0.046	0.047	0.047	0.047	0.047	0.049
Y-Mean	0.240							
Std. Dev. Of Y	(0.427)							
Outcome: # of Health Conditions								
In-utero Cigarette Taxes (10 cents)	-0.018**	-0.018**	-0.018**	-0.018**	-0.017**	-0.018**	-0.018**	-0.021***
	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.008)
Cig. Taxes at Age 25 (10 cents)	-0.002*	-0.002*	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	5,402	5,402	5,402	5,402	5,402	5,402	5,402	5,402
R-squared	0.035	0.043	0.048	0.049	0.05	0.05	0.05	0.051
Y-Mean	0.279							
Std. Dev. Of Y	(0.530)							
Birth Year FE, Birth State FE	X	X	X	X	X	X	X	X
Gender, Race, Age Square		X	X	X	X	X	X	X
Family Background at Birth Year			X	X	X	X	X	X
Tax Rate for Beer, Wine & Spirit				X	X	X	X	X
Minimum Legal Purchasing Age for Tobacco					X	X	X	X
AFDC, EITC, CDCTC Benefit						X	X	X
Per Capita Hospital Beds and State Welfare Vendor Payment for Medical							X	X
Minimum Wage, Max income MTR, and Per Capita GDP								X

Note: Each column of each panel is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at ages 25-35. 1(Any health condition) = 1 if the individual has any disease out of asthma, lung disease, heart disease and heart attack. # of health condition = the number of disease the individual has out of asthma, lung disease, heart disease and heart attack. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 7: Decompose Long-Term Health Effects: Investigating Effects on Specific Health Conditions

	1(Any Health condition) (1)	# of Health condition (2)	Asthma (3)	Lung Disease (4)	Heart Attack (5)	Heart Disease (6)
Panel A, Baseline, Effects on Health Status for Individuals Aged 25-35						
In-utero Cigarette Taxes (10 cents)	-0.018***	-0.021***	-0.017***	-0.004	-0.001	0.001
	(0.006)	(0.008)	(0.006)	(0.003)	(0.001)	(0.001)
Cigarette Tax at Age 25 (10 cents)	-0.002*	-0.002	-0.001	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Observations	5,402	5,402	5,402	5,402	5,402	5,402
R-squared	0.049	0.051	0.047	0.045	0.036	0.035
Y-Mean	0.240	0.279	0.185	0.070	0.005	0.019
Std. Dev. Of Y	(0.427)	(0.530)	(0.388)	(0.254)	(0.071)	(0.137)
Panel B, Effects on Health Status for Individuals Aged 35-45						
In-utero Cigarette Taxes (10 cents)	-0.028***	-0.047***	-0.022**	-0.014**	-0.005	-0.007
	(0.010)	(0.015)	(0.009)	(0.006)	(0.003)	(0.005)
Cigarette Tax at Age 35 (10 cents)	0.000	0.001	0.000	0.001	0.000	0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)
Observations	2,983	2,983	2,983	2,983	2,983	2,983
R-squared	0.06	0.064	0.052	0.061	0.043	0.05
Y-Mean	0.223	0.283	0.170	0.064	0.017	0.032
Std. Dev. Of Y	(0.416)	(0.587)	(0.376)	(0.245)	(0.129)	(0.176)
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes

Note: Each column in each panel is from a separate regression. For the baseline model in panel A, the sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. The sample for Panel B consists of individuals born into PSID families between 1968-1984 who became household heads or spouses at ages 35-45 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at the corresponding ages. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 8: Effects Estimated with Staggered DID Estimator

	1(Any Health condition)	# of Health condition	Asthma	Lung Disease	Heart Attack	Heart Disease
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A, Effects on Health Status for Individuals Aged 25-35						
Discrete In-utero Cigarette Taxes Level	-0.039***	-0.049**	-0.032***	-0.013	-0.004	0.000
	(0.015)	(0.021)	(0.012)	(0.014)	(0.002)	(0.006)
Observations	3669	3669	3670	3670	3670	3669
Num of Switchers	1040	1040	1040	1040	1040	1040
Panel B, Effects on Health Status for Individuals Aged 35-45						
Discrete In-utero Cigarette Taxes Level	-0.064***	-0.072***	-0.055***	-0.009	-0.005	-0.003
	(0.020)	(0.023)	(0.016)	(0.015)	(0.008)	(0.009)
Observations	1936	1936	1936	1936	1936	1936
Num of Switchers	627	627	627	627	627	627

Note: Results from the staggered DID estimator proposed by de Chaisemartin and d'Haultfoeuille (2020). Each column in each panel is from a separate regression. The sample for panel A consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. The sample for Panel B consists of individuals born into PSID families between 1968-1984 who became household heads or spouses at ages 35-45 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at the corresponding ages. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. I divided in utero cigarette tax into seven distinct tiers by rounding it by 20 cents. The first tier ranges from 0 to 10 cents, while the subsequent tiers go from 11 to 30 cents, then from 31 to 50, and so on, with the highest tier cigarette tax spanning from 110 to 130 cents.

Table 9: Subgroup Analysis

	Gender		Race		Family's Economic Status at Birth Time		Parent's Marital Status at Birth Time		Mother's Educational Level at Birth Time		
	Female	Male	Nonwhite	White	In Poverty	Not in Poverty	Married	Single Parent	Less than High School	High School or Some College	College or above
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Outcome: 1(Any Health Condition)											
In-utero Cigarette Taxes (10 ¢)	-0.012	-0.025**	-0.008	-0.019**	-0.009	-0.022***	-0.022***	0.009	-0.023**	-0.020***	-0.019
	(0.008)	(0.012)	(0.011)	(0.008)	(0.012)	(0.007)	(0.007)	(0.018)	(0.011)	(0.006)	(0.024)
Observations	2,894	2,508	2,379	3,023	1,611	3,791	4,349	1,053	1,542	3,106	754
R-squared	0.075	0.057	0.145	0.055	0.159	0.053	0.051	0.179	0.136	0.07	0.148
Y-Mean	0.27	0.208	0.254	0.237	0.304	0.225	0.232	0.29	0.262	0.236	0.229
Std. Dev. Of Y	(0.444)	(0.406)	(0.435)	(0.425)	(0.460)	(0.417)	(0.422)	(0.454)	(0.440)	(0.424)	(0.421)
Outcome: # of Health Condition											
In-utero Cigarette Taxes (10 ¢)	-0.011	-0.034**	-0.016	-0.022**	-0.02	-0.024***	-0.025***	0.013	-0.034**	-0.024***	-0.018
	(0.010)	(0.014)	(0.013)	(0.009)	(0.017)	(0.009)	(0.008)	(0.021)	(0.014)	(0.009)	(0.025)
Observations	2,894	2,508	2,379	3,023	1,611	3,791	4,349	1,053	1,542	3,106	754
R-squared	0.076	0.064	0.151	0.056	0.156	0.052	0.051	0.199	0.126	0.075	0.137
Y-Mean	0.316	0.239	0.316	0.27	0.369	0.257	0.265	0.364	0.326	0.27	0.251
Std. Dev. Of Y	(0.558)	(0.496)	(0.589)	(0.515)	(0.604)	(0.508)	(0.513)	(0.617)	(0.595)	(0.518)	(0.483)
Cigarette Tax at Age 25	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Each coefficient is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Mother's educational level is categorized as less than high school (if highest grade < 12), high school/some college (if highest grade 12-15), and college or above (if highest grade ≥ 16). For the economic status subgroups, "in poverty" families are defined as families with income less than or equal to 1.5 times Census need standard. Outcome variables are health status at ages 25-35. In utero cigarette tax refers to the state cigarette tax in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors are clustered by state of birth. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 10: Robustness Check

	1(Any Health condition)				# of Health condition			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
In-utero Cigarette Taxes (10 ¢)	-0.018***	-0.018***	-0.016**		-0.021***	-0.021***	-0.020**	
	(0.006)	(0.006)	(0.007)		(0.008)	(0.007)	(0.007)	
Avg. Cig. Tax at ages 1-13			-0.04				-0.034	
			(0.092)				(0.099)	
Avg. Cig. Tax at ages 14-17		-0.043	-0.035			-0.036	-0.03	
		(0.034)	(0.037)			(0.039)	(0.043)	
Cig. Tax at Age 25	-0.002*	-0.002*	-0.002**		-0.002	-0.002	-0.002	
	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)	
In-utero Cigarette Taxes (10 ¢)*Born in 1968-1980				-0.017***				-0.021***
				(0.006)				(0.008)
Difference in Cig. Tax Effect bewteen Born in 1968-1980 and Born in 1981-1994				-0.002				0.001
				(0.007)				(0.010)
N	5,402	5,402	5,402	5,402	5,402	5,402	5,402	5,402
R-squared	0.049	0.049	0.049	0.049	0.051	0.052	0.052	0.051
Y-mean	0.240				0.279			
Std. Dev. Of Y	(0.427)				(0.530)			
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Each column is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are health status at ages 25-35. Cigarette taxes are the state cigarette tax in the birth state. Taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 11: The Impact of In Utero Cigarette Tax Exposure on Birth Outcomes and Maternal Smoking Behavior, Estimated with Natality Data

	Average Birth Weight	Very Low Birth Weight Rate (<1500g)	Average Gestational Age	Preterm Delivery Rate (Weeks< 28)	Average Apgar Score	Low Apgar Score Rate (< 6)	Smoke Rate of Mothers
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cigarette Taxes, *t* (10 ¢)	9.038	-0.001**	0.028	-0.000*	0.064*	-0.002***	-0.016*
	(8.861)	0.000	(0.032)	0.000	(0.033)	(0.001)	(0.008)
Observations	106,025	106,025	106,025	106,025	83,918	83,918	34,328
R-squared	0.937	0.551	0.893	0.469	0.895	0.5	0.975
Y-mean	3,365	0.010	39.33	0.005	9.028	0.015	0.170
Std. Dev. Of Y	128.9	0.008	0.431	0.006	0.163	0.009	0.132
Group FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Each column is from a separate regression estimated with Natality birth data from years 1969 to 1994. We do not include data from 1968 because the educational attainment of mother and marital status of mother are not recorded in 1968. The outcome variables are average birth weight, very low birth weight rate, average gestational age, preterm delivery rate, smoke rate of mothers, average Apgar score, and low Apgar score rate for cells defined by state, year, marital status, age, race, educational attainment of the mother, and the birth order of the newborn. Estimates are weighted by the number of birth in the cells. Cigarette taxes are the state cigarette tax in the child's birth state in the birth year. Taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include group fixed effect and birth state fixed effect. Group is defined by state, marital status, age, race, educational attainment of the mother, and the birth order of the newborn. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, number of the hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 12: The Impact of In Utero Cigarette Tax Exposure on Childhood Health

	1(Any Physical Health condition)	# of Physical Health condition	1(Any Mental Health condition)	# of Mental Health condition
	(1)	(2)	(3)	(4)
In-utero Cigarette Taxes (10 ¢)	-0.004**	-0.010*	-0.003	-0.008***
	(0.002)	(0.006)	(0.002)	(0.002)
Observations	4,260	4,260	5,204	5,204
R-squared	0.06	0.077	0.082	0.084
Y-mean	0.568	0.973	0.215	0.308
(Std. Dev. Of Y)	(0.495)	(1.105)	(0.411)	(0.701)
Cigarette Tax in Childhood	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes
Smoke Bans at Birth Year	Yes	Yes	Yes	Yes

Note: Each column is from a separate regression. The sample consists of children surveyed in Child Development Supplement in 1997, 2001, 2007, 2014 and 2019. These children born between 1989 and 2013. Estimates are weighted using the PSID longitudinal weights. Outcome variables are children's health status at agess 6-12. 1(Any physical health condition) = 1 if children have any physical problem out of anemia, allergies, asthma, diabetes, ear disease, hear difficulty, eye disease, obesity, or development delay. # of physical health condition is the number if physical problem the children have out of anemia, allergies, asthma, diabetes, ear disease, hear difficulty, eye disease, obesity, or development delay. 1(Any mental problem) = 1 if children have any mental problem out of convulsion, autism, speech problem, retardation, emotion disturbance, or hyperactivity. # of mental problem is the number of problem the children have out of convulsion, autism, speech problem, retardation, emotion disturbance, or hyperactivity. Cigarette tax at age 6 is controlled for health effect. Cigarette taxes are the state cigarette tax in the child's birth state. Taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Family background at birth includes mother's educational level, a dummy variable indicating if the age of mother is greater than 35, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include smoke bans, the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, number of the hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 13: The Impact of In Utero Cigarette Tax Exposure on Smoking Behavior in Later Life

	In Adolescent (Data from CDS)		In Adulthood (Data from main PSID)	
	Smoke	Smoke Days in Last Month	Ever Smoked	# Cigarettes/Day (Smokers only)
	(1)	(2)	(3)	(4)
In-utero Cigarette Taxes (10 ¢)	-0.005**	-3.981***	-0.016**	-0.660***
	(0.002)	(1.301)	(0.007)	(0.246)
Cigarette Tax at Age 12	-0.002	-0.134	-	-
	(0.001)	(0.407)		
Cigarette Tax at Age 25	-	-	-0.001	0.004
			(0.001)	(0.039)
Observations	2,994	191	4,564	1,156
R-squared	0.199	0.571	0.085	0.242
Y-Mean	0.079	17.850	0.388	12.010
Std. Dev. Of Y	(0.269)	(11.44)	(0.487)	(7.855)
Cigarette Tax in Childhood or Adulthood	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes

Note: Each column is from a separate regression. For the first two columns, outcome variables are children's smoke behavior at ages 12-18. The sample consists of children surveyed in Child Development Supplement in 1997, 2001, 2007, 2014 and 2019. Estimates are weighted using the PSID longitudinal weights. Cigarette tax in the birth state at age 12 is controlled. For the last two columns, outcome variables are individuals' smoke behavior at ages 25-35. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Family background at birth includes the educational level and age of the mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include smoke bans, the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, number of the hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 14: The Long-term Effects of In Utero Cigarette Tax Exposure on Adult Health for People who Never Smoke

	1(Any Health condition)	# of Health condition	Asthma	Lung Disease	Heart Attack	Heart Disease
	(1)	(2)	(3)	(4)	(5)	(6)
In-utero Cigarette Taxes (10 ¢)	-0.010*	-0.013**	-0.013**	0.000	-0.002	0.002
	(0.006)	(0.006)	(0.005)	(0.003)	(0.001)	(0.002)
Cigarette Tax at Age 25 (10 ¢)	0.000	0.001	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Observations	2,980	2,980	2,980	2,980	2,980	2,980
R-squared	0.064	0.062	0.069	0.065	0.044	0.052
Y-Mean	0.200	0.218	0.161	0.039	0.002	0.016
Std. Dev. Of Y	(0.400)	(0.457)	(0.368)	(0.194)	(0.049)	(0.124)
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes

Note: Each column is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys and never smoked. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at ages 25-35. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 15: The Impact of In Utero Cigarette Tax Exposure on Academic Performance in Childhood

	Reading Score			Math Score		
	Low Score	Medium Score	High Score	Low Score	Medium Score	High Score
	(1)	(2)	(3)	(4)	(5)	(6)
In-utero Cigarette Taxes (10 ¢)	-0.007***	0.008**	-0.001	-0.007**	0.000	0.007**
	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	5,100	5,100	5,100	5,080	5,080	5,080
R-squared	0.224	0.059	0.197	0.205	0.051	0.213
Y-mean	0.245	0.356	0.399	0.230	0.330	0.440
Std. Dev. Of Y	(0.430)	(0.479)	(0.490)	(0.420)	(0.470)	(0.496)
Cigarette Tax in Childhood	Yes	Yes	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes

Note: Each column is from a separate regression. The sample consists of children surveyed in Child Development Supplement in 1997, 2001, 2007, 2014 and 2019. Estimates are weighted using the PSID longitudinal weights. Outcome variables are children's Woodcock-Johnson test standard scores. The test is provided to children older than 6 and the scores are comparable for different age. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 6. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Family background at birth includes mother's educational level, a dummy variable indicating if the age of mother is greater than 35, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include smoke bans, the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, number of the hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 16: The Impact of In Utero Cigarette Tax Exposure on Educational Level

	Highest Grade	1(College or Above)
	(1)	(2)
In-utero Cigarette Taxes (10 ¢)	0.040	0.014*
	(0.037)	(0.007)
Observations	5,320	5,320
R-squared	0.333	0.294
Y-mean	14.01	0.366
Std. Dev. Of Y	(2.122)	(0.482)
Cigarette Tax at Age 25	Yes	Yes
Birth Year FE	Yes	Yes
Birth State FE	Yes	Yes
Individual Controls	Yes	Yes
Family Background at Birth Year	Yes	Yes
State covariates at Birth Year	Yes	Yes

Note: Each column is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' educational level at ages 25-30. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age is the age of the individual at the last year he/she showed up in PSID survey during his/her age 25-30. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table 17: The Impact of In Utero Cigarette Tax Exposure on Age of Having the First Kid

	Age of Having the First Kid		
	Whole Sample	Male Sample	Female Sample
	(1)	(2)	(3)
In-utero Cigarette Taxes (10 ¢)	0.173*	0.15	0.188
	(0.092)	(0.151)	(0.115)
Observations	3,658	1,584	2,074
R-squared	0.321	0.317	0.34
Y-mean	25.33	26.41	24.45
Std. Dev. Of Y	(5.448)	(5.417)	(5.314)
Cigarette Tax at Age 25	Yes	Yes	Yes
Birth Year FE	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes

Note: Each column is from a separate regression. The sample of the first column consists of individuals born into PSID families between 1968-1994. The sample of the second column and the third column are subgroups of male and female respectively. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables is the age of having first kid. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age is the age of the individual at the last year he/she showed up in PSID survey during his/her age 25-30. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

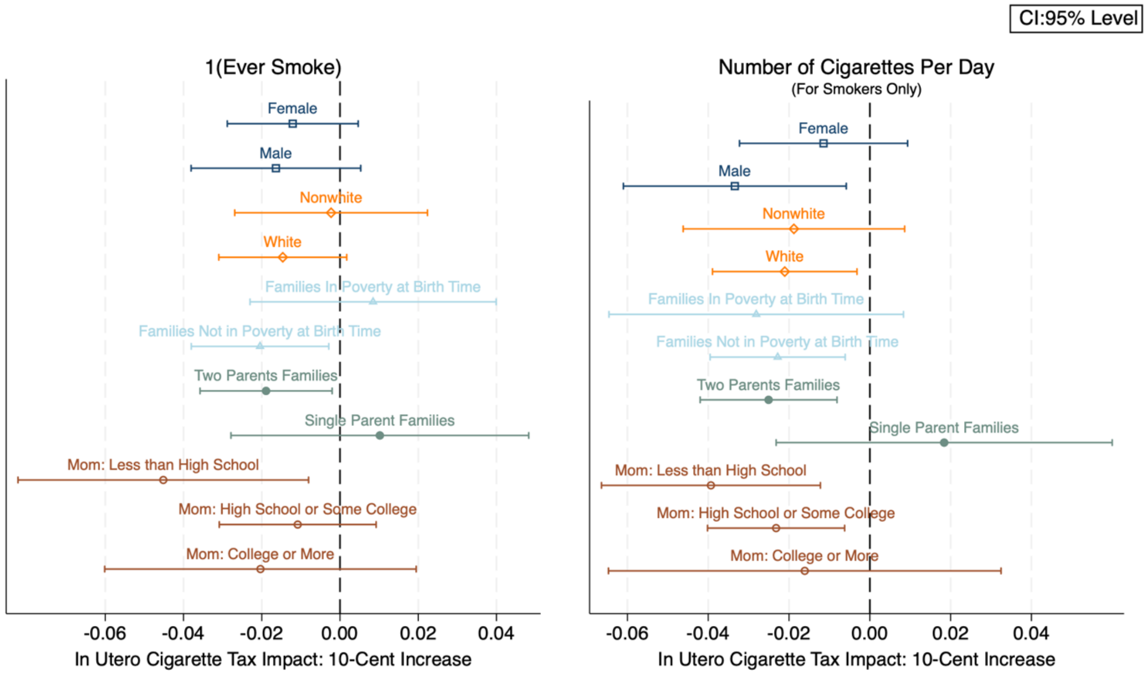
Table 18: Comparison of Effect Size on Health Outcomes

	Adult Health				Mechanism: Childhood Health			
	Our Analysis			Hoehn-Velasco et al. (2021)	Our Analysis	Simon (2016)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Data Source	PSID			Natality Files	PSID-CDS	NHIS		
Birth Cohorts	1968-1994			1965-2000	1989-2013	1988-2009		
Average Cig. Tax	0.50			0.84	0.99	1.24		
Outcome (Y)	Probability of ever have any of the following health conditions: asthma, lung disease, heart disease, heart attack.	Probability of ever have asthma	Probability of ever have lung disease	Probability of being overweight or obese during pregnancy	Probability of ever have any physical health conditions	Probability of having asthma	Probability of two or more doctor visits per year	Sick days from school
Surveyed Age	25-35	25-35	25-35	During pregnancy	6-12	2-17	2-17	5-17
Coefficient corresponding to a 10 cents tax increase	-1.8 pp	-1.7 pp	-0.4 pp	-0.4 pp	-0.4 pp	-0.8 pp	-0.2 pp	-0.03
Mean of Y	24%	18.5%	7%	48.2%	56.8%	5.8%	61.9%	3.4%
Effect compared to the mean	8%	9%	6%	1%	1%	14%	0.4%	1%

Note: This table compares sample characteristics and effect sizes in Hoehn-Velasco et al. (2021) and Simon (2016). All effect sizes estimated by Hoehn-Velasco et al. (2021) and Simon (2016) are scaled to be comparable to our estimated effects, i.e., they reflect the impact of 10-cent tax increases in terms of real 2020 USD.

APPENDIX

Figure A1: Subgroup Analysis for The Impact of In Utero Cigarette Tax Exposure on Smoke Behaviors in Adulthood



Note: The sample size is too small (<100) for the subgroup of individuals whose mother have college degree or higher level education.
Note: Each coefficient is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Mother's educational level is categorized as less than high school (if highest grade < 12), high school/some college (if highest grade 12-15), and college or above (if highest grade ≥ 16). For the economic status subgroups, "in poverty" families are defined as families with income less than or equal to 1.5 times Census need standard. Outcome variables are smoking behaviors at ages 25-35. In utero cigarette tax refers to the state cigarette tax in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors are clustered by state of birth. Confidence interval at 95%.

Table A1: Estimation of Effect of State Cigarette Taxes on State-Level Demographic, Economic Policies, and Economic Conditions

	Cigarette Tax at time *t*	
State Covariates at time *t*+1		
Male	0.003	(0.025)
White	-0.018	(0.030)
Married	0.007	(0.050)
Less than HS	0.007	(0.030)
High School or Some College	-0.001	(0.034)
College or Higher Education	-0.006	(0.015)
Age	0.176	(1.843)
State Max. CDCTC	0.187	(0.308)
State Max. EITC	-0.039	(0.039)
State Max. AFDC/TANF Benefit	0.009	(0.076)
State Hospital Beds	1.204	(4.713)
State Welfare Vendor Payment for Medical	-0.308	(0.813)
State Min. Wage	0.264	(0.828)
State Income MTR	-0.46	(1.244)
State per capita GDP	0.292	(3.288)
State Fixed Effect	Yes	
Year Fixed Effect	Yes	
N	1230	

Note: Each row is a separate model with the full set of covariates using samples aggregated to the state-year level. We use data from 1968-1994. Outcome variables are state-level demographics, economic policies, or economic conditions in year *t+1*. Cigarette taxes and controls are from the year *t*. State FE and State FE are controlled in the model. Standard errors clustered on state are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A2: Effects of Early-life Cigarette Tax on Health Status in Adulthood Across Age Groups

	1(Any Health condition) (1)	# of Health condition (2)
Panel A, Outcome Variable = Health Status at ages 25-30		
In-utero Cigarette Taxes (10 ¢)	-0.014**	-0.019**
	(0.006)	(0.007)
Cig. Taxes at Age 25 (10 ¢)		
	-0.002	-0.001
	(0.001)	(0.001)
N	5,025	5,025
R-squared	0.049	0.05
Y-mean	0.216	0.243
Std. Dev. Of Y	(0.411)	(0.490)
Panel B, Outcome Variable = Health Status at ages 30-35		
In-utero Cigarette Taxes (10 ¢)	-0.023***	-0.026***
	(0.007)	(0.008)
Cig. Tax at Age 30 (10 ¢)	-0.001	-0.001
	(0.001)	(0.001)
N	4,227	4,227
R-squared	0.05	0.055
Y-mean	0.194	0.224
Std. Dev. Of Y	(0.395)	(0.486)
Panel C, Outcome Variable = Health Status at ages 35-40		
In-utero Cigarette Taxes (10 ¢)	-0.025***	-0.034***
	(0.008)	(0.010)
Cig. Tax at Age 35 (10 ¢)	0	0
	(0.001)	(0.001)
N	2,958	2,958
R-squared	0.057	0.056
Y-mean	0.202	0.244
Std. Dev. Of Y	(0.402)	(0.529)
Panel D, Outcome Variable = Health Status at ages 40-45		
In-utero Cigarette Taxes (10 ¢)	-0.031*	-0.058**
	(0.017)	(0.029)
Cig. Tax at Age 40 (10 ¢)	-0.021	-0.027*
	(0.015)	(0.015)
N	1,707	1,707
R-squared	0.094	0.09
Y-mean	0.209	0.27
Std. Dev. Of Y	(0.406)	(0.588)
Panel E, Outcome Variable = Health Status at ages 18-35		
In-utero Cigarette Taxes (10 ¢)	-0.019***	-0.024***
	(0.006)	(0.007)
Cig. Tax at Age 18 (10 ¢)	-0.003**	-0.004**
	(0.001)	(0.001)
N	5,553	5,553
R-squared	0.054	0.058
Y-mean	0.264	0.312
Std. Dev. Of Y	(0.441)	(0.564)
Panel F, Outcome Variable = Health Status at ages 22-35		
In-utero Cigarette Taxes (10 ¢)	-0.020***	-0.024***
	(0.006)	(0.007)
Cig. Tax at Age 22 (10 ¢)	-0.002**	-0.003**
	(0.001)	(0.001)
N	5,515	5,515

R-squared	0.051	0.056
Y-mean	0.259	0.304
Std. Dev. Of Y	(0.438)	(0.555)
Birth Year FE	Yes	Yes
Birth State FE	Yes	Yes
Individual Controls	Yes	Yes
Family Background at Birth Year	Yes	Yes
State covariates at Birth Year	Yes	Yes

Note: Each column of each panel is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses during specific age range during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are health status of individuals during specific age range. Cigarette tax at birth month is the state cigarette tax in birth state at birth month. Cigarette tax at age 25 is the state cigarette tax in the residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level of mother, if age of mother is greater than 35, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A3: Robustness Check on Sample Weight

	1(Any Health condition)	# of Health condition
	(1)	(2)
Panel A, Weighted by Weight at Birth Year		
In-utero Cigarette Taxes (10 ¢)	-0.017***	-0.021***
	(0.006)	(0.008)
Cigarette Tax at Age 25 (10 ¢)	-0.002*	-0.002
	(0.001)	(0.001)
Observations	5,402	5,402
R-squared	0.049	0.051
Y-Mean	0.240	0.279
Std. Dev. Of Y	(0.427)	(0.530)
Panel B, Weighted by Weight at Age 18		
In-utero Cigarette Taxes (10 ¢)	-0.016**	-0.021***
	(0.006)	(0.008)
Cigarette Tax at Age 25 (10 ¢)	-0.002*	-0.002
	(0.001)	(0.001)
Observations	5,402	5,402
R-squared	0.048	0.051
Y-Mean	0.240	0.279
Std. Dev. Of Y	(0.427)	(0.530)
Birth Year FE	Yes	Yes
Birth State FE	Yes	Yes
Individual Controls	Yes	Yes
Family Background at Birth Year	Yes	Yes
State covariates at Birth Year	Yes	Yes

Note: Each column of each panel is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Outcome variables are health status at ages 25-35. Cigarette taxes are the state cigarette tax in the birth state. Taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A4: Robustness Check: Control State-specific Time Trend

	1(Any Health condition) (1)	# of Health condition (2)	Asthma (3)	Lung Disease (4)	Heart Attack (5)	Heart Disease (6)
In-utero Cigarette Taxes (10 ¢)	-0.020***	-0.022**	-0.022***	0.003	-0.001	-0.002
	(0.007)	(0.009)	(0.008)	(0.004)	(0.001)	(0.002)
Cigarette Tax at Age 25 (10 cents)	-0.001	-0.001	-0.001	0	0	-0.000*
	(0.001)	(0.001)	(0.001)	(0.001)	0.000	0.000
Observations	5,402	5,402	5,402	5,402	5,402	5,402
R-squared	0.063	0.063	0.064	0.058	0.045	0.049
Y-Mean	0.240	0.279	0.185	0.070	0.005	0.019
Std. Dev. Of Y	(0.427)	(0.530)	(0.388)	(0.254)	(0.071)	(0.137)
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes
State-Specific Time Trend	Yes	Yes	Yes	Yes	Yes	Yes

Note: Each column in each panel is from a separate regression. The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at ages 25-35. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. State-specific time trend is controlled. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.

Table A5. Comparing OLS regression and Logistic Regression

	1(Any Health condition)	# of Health condition	Asthma	Lung Disease	Heart Attack	Heart Disease
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: OLS Regression						
In-utero Cigarette Taxes (10 ¢)	-0.018***	-0.021***	-0.017***	-0.004	-0.001	0.001
	(0.006)	(0.008)	(0.006)	(0.003)	(0.001)	(0.001)
Odds Ratio	0.947	0.952	0.927	0.947	0.801	1.052
	(0.019)	(0.021)	(0.026)	(0.040)	(0.199)	(0.052)
Panel B, Logistic Regression						
In-utero Cigarette Taxes (10 ¢)	-0.105***	-0.107***	-0.122***	-0.080	-	-0.146
	(0.040)	(0.040)	(0.045)	(0.072)	-	(0.134)
Odds Ratio	0.900	0.900	0.885	0.923	-	0.864
	(0.036)	(0.036)	(0.039)	(0.066)	-	(0.115)
Birth Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Birth State FE	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Family Background at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes
State covariates at Birth Year	Yes	Yes	Yes	Yes	Yes	Yes

Note: The convergence is not achieved for heart attack for logistic regression. Results in panel B-column 1,3,4,6 is from logit regression and results in panel B-column 2 is from an ordered logit regression.

Odds is the probability that the individual has any of the four smoke related diseases rather than the individual does not have any of the four smoke related diseases. For column 2, odds is the probability that the outcome variable is less than or equal to *j* rather than greater than *j*. Odds ratio is the odds at the 10 cent improved cigarette tax over the odds at the current cigarette tax.

The sample consists of individuals born into PSID families between 1968-1994 who became household heads or spouses between ages 25-35 during later PSID surveys. Estimates are weighted using average PSID longitudinal weights for ages 1-18. Outcome variables are individuals' health status at ages 25-35. In utero cigarette taxes refer to the state cigarette taxes in the birth state at the year-month of birth. The model also accounts for the cigarette taxes in the individual's residence state at age 25. Both taxes are cpi-adjusted and reported in 2020 dollars. The unit is 10 cents. Baseline fixed effects include birth year fixed effect and birth state fixed effect. Individual demographic controls include gender, race, and age square. Age represents the age at the time of the last survey conducted between ages 25 and 35. Family background at birth includes the educational level and age of mother, gender of head, marital status of head, number of children in the family, and family income-Census needs standard ratio at birth year. State covariates include the minimum legal age for purchasing tobacco products, beer tax, spirit tax, wine tax, maximum AFDC/TANF benefits, maximum EITC benefits, maximum CDCTC benefits, the minimum wage, the maximum income marginal tax rate, per capita GDP, the number of hospital beds, and welfare vendor payment for medical at birth year. Standard errors clustered by state of birth are in parentheses. Significance levels: * p<0.1, ** p<0.05, *** p<0.01.