THE LONG-TERM IMPACT OF EARLY-LIFE CIGARETTE TAXES ON ADULT PRE-PREGNANCY AND PRENATAL SMOKING

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• I have no other tobacco-related conflicts over the last 10 years.
INTRODUCTION
Motivation

- Do early-life public policies impact long-term health behaviors?
  - Literature has shown—prenatal and early-childhood environment crucial for human capital development*
  - If early-life influences also impact on long-run health behaviors (such as smoking)—provides another potential avenue for early-childhood health to persist into adulthood

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

• Do higher early-life cigarette taxes have long-term intergenerational links to adult smoking behavior?
  • Consider cigarette taxes in place during the mother’s in-utero development (faced by the grandmother)
  • Ask whether there is a long-term link between ↑ in-utero cigarette taxes & ↑ later-life adult prenatal smoking
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**Why Prenatal Smoking?**

- Prenatal smoking remains an ongoing public health threat
  - Raises the likelihood of pregnancy complications such as low birth weight \( (\text{Almond et al.; 2005}) \)
  - Prenatal smoking during gestation may also have long-term implications for health and human capital development \( (\text{Simon, 2016; Settele and Van Ewijk, 2018}) \)
  - Birth Certificates provide well-reported administrative record of prenatal smoking & include the mother’s own birth state
- Due to the adverse effects – prenatal period remains a crucial target for public health policy
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• **Early-life taxes**: taxes in place during the mother’s own gestation (1965-2000)

• Use a fixed effects model:
  • Month-year of the current pregnancy’s conception & mother’s conception year
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  • Linear trends for the mother’s birth state and conception year
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  • 1% increase in early-life cigarette tax is associated with a reduction in the probability of prenatal smoking by 0.24 percent and pre-pregnancy smoking by 0.21 percent
  
  • 1$ increase in the cigarette tax linked to a 2.1 percentage point decline in prenatal smoking and a 2.7 percentage point decline in pre-pregnancy smoking
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• *Human capital formation* and adult *socioeconomic status*
  1. Higher cigarette tax in the years leading up to the mother’s in-utero exposure changes the likelihood of:
  2. SES/human capital also linked to lower prenatal smoking

• *Multigenerational effects* on health and health behaviors
  
  • Infant health:
    1. ↓ very premature
    2. ↓ very low birth weight
• *Human capital formation* and adult *socioeconomic status*

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     1.1 ↑ *college* degree attainment
     1.2 ↑ *married* at first delivery
     1.3 ↓ *WIC* receipt

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Mother health:

1. ↓ pre-pregnancy BMI
2. ↓ diabetes
3. ↑ breastfeeding

Infant health:

1. ↓ very premature
2. ↓ very low birth weight
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1. Contemporary and teenage cigarette taxes: influential for older cohorts, those with first child during the late 1990s and early 2000s
2. Early-life cigarette taxes appear important after 2006

Higher cigarette taxes may have disrupted a generation of smokers in early life making these individuals less responsive to contemporary taxes today

Potential factor contributing to the decline in contemporary cigarette tax responsiveness
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LITERATURE
Cigarette Taxes and Smoking

1. Literature studying cigarette taxes and smoking in pregnancy: Evans and Ringel (1999); Gruber and Koszegi (2001); Bradford (2003); Colman et al. (2003); Levy and Meara (2006); Simon (2016); Adams et al. (2012); Dennett (2020).


3. Long-term Impacts of Cigarette Taxes:
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Why would early-life taxes influence adult smoking?
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- **Reason 1:** Higher cigarette taxes during the mother’s in-utero development will affect the grandmother’s prenatal smoking.

Prenatal smoking:

- Impairs early health and human capital development (*Settele and Van Ewijk* (2018))
- Increases infant risk factors, such as low birth weight (*Almond et al.*, 2005)
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Reason 2: In-utero and childhood exposure to nicotine may affect the individual’s general proclivity towards nicotine-containing products

- Nicotine exposure has been shown to affect rodent brain development; which may be generalizable to humans (Lv et al., 2008; England et al., 2015; HHS, 2016, 2018; Romoli et al., 2019)
- Reducing exposure to nicotine during pregnancy may disrupt a generation of smokers
**Why would early-life taxes influence adult smoking?**

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  • Reducing exposure to nicotine during pregnancy may disrupt a generation of smokers
• **Reason 3:** Higher cigarette taxes will affect smoking in the home environment
  
  • Children who grow up in households with smoking parents more likely to smoke in adulthood (*Bantle and Haisken-DeNew, 2002; Gohlmann et al., 2010*)
  
  • Parental health behaviors causally impact the health behaviors of adult children (*Darden and Gilleskie, 2016; Fadlon and Nielsen, 2019*)
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• **Reason 4:** Higher cigarette taxes shape the state-level cultural environment
  
  • Mother’s beliefs about smoking shaped by parents, peers, and acquaintances
  • Cultural transmission of smoking behaviors (Christopoulou and Lillard, 2015; Rodriguez-Planas and Sanz-de Galdeano, 2019; Kleinjans and Gill, 2020; Catalano and Gilleskie, 2021)
  • Childhood exposure to a permissive smoking culture may play a role in shaping health behaviors
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• **Reason 5:** Cigarette taxes raised during early childhood may be *earmarked for public expenditures* on education or other beneficial programs (*Lav, 2002; Evans and Zhang, 2007*)

  • If this is the case—omitted causal factor may be educational expenditures or public spending on health
  • We test for this in the mechanisms section
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Why would early-life taxes influence adult smoking?

1. In-utero exposure and human capital formation
2. Nicotine receptors in the developing brain
3. Smoking culture at home
4. Smoking culture in state
5. Earmarked expenditures
BACKGROUND

Cigarette Taxes over Time
Information presented above for the average cigarette taxes, the sum of the state-level taxes plus the federal tax. Real cigarette taxes are CPI-adjusted and reported in 2020 dollars. The green dashed line represents the inflation-adjusted year-over-year change in the nominal tax rate.
   - Natality Detail File from the CDC and NVSS
   - Revised version has information on smoking at three points in time (2009+)
   - Primarily focus on revised version

2. *Cigarette Excise Taxes*
   - State and federal excise taxes from the CDC’s Tax Burden on Tobacco
   - Use cigarette taxes in place at the conception of mother, during teen years (age 13), and at the conception of the newborn

3. Additional data sources: for tobacco and state-level policy controls listed in Appendix
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• **Main outcomes:**

  1. Prenatal Smoking
     - Any smoking during the three trimesters of pregnancy
  2. Smoking pre-pregnancy
  3. Quantity of Cigarettes
     - Number of cigarettes smoked during the three trimesters of pregnancy
• **Main outcomes:**

1. **Prenatal Smoking**
   - Any smoking during the three trimesters of pregnancy
2. **Smoking pre-pregnancy**
3. **Quantity of Cigarettes**
   - Number of cigarettes smoked during the three trimesters of pregnancy

• **Main Sample:** first deliveries to adults (18-49) occurring over 2009-2020
### 2003 Birth Certificate Revision


#### Table: Mother Information

<table>
<thead>
<tr>
<th>Field</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>29a. Date of First Prenatal Care Visit</td>
<td>MM/DD/YYYY (No Prenatal Care)</td>
</tr>
<tr>
<td>29b. Date of Last Prenatal Care Visit</td>
<td>MM/DD/YYYY (If none, enter AD.)</td>
</tr>
<tr>
<td>30. Total Number of Prenatal Visits for this Pregnancy</td>
<td></td>
</tr>
<tr>
<td>31. Mother's Height (feet/inches)</td>
<td></td>
</tr>
<tr>
<td>32. Mother's Prepregnancy Weight (pounds)</td>
<td></td>
</tr>
<tr>
<td>33. Mother's Weight at Delivery (pounds)</td>
<td></td>
</tr>
<tr>
<td>34. Did Mother Get WIC Food for Herself During this Pregnancy?</td>
<td>Yes or No</td>
</tr>
<tr>
<td>35. Number of Previous Live Births (Do not include this child)</td>
<td></td>
</tr>
<tr>
<td>35a. Now Living</td>
<td>Number ____</td>
</tr>
<tr>
<td>35b. Now Dead</td>
<td>Number ____</td>
</tr>
<tr>
<td>35c. Date of Last Live Birth</td>
<td>MM/DD/YYYY</td>
</tr>
<tr>
<td>36. Number of Other Pregnancy Outcomes</td>
<td></td>
</tr>
<tr>
<td>36a. Other Outcomes</td>
<td>Number ____</td>
</tr>
<tr>
<td>37. Cigarette Smoking Before and During Pregnancy</td>
<td></td>
</tr>
<tr>
<td>Average number of cigarettes or packs of cigarettes smoked per day</td>
<td></td>
</tr>
<tr>
<td>Three Months Before Pregnancy</td>
<td># of cigarettes OR # of packs</td>
</tr>
<tr>
<td>First Three Months of Pregnancy</td>
<td></td>
</tr>
<tr>
<td>Second Three Months of Pregnancy</td>
<td></td>
</tr>
<tr>
<td>Third Trimester of Pregnancy</td>
<td></td>
</tr>
<tr>
<td>38. Principal Source of Payment for this Delivery</td>
<td></td>
</tr>
<tr>
<td>□ Private Insurance</td>
<td></td>
</tr>
<tr>
<td>□ Medicaid</td>
<td></td>
</tr>
<tr>
<td>□ Self-pay</td>
<td></td>
</tr>
<tr>
<td>□ Other (Specify)</td>
<td></td>
</tr>
<tr>
<td>39. Date Last Normal Menstrual Period Began</td>
<td>MM/DD/YYYY</td>
</tr>
<tr>
<td>40. Mother's Medical Record Number</td>
<td></td>
</tr>
</tbody>
</table>
Empirical Strategy

For individual $i$ residing in county $j$ and state $s_c$ at time $t$ who was born in state $s_b$ this specification appears as:

$$\text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \beta \text{Early-life Tax}_{s_b(t-\text{age}-1)} + \mathbf{x}'_{i,j,s_c,s_b,t} \gamma + a_{s_c} + \delta_{s_b} + \eta(t-g) + \nu(t-\text{age}-1) + \phi_{s_b}(t-\text{age}-1) + \epsilon_{i,j,s_c,s_b,t}$$  \hspace{1cm} (1)

- **Smoking$_{i,j,s_c,s_b,t}$** - smoking behavior for individual $i$
- **Early-life Tax$_{s_b(t-\text{age}-1)}$** - real cigarette tax in the mother’s birth state $s_b$ & conception year ($t-\text{age}-1$)
- **$\mathbf{x}'_{i,j,s_c,s_b,t}$** - demographic and policy controls
- **Fixed effects and trends**
- **$\epsilon_{i,j,s_c,s_b,t}$** is the standard error (clustered at the birth state level)
Empirical Strategy

For individual $i$ residing in county $j$ and state $s_c$ at time $t$ who was born in state $s_b$ this specification appears as:

$$\text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \beta \text{Early-life Tax}_{s_b(t-\text{age}-1)} + \mathbf{X}'_{i,j,s_c,s_b,t} \gamma + a_{s_c} + \delta_{s_b}$$

$$+ \eta(t-g) + \nu(t-\text{age}-1) + \phi_{s_b}(t - \text{age} - 1) + \epsilon_{i,j,s_c,s_b,t}$$

1. **Smoking**$_{i,j,s_c,s_b,t}$ - smoking behavior for individual $i$
2. **Early-life Tax**$_{s_b(t-\text{age}-1)}$ - real cigarette tax in the mother’s birth state $s_b$ & conception year $(t - \text{age} - 1)$
3. $\mathbf{X}'_{i,j,s_c,s_b,t} \gamma$ are demographic and policy controls
4. Fixed effects and trends
5. $\epsilon_{i,j,s_c,s_b,t}$ is the standard error (clustered at the birth state level)
Empirical Strategy

For individual $i$ residing in county $j$ and state $s_c$ at time $t$ who was born in state $s_b$ this specification appears as:

\[
\text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \beta \text{Early-life Tax}_{s_b(t-\text{age}-1)} + \mathbf{x}'_{i,j,s_c,s_b,t} \gamma + a_{s_c} + \delta_{s_b} \\
+ \eta(t-g) + \nu(t-\text{age}-1) + \phi_{s_b}(t-\text{age}-1) + \epsilon_{i,j,s_c,s_b,t}
\]

(1)

- **Smoking$_{i,j,s_c,s_b,t}$** - smoking behavior for individual $i$
- **Early-life Tax$_{s_b(t-\text{age}-1)}$** - real cigarette tax in the mother’s birth state $s_b$ & conception year ($t - \text{age} - 1$)
- **$\mathbf{x}'_{i,j,s_c,s_b,t} \gamma$** are demographic and policy controls
  1. Demographic controls: race/ethnicity
  2. Tobacco control: contemporary state-level cigarette tax, county-level Tobacco 21 laws, share of the population covered by indoor vaping and smoking restrictions, standardized ecigarette tax, and e-cigarette minimum purchasing age indicator
  3. General policy: ACA Medicaid expansion, state-level minimum wage and beer tax, county-level unemployment rate, median income, poverty rate, binary variables for state-level recreational & medical marijuana legalization and opioid PDMP

Fixed effects and trends

$\epsilon_{i,j,s_c,s_b,t}$ is the standard error (clustered at the birth state level)

Hoehn-Velasco et al /two.pnum/one.pnum / /three.pnum/five.pnum
For individual $i$ residing in county $j$ and state $s_c$ at time $t$ who was born in state $s_b$ this specification appears as:

\[
\text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \beta \text{Early-life Tax}_{s_b(t-\text{age}-1)} + \mathbf{X}'_{i,j,s_c,s_b,t}\gamma + a_{s_c} + \delta_{s_b} \\
+ \eta(t-g) + \nu(t-\text{age}-1) + \phi_{s_b}(t - \text{age} - 1) + \epsilon_{i,j,s_c,s_b,t} \tag{1}
\]

- **Smoking$_{i,j,s_c,s_b,t}$** - smoking behavior for individual $i$
- **Early-life Tax$_{s_b(t-\text{age}-1)}$** – real cigarette tax in the mother’s birth state $s_b$ & conception year ($t - \text{age} - 1$)
- **$\mathbf{X}'_{i,j,s_c,s_b,t}\gamma$** are demographic and policy controls
- **Fixed effects and trends**
- **$\epsilon_{i,j,s_c,s_b,t}$** is the standard error (clustered at the birth state level)
Empirical Strategy

For individual $i$ residing in county $j$ and state $s_c$ at time $t$ who was born in state $s_b$ this specification appears as:

\[
\text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \beta \text{Early-life Tax}_{s_b(t-\text{age}-1)} + \mathbf{x}'_{i,j,s_c,s_b,t} \gamma + a_{s_c} + \delta_{s_b} \\
+ \eta(t-g) + \nu(t-\text{age}-1) + \phi_{s_b}(t-\text{age}-1) + \epsilon_{i,j,s_c,s_b,t}
\]  

(1)

- Smoking$_{i,j,s_c,s_b,t}$—smoking behavior for individual $i$
- Early-life Tax$_{s_b(t-\text{age}-1)}$—real cigarette tax in the mother’s birth state $s_b$ & conception year ($t - \text{age} - 1$)
- $\mathbf{x}'_{i,j,s_c,s_b,t} \gamma$ are demographic and policy controls
- Fixed effects and trends
  1. Current state $a_{s_c}$ and birth state $\delta_{s_b}$
  2. Infant month-year of conception $\eta(t-g)$, mother’s conception year, $\nu(t-\text{age}-1)$ and $\phi_{s_b}(t-\text{age}-1)$ linear time trends
- $\epsilon_{i,j,s_c,s_b,t}$ is the standard error (clustered at the birth state level)
For individual $i$ residing in county $j$ and state $s_c$ at time $t$ who was born in state $s_b$ this specification appears as:

$$\text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \beta \text{Early-life Tax}_{s_b(t-\text{age}-1)} + x'_{i,j,s_c,s_b,t} \gamma + a_{s_c} + \delta_{s_b}$$

$$+ \eta(t-g) + \nu(t-\text{age}-1) + \phi_{s_b}(t - \text{age} - 1) + \epsilon_{i,j,s_c,s_b,t}$$

1. Smoking$_{i,j,s_c,s_b,t}$—smoking behavior for individual $i$
2. Early-life Tax$_{s_b(t-\text{age}-1)}$—real cigarette tax in the mother’s birth state $s_b$ & conception year $(t - \text{age} - 1)$
3. $x'_{i,j,s_c,s_b,t}$ are demographic and policy controls
4. Fixed effects and trends
   1. Current state $a_{s_c}$ and birth state $\delta_{s_b}$
   2. Infant month-year of conception $\eta(t-g)$, mother’s conception year, $\nu(t-\text{age}-1)$ and $\phi_{s_b}(t - \text{age} - 1)$ linear time trends
5. $\epsilon_{i,j,s_c,s_b,t}$ is the standard error (clustered at the birth state level)
Empirical Strategy

For individual $i$ residing in county $j$ and state $s_c$ at time $t$ who was born in state $s_b$ this specification appears as:

$$\text{Smoking}_{i,j,s_c,s_b,t} = \alpha + \beta \text{Early-life Tax}_{s_b(t-\text{age}-1)} + \mathbf{x}'_{i,j,s_c,s_b,t} \gamma + a_{s_c} + \delta_{s_b}$$

$$+ \eta(t-g) + \nu(t-\text{age}-1) + \phi_{s_b}(t-\text{age}-1) + \epsilon_{i,j,s_c,s_b,t}$$

1. $\text{Smoking}_{i,j,s_c,s_b,t}$ – smoking behavior for individual $i$
2. $\text{Early-life Tax}_{s_b(t-\text{age}-1)}$ – real cigarette tax in the mother’s birth state $s_b$ & conception year $(t - \text{age} - 1)$
3. $\mathbf{x}'_{i,j,s_c,s_b,t} \gamma$ are demographic and policy controls
4. Fixed effects and trends
5. $\epsilon_{i,j,s_c,s_b,t}$ is the standard error (clustered at the birth state level)
Main Results
## Effect of Early-life Taxes on Smoking

### Table: Effect of Early-life Taxes on Smoking

<table>
<thead>
<tr>
<th>At-Conception Cigarette Tax</th>
<th>1(Any Pre-Pregnancy Smoking)</th>
<th>1(Any Prenatal Smoking)</th>
<th>Prenatal Per Day Cigarettes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
<tr>
<td></td>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
</tr>
<tr>
<td>Observations</td>
<td>9,466,192</td>
<td>9,466,192</td>
<td>9,466,192</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.053</td>
<td>0.069</td>
<td>0.071</td>
</tr>
<tr>
<td>Mean Dependent</td>
<td>0.104</td>
<td>0.104</td>
<td>0.104</td>
</tr>
<tr>
<td>Baseline FE</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Controls</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Maternal Birth State Trends</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

### Notes:
Elasticities reported. Robust standard errors clustered at the level of the mother’s birth state. 
***, **, * represent statistical significance at 1, 5 and 10 percent levels.
# Effect of Early-life Taxes on Smoking

<table>
<thead>
<tr>
<th></th>
<th>1(Any Pre-Pregnancy Smoking)</th>
<th>1(Any Prenatal Smoking)</th>
<th>Prenatal Per Day Cigarettes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>At-Conception Cigarette Tax</td>
<td>-0.3115**</td>
<td>-0.3050**</td>
<td>-0.2126***</td>
</tr>
<tr>
<td></td>
<td>(0.1414)</td>
<td>(0.1471)</td>
<td>(0.0707)</td>
</tr>
<tr>
<td>Observations</td>
<td>9,466,192</td>
<td>9,466,192</td>
<td>9,466,192</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.053</td>
<td>0.069</td>
<td>0.071</td>
</tr>
<tr>
<td>Mean Dependent</td>
<td>0.104</td>
<td>0.104</td>
<td>0.104</td>
</tr>
<tr>
<td>Baseline FE</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Controls</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Maternal Birth State Trends</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Elasticities reported. Robust standard errors clustered at the level of the mother’s birth state. ***, **, * represent statistical significance at 1, 5 and 10 percent levels.
## Effect of Early-life Taxes on Smoking

### Table: Elasticities of At-Conception Cigarette Tax on Smoking Outcomes

<table>
<thead>
<tr>
<th></th>
<th>1(Any Pre-Pregnancy Smoking)</th>
<th>1(Any Prenatal Smoking)</th>
<th>Prenatal Per Day Cigarettes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>At-Conception Cigarette Tax</td>
<td>-0.3115** (0.1414)</td>
<td>-0.3050** (0.1471)</td>
<td>-0.2126*** (0.0707)</td>
</tr>
<tr>
<td>Observations</td>
<td>9,466,192</td>
<td>9,466,192</td>
<td>9,466,192</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.053</td>
<td>0.069</td>
<td>0.071</td>
</tr>
<tr>
<td>Mean Dependent</td>
<td>0.104</td>
<td>0.104</td>
<td>0.104</td>
</tr>
<tr>
<td>Baseline FE</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Controls</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Maternal Birth State Trends</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Elasticities reported. Robust standard errors clustered at the level of the mother’s birth state. ***,**, * represent statistical significance at 1, 5 and 10 percent levels.
Robustness
Contemporary, Teenage, and Early-life Cigarette Taxes

Panel A: Main Sample, Adding Teenage and Contemporary Taxes

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(Any Pre-Pregnancy Smoking)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1(Any Prenatal Smoking)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prenatal Per Day Cigarettes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At-Conception Cigarette Tax</td>
<td>-0.3403**</td>
<td>-0.3163**</td>
<td>-0.2092**</td>
<td>-0.4001**</td>
<td>-0.3713**</td>
<td>-0.2353**</td>
<td>-0.4472**</td>
<td>-0.4256**</td>
<td>-0.2423***</td>
</tr>
<tr>
<td></td>
<td>(0.1444)</td>
<td>(0.1425)</td>
<td>(0.0686)</td>
<td>(0.1713)</td>
<td>(0.1710)</td>
<td>(0.0834)</td>
<td>(0.1600)</td>
<td>(0.1657)</td>
<td>(0.0831)</td>
</tr>
<tr>
<td>Teenage (Age 13) Cigarette Tax</td>
<td>0.0997*</td>
<td>0.0895</td>
<td>0.0153</td>
<td>0.1151*</td>
<td>0.1023</td>
<td>0.0223</td>
<td>0.1086*</td>
<td>0.0952</td>
<td>0.0365</td>
</tr>
<tr>
<td></td>
<td>(0.0603)</td>
<td>(0.0640)</td>
<td>(0.0348)</td>
<td>(0.0649)</td>
<td>(0.0688)</td>
<td>(0.0352)</td>
<td>(0.0628)</td>
<td>(0.0660)</td>
<td>(0.0386)</td>
</tr>
<tr>
<td>Present-Day Cigarette Tax</td>
<td>0.2316**</td>
<td>0.1433**</td>
<td>0.1621*</td>
<td>0.2493**</td>
<td>0.1336**</td>
<td>0.1585</td>
<td>0.2362**</td>
<td>0.0549</td>
<td>0.0784</td>
</tr>
<tr>
<td></td>
<td>(0.1002)</td>
<td>(0.0639)</td>
<td>(0.0881)</td>
<td>(0.1111)</td>
<td>(0.0681)</td>
<td>(0.1008)</td>
<td>(0.1156)</td>
<td>(0.0728)</td>
<td>(0.1027)</td>
</tr>
<tr>
<td>Observations</td>
<td>9,466,192</td>
<td>9,466,192</td>
<td>9,466,192</td>
<td>9,470,171</td>
<td>9,470,171</td>
<td>9,470,171</td>
<td>9,456,678</td>
<td>9,456,678</td>
<td>9,456,678</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.053</td>
<td>0.069</td>
<td>0.071</td>
<td>0.040</td>
<td>0.053</td>
<td>0.055</td>
<td>0.026</td>
<td>0.035</td>
<td>0.036</td>
</tr>
<tr>
<td>Mean Dependent</td>
<td>0.104</td>
<td>0.104</td>
<td>0.104</td>
<td>0.072</td>
<td>0.072</td>
<td>0.072</td>
<td>0.521</td>
<td>0.521</td>
<td>0.521</td>
</tr>
<tr>
<td>Baseline FE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Controls</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Maternal Birth State Trends</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Elasticities reported. Robust standard errors clustered at the level of the mother’s birth state. ***, **, * represent statistical significance at 1, 5 and 10 percent levels.
Contemporary, Teenage, and Early-life Cigarette Taxes

### Panel B: Never Movers, Adding Teenage and Contemporary Taxes

<table>
<thead>
<tr>
<th></th>
<th>1(Any Pre-Pregnancy Smoking)</th>
<th>1(Any Prenatal Smoking)</th>
<th>Prenatal Per Day Cigarettes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td><strong>At-Conception Cigarette Tax</strong></td>
<td>-0.341** -0.3336** -0.2253***</td>
<td>-0.392** -0.3869* -0.2499***</td>
<td>-0.4110** -0.4222** -0.2471**</td>
</tr>
<tr>
<td><strong>Teenage (Age 13) Cigarette Tax</strong></td>
<td>0.1361** 0.1208* 0.0206</td>
<td>0.1634*** 0.1433** 0.0289</td>
<td>0.1564*** 0.1339* 0.0415</td>
</tr>
<tr>
<td><strong>Present-Day Cigarette Tax</strong></td>
<td>0.2498* 0.1367 0.1696</td>
<td>0.2725* 0.1336 0.1759</td>
<td>0.2529* 0.0335 0.0708</td>
</tr>
</tbody>
</table>

| Observations | 6,500,087 | 6,500,087 | 6,500,087 | 6,502,930 | 6,502,930 | 6,502,930 | 6,493,287 | 6,493,287 | 6,493,287 |
| Adjusted R-squared | 0.054 | 0.071 | 0.073 | 0.041 | 0.055 | 0.057 | 0.026 | 0.036 | 0.037 |
| Mean Dependent | 0.111 | 0.111 | 0.111 | 0.077 | 0.077 | 0.077 | 0.567 | 0.567 | 0.567 |
| Baseline FE | X | X | X | X | X | X | X | X | X |
| Controls | X | X | X | X | X | X | X | X | X |
| Maternal Birth State Trends | X | X | X | X | X | X | X | X | X |

Notes: Elasticities reported. Robust standard errors clustered at the level of the mother’s birth state. ***, **, * represent statistical significance at 1, 5 and 10 percent levels.
Contemporary, Teenage, and Early-life Cigarette Taxes

### Panel C: Main Sample, Only Adding Teenage Taxes

<table>
<thead>
<tr>
<th>At-Conception Cigarette Tax</th>
<th>1(Any Pre-Pregnancy Smoking)</th>
<th>1(Any Prenatal Smoking)</th>
<th>Prenatal Per Day Cigarettes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>At-Conception Cigarette Tax</td>
<td>-0.3243** (0.1343)</td>
<td>-0.3150** (0.1427)</td>
<td>-0.2099** (0.0681)</td>
</tr>
<tr>
<td>Teenage (Age 13) Cigarette Tax</td>
<td>0.0943* (0.0570)</td>
<td>0.0887 (0.0639)</td>
<td>0.0123 (0.0356)</td>
</tr>
</tbody>
</table>

**Observations:**
- (1) 9,466,192
- (2) 9,466,192
- (3) 9,466,192
- (4) 9,470,171
- (5) 9,470,171
- (6) 9,470,171
- (7) 9,456,678
- (8) 9,456,678
- (9) 9,456,678

**Adjusted R-squared:**
- (1) 0.053
- (2) 0.069
- (3) 0.071
- (4) 0.040
- (5) 0.053
- (6) 0.055
- (7) 0.026
- (8) 0.035
- (9) 0.036

**Mean Dependent:**
- (1) 0.104
- (2) 0.104
- (3) 0.104
- (4) 0.072
- (5) 0.072
- (6) 0.072
- (7) 0.521
- (8) 0.521
- (9) 0.521

**Baseline FE:**
- (1) X
- (2) X
- (3) X
- (4) X
- (5) X
- (6) X
- (7) X
- (8) X
- (9) X

**Controls:**
- (1) X
- (2) X
- (3) X
- (4) X
- (5) X
- (6) X
- (7) X
- (8) X
- (9) X

**Maternal Birth State Trends:**
- (1) X
- (2) X
- (3) X
- (4) X
- (5) X
- (6) X
- (7) X
- (8) X
- (9) X

Notes: Elasticities reported. Robust standard errors clustered at the level of the mother’s birth state. ***, **, * represent statistical significance at 1, 5 and 10 percent levels.
Panel D: Main Sample, Adding Each Cigarette Tax Alone

<table>
<thead>
<tr>
<th></th>
<th>1(Any Pre-Pregnancy Smoking)</th>
<th>1(Any Prenatal Smoking)</th>
<th>Prenatal Per Day Cigarettes</th>
</tr>
</thead>
<tbody>
<tr>
<td>At-Conception Cigarette Tax</td>
<td>-0.2127***</td>
<td>-0.2403***</td>
<td>-0.2506***</td>
</tr>
<tr>
<td></td>
<td>(0.0704)</td>
<td>(0.0853)</td>
<td>(0.0847)</td>
</tr>
<tr>
<td>Teenage (Age 13) Cigarette Tax</td>
<td>0.0304</td>
<td>0.0397</td>
<td>0.0560</td>
</tr>
<tr>
<td></td>
<td>(0.0411)</td>
<td>(0.0417)</td>
<td>(0.0439)</td>
</tr>
<tr>
<td>Present-Day Cigarette Tax</td>
<td>0.1608*</td>
<td>0.1566</td>
<td>0.0753</td>
</tr>
<tr>
<td></td>
<td>(0.0889)</td>
<td>(0.1018)</td>
<td>(0.1039)</td>
</tr>
<tr>
<td>Observations</td>
<td>9,466,192</td>
<td>9,466,192</td>
<td>9,456,678</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.071</td>
<td>0.071</td>
<td>0.036</td>
</tr>
<tr>
<td>Mean Dependent</td>
<td>0.104</td>
<td>0.104</td>
<td>0.521</td>
</tr>
<tr>
<td>Baseline FE</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Controls</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Maternal Birth State Trends</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Notes: Elasticities reported. Robust standard errors clustered at the level of the mother’s birth state. ***, **, * represent statistical significance at 1, 5 and 10 percent levels.
Panel A: Real Cigarette Tax at Each Age

Outcome: 1 (Any Prenatal Smoking)

Real Cigarette Tax Level at Each Age

95% CI  Point Estimate
Other Notable Robustness Checks

1. Real taxes increases at each age (separately considered)
2. Event study of tax increases relative to mother’s birth year
3. Effect over trimester
4. Balanced panels
5. Alternative clustering of standard errors
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Mechanisms for the Main Effect
Mechanisms

1. Human Capital and Socioeconomic Status
2. Earmarked Expenditure
3. Related State-level Tobacco Control Policies
4. Biological impacts: mother and infant health
5. *Unable to test: Intergenerational effects*
Mechanisms

• Early-life cigarette taxes influence *human capital formation* and adult *socioeconomic status*

  1. Higher cigarette tax in the years leading up to the mother’s in-utero exposure changes the likelihood of:
     
     1.1 ↑ college degree attainment
     1.2 ↑ married at first delivery
     1.3 ↓ WIC receipt

  2. Also show that SES/human capital is linked to lower prenatal smoking
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Mechanisms

• *Multigenerational effects* on health and health behaviors.

• Mother health:
  1. ↓ pre-pregnancy BMI
  2. ↓ diabetes
  3. ↑ breastfeeding

• Infant health:
  1. ↓ very premature
  2. ↓ very low birth weight
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EXTENSIONS—Is this a Cohort Effect?
Remaining Questions

- Remaining questions:
  1. When did early-life taxes become important?
  2. Why do contemporary and teen taxes fail to affect smoking behavior? Have these cigarette taxes lost their bite? (Hansen et al. (2017); DeCicca et al. (2020))

- Add earlier delivery years, using the unrevised birth certificate data:
  - Consider 1996-2005 and 2002-2020
  - Ideally want to show when contemporary/teen taxes became less important and when early-life taxes arose as important
The Changing Importance of Life-Course Cigarette Taxes

Panel A: Cigarette Taxes over 1996-2005

Outcome: 1(Prenatal Smoking)

Birth Certificate Years Included (1996+)

Panel B: Cigarette Taxes over 2002-2020

At-Conception Tax

Present-Day Tax

Teenage Tax
The Changing Importance of Life-Course Cigarette Taxes

Panel B: Cigarette Taxes over 2002-2020

Outcome: 1 (Prenatal Smoking)

Birth Certificate Years Included (to 2020)

- At-Conception Tax
- Present-Day Tax
- Teenage Tax

Hoehn-Velasco et al
Conclusions
• **Primary Findings:** long-term link between mother’s exposure to higher in-utero (early-life) cigarette taxes and later-life adult prenatal smoking

1. The importance of early-life taxes holds over various specifications, notably:
   - Controlling for present-day and teenage cigarette taxes.
   - Event study
   - Considering taxes at all ages

2. Most plausible mechanisms:
   2.1 *Human capital formation* and adult *socioeconomic status*
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2. Public policies may have cohort-specific effects
   - Today, pregnant women less responsive to contemporary/teenage taxes
   - Marginal smokers quit smoking earlier in life or never starting to begin with
   - Remaining smokers are more committed (inelastic demand)
   - Instead, early-life cigarette taxes most influential over the past 15 years (after 2006)

3. Demonstrates the persistent effect of public policy on long-term health behaviors
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Thank you!

Email: lvelasco@gsu.edu