Taxing Addiction in Hard Times: Cigarette Taxes and Smoking During Recessions*

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Abstract

This paper examines whether smokers become less responsive to cigarette taxes during economic downturns. Using data from the Behavioral Risk Factor Surveillance System (BRFSS) linked to state cigarette excise taxes from 2003 to 2009, we estimate how the relationship between cigarette taxes and quit attempts changed during the Great Recession. Before the downturn, a one-dollar increase in the cigarette tax is associated with a 2.4 percentage point increase in the probability that a current smoker makes a quit attempt. During the recession, this estimate falls to 1.3 percentage points. The decline is larger among daily smokers and among smokers with lower income and less education. These findings suggest that cigarette taxes are less effective in inducing quit attempts during economic downturns, but may remain a relatively stable source of revenue when other tax revenues come under pressure.

Keywords: cigarette taxes; quit attempts; economic downturns; smoking cessation; tax responsiveness.
JEL codes: I12; H20; H71; E32.

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1 Introduction

Smoking remains a major source of preventable disease, premature death, and economic loss in the United States (Nargis et al., 2022). Governments often rely on cigarette excise taxes both to discourage smoking and to raise revenue (Chaloupka et al., 2010, 2019). This dual role becomes especially salient during recessions, when state budgets come under greater pressure and tobacco tax revenue may take on greater practical importance for state governments (Inman, 2010; Alm and Sjoquist, 2014). Yet the public-health and fiscal objectives of cigarette taxation do not necessarily move together. Strong behavioral responses can improve health but erode the tax base, while weaker responses can preserve revenue but reduce health gains. This paper asks whether the relationship between cigarette taxes and quit attempts changes during economic downturns.

Economic downturns may shape responses to cigarette taxation through opposing channels. On the one hand, rational addiction models imply that smokers are forward-looking, so expected future cigarette prices can influence current smoking behavior (Gruber and Köszegi, 2001). Evidence on cigarette demand also suggests that smoking responds to both price and income, which implies that tighter household budgets may strengthen incentives to cut back or attempt cessation (Gallet and List, 2003). On the other hand, recessions may increase economic insecurity, psychological distress, and the difficulty of behavior change (Paul and Moser, 2009; Price et al., 2002). These pressures may matter not only for workers who lose jobs, but also for employed workers who face greater uncertainty about future income and employment stability (Hou, 2022). Under such conditions, smokers may become less likely to reduce smoking or make quit attempts in response to higher cigarette taxes, particularly given the addictive nature of nicotine (Stolerman and Jarvis, 1995; Shaw et al., 2011). This ambiguity matters for policy because it bears directly on both the health consequences of cigarette taxation and the stability of tobacco tax revenue.

Cigarette taxation provides a useful setting for studying this question. State cigarette excise taxes vary substantially across states and over time, generating meaningful differences in the incentives smokers face (Chaloupka et al., 2010). That variation is particularly informative around the Great Recession, when tax policy operated under severe household financial stress and labor-market distress. This setting makes it possible to examine whether cigarette taxes remained equally effective in encouraging quit attempts when economic conditions deteriorated.

To answer this question, we combine data from the Behavioral Risk Factor Surveillance System (BRFSS) with state cigarette excise taxes from 2003 to 2009. The main outcome is whether a current smoker made a quit attempt in the past 12 months. This measure captures an important margin of cessation effort and allows us to test whether the association between cigarette taxes and quit attempts weakened during the Great Recession. Our baseline specification allows the association between cigarette taxes and quit attempts to vary with economic downturns while controlling for state and

year fixed effects, individual demographic characteristics, unemployment insurance generosity, and smoke-free policies.

The results show that higher cigarette taxes are associated with more quit attempts before the recession. In the preferred specification, a one-dollar increase in the cigarette tax is associated with a 2.4 percentage point increase in the probability that a current smoker makes a quit attempt. During the downturn, this association attenuates substantially. The estimates imply that the same one-dollar tax increase is associated with only a 1.3 percentage point increase in quit attempts, roughly half as large as in the earlier period. This result is not sensitive to alternative ways of capturing economic distress, inference, or tax exposure. The estimates remain similar when we extend the recession window, replace the recession indicator with the state unemployment rate, use wild cluster bootstrap inference, or adopt an alternative tax measure aligned with the 12-month recall period.

The heterogeneity analysis shows that this pattern is concentrated among daily smokers and among smokers with lower income and less education. These results suggest that the smaller overall response is driven primarily by smokers who are more likely to face financial strain and more persistent smoking habits. In this setting, higher cigarette taxes may still increase the incentive to quit, but economic stress appears to make vulnerable smokers less likely to act on that incentive. This result points to a policy tension: tobacco tax revenue may remain relatively stable during recessions even as the short-run health gains from higher taxes become more limited.

This paper contributes to the literature on cigarette taxation and smoking behavior. Existing work shows that higher cigarette taxes reduce smoking participation and cigarette consumption, with less attention to cessation-related outcomes such as quit attempts and quitting behavior (Chaloupka et al., 2010, 2019; Adda and Cornaglia, 2006; Harding et al., 2012; Le and Jaffri, 2022). We add to this literature by showing that the relationship between cigarette taxes and quit attempts depends on the macroeconomic environment. Using BRFSS data linked to state cigarette excise taxes from 2003 to 2009, we find that higher cigarette taxes are associated with a greater likelihood of a quit attempt before the Great Recession, but that the estimated response is substantially smaller during the downturn. The paper thus shows that the relationship between cigarette taxes and quit attempts changes with economic conditions (Chaiton et al., 2016; Smit et al., 2014; Tobacco et al., 2008).

The paper also contributes to the literature on macroeconomic conditions and health behavior. Previous work shows that recessions, unemployment, and financial strain can affect psychological well-being and addictive behaviors (Paul and Moser, 2009; Price et al., 2002; Hou, 2022). We show that the association between cigarette taxes and quit attempts becomes smaller among daily smokers and among smokers with lower income and less education. These patterns suggest that financial strain and stronger nicotine dependence make smokers less likely to translate higher taxes into quit attempts during downturns (Stolerman and Jarvis, 1995; Shaw et al., 2011). The findings also inform the policy debate over sin taxation in hard times by suggesting that the public health and

fiscal effects of cigarette taxation do not necessarily move together during downturns (Inman, 2010; Alm and Sjoquist, 2014).

The remainder of the paper proceeds as follows. Section 2 describes the BRFSS data and the construction of the key variables. Section 3 outlines the empirical strategy. Section 4 presents the main results, sensitivity analysis, heterogeneity analysis, and additional analysis. Section 5 discusses the policy implications. Section 6 concludes.

2 Data

Data come from the 2003–2009 Behavioral Risk Factor Surveillance System (BRFSS), a repeated cross-sectional survey conducted annually by the Centers for Disease Control and Prevention.[1] The survey covers adults aged 18 and older in all 50 states and the District of Columbia and provides comparable measures over time. It includes detailed information on smoking behavior, demographic and socioeconomic characteristics, and selected health measures. We link these individual records to state-level information on cigarette excise taxes, labor market conditions, unemployment insurance generosity, and smoke-free policies. The 2003-2009 sample period covers both the pre-recession years and the Great Recession.

Our primary outcome is an indicator of whether a current smoker made a quit attempt during the past 12 months. Following the BRFSS questionnaire, this variable equals one if a respondent reports stopping smoking for at least one day in an effort to quit. We focus on quit attempts because smoking cessation typically occurs through a process involving repeated attempts rather than a single transition to permanent abstinence (Chaiton et al., 2016; Tobacco et al., 2008). For this reason, quit attempts are widely used in the smoking cessation literature as a meaningful indicator of cessation effort even when they do not immediately lead to long-run abstinence (Smit et al., 2014; Vangeli et al., 2011). In addition, we examine several secondary outcomes, including current smoking, daily smoking, and some-day smoking. These measures allow us to assess whether similar patterns appear in broader smoking behavior and help address potential compositional concerns, since quit attempts are observed only among smokers and changes in smoking prevalence may alter the underlying sample over time.

We construct a panel of monthly state cigarette excise tax rates using data from Orzechowski and Walker (2014), cross-validated with records from the CDC State Tobacco Activities Tracking and Evaluation (STATE) System.[2] Both sources report the amount and effective date of each tax change. We use this information to assign each BRFSS respondent the cigarette excise tax in effect in his or her state and month of interview. Nominal tax rates are converted to real 2003 dollars. In the

[1] BRFSS data are publicly available at `https://www.cdc.gov/brfss/data_documentation/index.htm`.

[2] CDC data are accessed through *The Tax Burden on Tobacco, 1970–2019*. Supplementary implementation dates and tax amounts are verified against the Campaign for Tobacco-Free Kids (2025), *Cigarette Tax Increases by State per Year, 2000–2025*.

baseline specification, we use the contemporaneous monthly tax as our main tax measure. Because the quit-attempt outcome refers to the previous 12 months, we also report robustness checks using the natural log of the tax, 1-month, 3-month, and 6-month lagged taxes, and the average tax over the current and previous 11 months.

Cigarette excise taxes changed substantially during the study period. Between 2008 and 2009, 17 states and the District of Columbia increased cigarette excise taxes.[3] Some of these increases were large. Rhode Island raised its tax by $1.00 to $3.46, Connecticut by $1.00 to $3.00, and Florida by $1.00 to $1.34. The average real state tax increased from $0.89 (SD = 0.57) in 2007 to $1.15 (SD = 0.72) in 2009, while nominal rates ranged from $0.07 in South Carolina to $3.46 in Rhode Island. Prior research suggests that many of these recession-era tax increases were driven by state fiscal pressures rather than by a sharp shift in public health objectives (DeCicca and McLeod, 2008).

We define the Great Recession using an indicator for interviews conducted between December 2007 and June 2009.[4] This measure captures the common national downturn that forms the focus of our main specification. Labor market conditions deteriorated sharply during this period, and states also faced substantial fiscal pressure. We also control for two additional state-level policies that are especially relevant in this setting. First, we include state unemployment insurance generosity, which may buffer the income loss and financial strain associated with job loss and thereby affect smoking behavior during downturns (Fu and Liu, 2019).[5] Second, we control for smoke-free policies, since restrictions on smoking in workplaces and public facilities changed during the study period and may independently affect smoking behavior.[6] These controls help separate the relationship between cigarette taxes and smoking behavior from other state policies that may also have shifted during the recession.

For the main analysis, we restrict the sample to interviews conducted between January 2003 and June 2009 and to respondents ages 18–64.[7] In line with Stehr (2007), we report unweighted estimates in the main specifications. Weighted estimates are reported as a robustness check in

[3]Table A1 reports the full list of cigarette tax changes and their effective dates in 2008 and 2009.

[4]The recession dates follow the National Bureau of Economic Research Business Cycle Dating Committee, which dates the Great Recession from December 2007 to June 2009. See NBER Business Cycle Dating Committee. In supplementary analyses, we also use the annual state unemployment rate from the Local Area Unemployment Statistics (LAUS) program from the Bureau of Labor Statistics. This measure provides a continuous indicator of local labor market conditions and is widely used in studies of health behavior over the business cycle (Ruhm, 2015).

[5]State unemployment insurance generosity is measured using the maximum weekly unemployment insurance benefit available under state law. The UI data are drawn from the U.S. Department of Labor and are available at U.S. Department of Labor UI Data Dashboard. Nominal benefit levels are converted to real 2003 dollars.

[6]Smoke-free policy data come from the CDC State Tobacco Activities Tracking and Evaluation (STATE) System, *Legislation – Smokefree Indoor Air, 1995–2025*. The dataset provides quarterly state-level information on smoke-free indoor air laws across venues, including workplaces, restaurants, bars, and other public facilities. See CDC STATE System documentation.

[7]The main specification defines the recession period as December 2007 through June 2009. Results are similar when the analysis window is extended through December 2009, and all interviews in 2009 are treated as recession-period observations.

Table 1.[8] Table A2 reports summary statistics for the full sample and for the subsample of current smokers, separately for the pre-recession and recession periods. Several patterns are worth noting. First, respondents in the recession period are somewhat older, while the share of current smokers in the full sample declines modestly. Second, among current smokers, the fraction reporting a quit attempt rises slightly from 0.55 before the recession to 0.57 during the recession. Third, in both periods, current smokers are more concentrated among respondents with lower education and lower household income than is the full sample. Taken on their own, these differences reflect a combination of changes in sample composition, macroeconomic conditions, and tobacco policy over time.

3 Empirical Strategy

The basic regression specification estimated below is:

$$Y_{ist} = \beta_1 \text{Tax}_{st} + \beta_2 \text{Recession}_t + \beta_3 \left(\text{Tax}_{st} \times \text{Recession}_t\right) + X'_{ist}\Gamma + Z'_{st}\Pi + \alpha_s + \delta_t + \varepsilon_{ist}, \quad (1)$$

where Y_{ist} denotes the outcome for individual i in state s interviewed in period t, Tax_{st} is the state cigarette excise tax, Recession_t equals one for interviews conducted between December 2007 and June 2009,[9] X_{ist} includes individual demographic characteristics, Z_{st} includes time-varying state controls for unemployment insurance generosity and smoke-free policies, and α_s and δ_t denote state and year fixed effects. Our main outcome is a quit-attempt indicator among current smokers. We estimate the same specification for current smoking, daily smoking, and some-day smoking, both to examine whether the pattern extends to broader smoking outcomes and to assess whether changes in the composition of current smokers help account for the results. We also examine selected health outcomes.[10] Standard errors are clustered at the state level.[11]

[8] Stehr (2007) notes that the BRFSS weights are designed for inference at the state level rather than for pooled national regression analysis. He further argues that population-rescaled weights may reduce bias in national estimation, but do not guarantee unbiasedness unless they capture all sample-selection factors associated with smoking behavior and can substantially reduce efficiency by sharply downweighting observations from smaller states. An alternative is to control flexibly for observable characteristics related to sample composition. We follow this approach in the main specifications and report weighted estimates as a robustness check in Table 1.

[9] In a robustness check, we extend the recession window through December 2009 and classify all interviews in 2009 as recession-period observations. The corresponding estimates are reported in Table A3 and are very similar to the main results.

[10] The additional health outcomes are constructed from the BRFSS health-status module. We define good health as an indicator equal to one if self-reported general health is excellent or very good, based on the BRFSS question asking whether health is excellent, very good, good, fair, or poor. We define poor physical health and poor mental health as indicators equal to one if the respondent reports at least one day in the past 30 days when physical health or mental health was not good, respectively.

[11] Standard errors are clustered at the state level. Because inference with a limited number of state clusters can be sensitive, Appendix Table A5 reports wild-cluster-bootstrap p-values based on state-level clustering and 9,999 replications. The bootstrap results remain robust.

The coefficient of interest is β_3. It captures whether the association between cigarette taxes and smoking outcomes differs during the recession. A negative estimate in the quit-attempt regressions implies that the positive association between cigarette taxes and quit attempts is weaker during the recession than outside it. The identifying variation comes from within-state changes in cigarette taxes over time and from differences in how cigarette taxes relate to the outcome before and during the recession. State fixed effects absorb time-invariant differences across states, while year fixed effects absorb shocks common to all states. In a robustness check, we also add state-specific linear trends. This allows smoking outcomes to evolve along different linear paths across states, beyond the common year effects. We treat this as a robustness check rather than the baseline specification because it absorbs a substantial share of the within-state variation used to estimate the interaction coefficient.

Our baseline control set is intentionally limited. We include age, age squared, gender, race and ethnicity, education, and marital status. These variables account for observable differences in respondent composition across states and over time, while remaining plausibly predetermined with respect to recession conditions. We do not include household income, employment status, or household composition in the baseline specification. These variables may themselves respond to recession conditions and therefore risk becoming bad controls when included mechanically in a fixed-effects regression with time-varying covariates (Caetano et al., 2022). This restriction is also substantively important in our setting. Income, employment, and family circumstances are plausible channels through which economic downturns affect smoking behavior. Conditioning on these variables in the baseline specification would therefore risk partialling out part of the channel through which recession conditions affect smoking behavior. For that reason, we examine several of them separately in the mechanism analysis rather than including them as baseline controls.

The estimates should be interpreted as reduced-form evidence rather than as definitive causal effects. All states were exposed to the national recession, and cigarette taxes were not assigned randomly. For that reason, the specification is best understood as testing whether the relationship between cigarette taxes and smoking outcomes changed during the recession, after accounting for persistent differences across states, common time shocks, and a limited set of demographic controls. At the same time, several features of the setting make the results informative. Prior work suggests that many state cigarette tax increases during this period were linked to fiscal pressure rather than to abrupt shifts in anti-smoking sentiment (DeCicca and McLeod, 2008). We assess the stability of the results in several ways. First, we consider alternative measures of tax exposure, including the log tax, lagged tax measures, and a 12-month average tax, to better match the retrospective nature of the quit-attempt outcome. Second, we replace the recession indicator with the state unemployment rate in supplementary specifications to examine whether the same pattern appears when labor market distress is measured continuously. These checks do not turn the design into a fully causal one,

but they help assess whether the main pattern is robust to reasonable alternative measures of tax exposure and economic distress.

4 Results

4.1 Main estimates

Table 1 reports baseline estimates of the relationship between state cigarette taxes and quit attempts among current smokers. In our preferred specification (Column 4), a one-dollar increase in the cigarette tax is associated with a 2.4 percentage point increase in the probability of making a quit attempt, which corresponds to an approximate 4.4 percent increase relative to the sample mean. This estimate is consistent with evidence that higher cigarette taxes are positively associated with quitting activity, although the recent economics literature exploiting within-state changes in cigarette taxes over time has primarily focused on smoking participation rather than quit attempts directly (Adda and Cornaglia, 2006; Harding et al., 2012; Carpenter and Cook, 2008; Pesko et al., 2020).

Studies that examine quit attempts as the outcome also find a positive association with cigarette taxes. Using BRFSS data from 2000 to 2019, Le and Jaffri (2022) find that a one-dollar increase in cigarette taxes is associated with a 1.71 percentage point increase in the probability of a quit attempt among current smokers. Their estimate, however, is based on the full sample period and therefore does not distinguish between periods of economic expansion and downturn. We show that this pooled relationship masks substantial business-cycle heterogeneity. The coefficient on the interaction between the cigarette tax and the recession indicator is -0.011, implying that during a recession, the same one-dollar tax increase is associated with only a 1.3 percentage point increase in quit attempts. In other words, macroeconomic downturns attenuate the estimated tax association by roughly one-half.

4.2 Sensitivity analysis

To assess the robustness of the main result, we consider several alternative specifications that address the measurement of macroeconomic distress, statistical inference, and the timing of tax exposure. First, Appendix Table A3 shows that the baseline findings are robust when the recession indicator is extended through the end of 2009. This extension is useful because labor market conditions remained weak well after the official end of the recession, and a specification that ends in mid-2009 may understate the duration of the downturn. Second, Appendix Table A4 shows that the same pattern holds when we replace the recession indicator with the state unemployment rate.[12] This

[12]The magnitude of the unemployment-rate specification is also close to the baseline recession estimate. In our sample, the mean state unemployment rate rises from 4.94 during 2003–2007 to 8.50 in 2009. Multiplying this increase by the interaction coefficient in Appendix Table A4 implies an attenuation of roughly 0.011, which is very close to the recession-interaction estimate in Table 1.

alternative matters for two reasons. It allows macroeconomic distress to vary continuously rather than assigning the same effect to all recession months, and it follows a broader literature that uses state unemployment rates to study how local economic conditions shape health and health-related behaviors over the business cycle (Ruhm, 2005; Tekin et al., 2018).

We also address inference concerns that arise because identification comes from state-level policy variation. Appendix Table A5 shows that the statistical significance of the main interaction term is preserved under wild-cluster-bootstrap inference. This procedure is useful in our setting because conventional cluster-robust standard errors can over-reject when the number of clusters is limited, and cluster sizes differ substantially across states (MacKinnon and Webb, 2017). Finally, Appendix Table A6 addresses the mismatch between the tax measure and the survey outcome. Because the dependent variable captures any quit attempt during the prior 12 months, respondents may have been exposed to different tax rates over the recall period. We therefore re-estimate the model using alternative temporal constructions of the tax variable that better align the tax measure with the recall window. The baseline conclusion remains unchanged.

4.3 Heterogeneous tax effects

Table 3 shows that the interaction between the cigarette tax and the recession indicator differs by smoking intensity. Among daily smokers, the interaction between the cigarette tax and the recession indicator is negative and precisely estimated, whereas the corresponding interaction for some-day smokers is much smaller and statistically insignificant. This difference suggests that the weaker association between cigarette taxes and quit attempts during the recession is concentrated among smokers with more persistent smoking behavior. This interpretation is consistent with evidence that daily smokers face greater difficulty quitting than intermittent smokers (Tindle and Shiffman, 2011) and that responses to cigarette taxes vary across the smoking distribution (Nesson, 2017).

Socioeconomic status is especially important in this setting because the effects of an economic downturn are unlikely to be felt uniformly across smokers. Table 4 shows that the recession interaction is concentrated among less educated smokers and among smokers with lower household income. The baseline tax coefficients are also larger for these groups, indicating that cigarette taxes are positively associated with quit attempts among smokers with fewer socioeconomic resources outside the recession. Taken together, these estimates suggest that the weaker association between cigarette taxes and quit attempts during the recession is concentrated among smokers with fewer socioeconomic resources. This pattern is notable because prior work often finds stronger price responsiveness among lower-income smokers on the participation margin, while recent evidence also suggests stronger quitting responses to cigarette taxes among less educated smokers in non-recession settings (Keeler et al., 2026; Riley, 2024). Our results suggest that this pattern weakens substantially when macroeconomic conditions deteriorate. One possible explanation is that financial strain makes

it harder for vulnerable smokers to convert the incentive created by higher cigarette taxes into an actual quit attempt. This interpretation is consistent with evidence that financially stressed smokers are more likely to want to quit, but less likely to make a quit attempt or to quit successfully (Siahpush et al., 2009; Kalkhoran et al., 2018).

We next examine heterogeneity by gender and race, since both smoking behavior and the effects of economic distress may differ across demographic groups. Previous work documents broad differences in smoking and cessation patterns across gender and racial groups (Fiore et al., 1989). More closely related to our setting, Stehr (2007) finds that women are more responsive to cigarette taxes than men, and recent evidence also suggests that smoking responses to tobacco taxes vary across racial groups (Cohen et al., 2023). Table 5 shows that the recession interaction is small and imprecisely estimated for men, but larger in magnitude and statistically significant for women. Across racial and ethnic groups, the estimates are less uniform: the interaction is negative for White and Black smokers, but close to zero or imprecisely estimated for the remaining groups. These gender estimates suggest that, once recession conditions are taken into account, the tax-related quit-attempt response is reduced more for women than for men.

Appendix Tables A7 and A8 further examine heterogeneity by age and household structure. These margins are relevant because financial strain during an economic downturn is unlikely to be felt uniformly over the life cycle or across family circumstances (Marshall et al., 2022). The estimates suggest that the interaction is larger in magnitude among smokers ages 40 to 49 and 50 to 64, among the married and the divorced, separated, or widowed, and among those with two or more children. One possible explanation is that the relationship between cigarette taxes and quit attempts weakens more during economic downturns when the resulting financial strain is harder to absorb. In this sense, the appendix estimates are consistent with the broader pattern in the paper that economic distress weakens the quit response associated with higher cigarette taxes.

4.4 Additional analysis

We report two additional analyses to further assess the main findings. We first examine whether the interaction between cigarette taxes and the recession appears in broader health outcomes, since economic downturns may affect not only smoking behavior but also physical and mental health more generally (Ruhm, 2003, 2005, 2015). We next examine whether differences in state unemployment insurance generosity help account for the main pattern, since stronger unemployment insurance may ease the financial strain associated with downturns (Fu and Liu, 2019). Appendix Table A9 shows no statistically significant effects of the interaction between cigarette taxes and the recession on self-rated health, poor physical health, or poor mental health. Appendix Table A10 shows that the interaction with log unemployment insurance generosity is not statistically significant. Taken together, these additional analyses suggest that the main result is unlikely to operate through changes

in broader health conditions or differences in state unemployment insurance generosity during the recession.

5 Policy Implication

Our empirical estimates indicate that a one-dollar increase in state cigarette taxes raises the probability of a quit attempt by approximately 2.4 percentage points. Although statistically meaningful, this response is modest in magnitude and consistent with the large literature documenting relatively inelastic cigarette demand in high-income settings (Chaloupka IV and Wechsler, 1995; Group, 2011; Centers for Disease Control and Prevention, 2014; Le and Jaffri, 2022). In practical terms, most smokers continue purchasing cigarettes following tax increases, implying that the taxable base is unlikely to contract sharply through quitting alone.

To interpret the fiscal implications of this relatively inelastic demand, we conduct a simple calibration exercise that embeds empirically plausible elasticity values in a retail-price demand framework with tax-base erosion. In the calibration, taxable sales decline through two channels: reduced cigarette consumption as retail prices rise and additional leakage through cross-border purchasing, product substitution, and illicit market activity. Each elasticity therefore generates a corresponding revenue schedule and revenue-maximizing tax rate. Table 6 reports the resulting simulations, and Appendix B describes the calibration in detail. The exercise is intended to clarify the economic mechanism linking behavioral responsiveness to fiscal outcomes rather than to provide quantitative policy prescriptions.

Our empirical results also show that responsiveness to cigarette taxes weakens during economic downturns. During the Great Recession, the quit-attempt response to a one-dollar tax increase declined by roughly half. If this attenuation extends beyond quit attempts to overall cigarette consumption, the effective price elasticity of cigarette demand would become smaller in absolute value during recessions. Within the calibration framework, such a shift implies weaker erosion of the taxable base as taxes rise and therefore a higher revenue-maximizing tax rate. In this sense, the simulated Laffer curves shift outward when behavioral responsiveness declines, indicating greater fiscal capacity for cigarette taxation under more inelastic demand.

Taken together, these findings highlight a central tension in cigarette excise taxation. Cigarette taxes serve both as public health interventions and as revenue instruments, but the balance between these objectives may vary over the business cycle. During economic downturns, cigarette taxes may generate relatively stable fiscal revenue while producing smaller behavioral responses. During expansions, by contrast, tax increases may induce stronger quitting responses[13] but yield smaller marginal revenue gains. At the same time, cigarette excise taxes raise distributional concerns

[13]Even modest reductions in smoking could generate substantial long-run health and economic benefits, including lower medical expenditures and improved productivity (Group, 2011; Le and Jaffri, 2022).

because lower-income smokers bear disproportionate tax burdens and may exhibit weaker cessation responsiveness during periods of economic stress. These considerations suggest that tax increases may be most effective when paired with accessible cessation support, including nicotine replacement therapies, counseling, and behavioral interventions that help translate price signals into successful quitting.

6 Conclusion

This paper examines whether cigarette taxes are less effective in encouraging quit attempts during economic downturns. Using BRFSS data linked to state cigarette excise taxes from 2003 to 2009, we find that higher cigarette taxes were associated with more quit attempts before the Great Recession, but that this relationship became substantially smaller during the downturn. This decline was concentrated among daily smokers and among smokers with lower income and less education. These patterns suggest that when economic conditions worsen, smokers who face greater financial pressure and stronger smoking dependence are less likely to respond to higher cigarette taxes by making a quit attempt. To the extent that fewer quit attempts delay smoking cessation, the consequences of this reduced response may extend beyond the recession itself.

The results carry an important fiscal implication. During downturns, higher cigarette taxes may be less likely to induce quitting and therefore less likely to shrink the tax base quickly. For governments facing budget pressure, taxes on addictive goods such as cigarettes may therefore remain a relatively stable source of revenue when other tax bases weaken. In that sense, cigarette tax increases may become especially useful during recessions as a way to raise revenue when fiscal conditions are tight.

At the same time, the results point to a clear policy tradeoff. If the main objective of cigarette taxation is to raise revenue, a smaller behavioral response during downturns makes cigarette tax increases more attractive. If the objective is to encourage smoking cessation, the same pattern is less encouraging, especially because the decline in responsiveness is concentrated among smokers who are more financially vulnerable and more strongly dependent on smoking. The main implication is that the effects of taxing addictive goods depend not only on the tax itself, but also on the economic conditions under which the tax is imposed and on the policy goal the tax is meant to serve.

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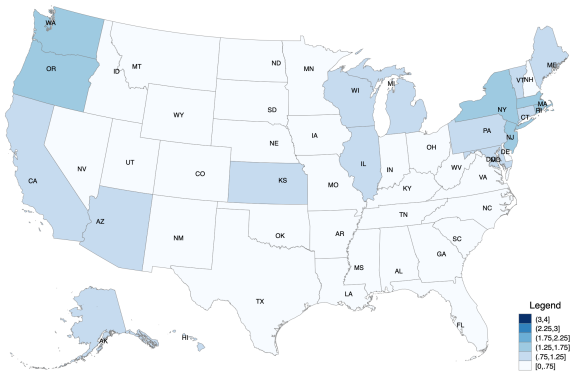
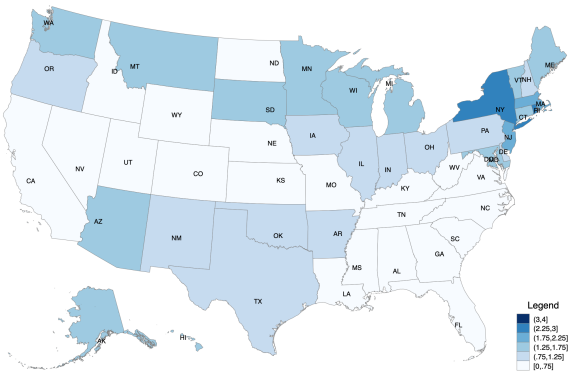
Figures and Tables

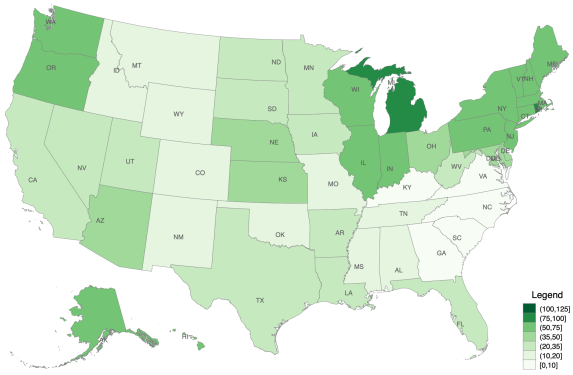
Figure 1: State variation in cigarette tax revenue and tax per pack in 2003 and 2009



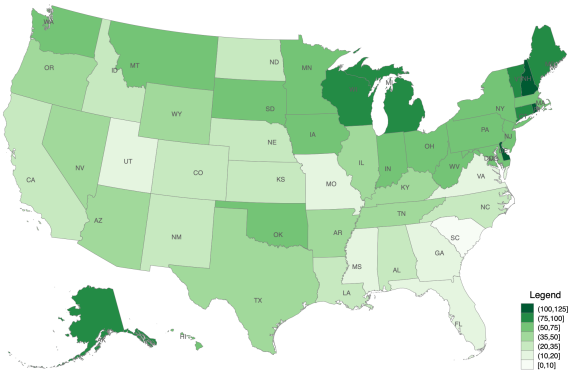
(a) State cigarette excise tax per pack, 2003



(b) State cigarette excise tax per pack, 2009



(c) State cigarette tax gross revenue per capita, 2003



(d) State cigarette tax gross revenue per capita, 2009

Notes: Panel (a) shows the state cigarette excise tax per pack in 2003, and panel (b) shows the corresponding tax in 2009. Panels (c) and (d) report state cigarette tax gross revenue per capita in 2003 and 2009, respectively. All monetary values are adjusted to 2003 dollars. Revenue per capita is measured using state population counts.

Table 1: State cigarette taxes and quit attempts during the Great Recession

Dependent variable: quit attempt	(1)	(2)	(3)	(4)	(5) + Trends	(6) + Trends + Weights
Recession × State Cigarette tax	-0.013***	-0.012***	-0.012***	-0.011***	-0.013***	-0.016***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)
Recession	0.012	0.013	0.013	0.012	0.013	0.027
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.022)
State Cigarette tax	0.022***	0.023***	0.023***	0.024***	0.023***	0.018*
	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)	(0.010)
Mean	0.551	0.551	0.551	0.551	0.551	0.572
Number of obs	368,312	367,419	367,419	367,419	367,419	367,419
R-squared	0.003	0.022	0.022	0.022	0.022	0.028
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	Yes	Yes	Yes	Yes
State UI generosity	No	No	Yes	Yes	Yes	Yes
Smoke-free policies	No	No	No	Yes	Yes	Yes
State-specific linear trends	No	No	No	No	Yes	Yes

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Recession equals one for interviews conducted between December 2007 and June 2009. Columns (1)–(4) report the main specifications. Column (5) adds state-specific linear trends. Column (6) re-estimates Column (5) using BRFSS sampling weights. Standard errors are clustered at the state level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2: State cigarette taxes and smoking status during the Great Recession

Dependent variables: smoking status outcomes	Current smoking		Daily smoking		Some-day smoking	
	(1)	(2) + Trends	(3)	(4) + Trends	(5)	(6) + Trends
Recession × State Cigarette tax	0.001	-0.000	0.002	0.001	-0.001	-0.001
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Recession	-0.005	-0.002	-0.005	-0.002	-0.000	-0.000
	(0.004)	(0.003)	(0.004)	(0.003)	(0.002)	(0.002)
State Cigarette tax	-0.004	-0.001	-0.004*	-0.002	0.001	0.001
	(0.003)	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)
Mean	0.224	0.224	0.169	0.169	0.054	0.054
Number of obs	1,651,069	1,647,170	1,651,069	1,647,170	1,651,069	1,647,170
R-squared	0.008	0.085	0.008	0.077	0.001	0.011
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes
State UI generosity	Yes	Yes	Yes	Yes	Yes	Yes
Smoke-free policies	Yes	Yes	Yes	Yes	Yes	Yes
State-specific linear trends	No	Yes	No	Yes	No	Yes

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variables are indicators for current smoking, daily smoking, and some-day smoking. Recession equals one for interviews conducted between December 2007 and June 2009. Each column reports a separate regression with the set of controls listed in the table. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: State cigarette taxes and quit attempts by smoking intensity

Dependent variable: quit attempt	Daily smokers			Some-day smokers		
	(1)	(2)	(3)	(4)	(5)	(6)
Recession × State Cigarette tax	-0.014***	-0.014***	-0.012***	-0.005	-0.005	-0.007
	(0.005)	(0.004)	(0.004)	(0.007)	(0.006)	(0.006)
Recession	0.016	0.017*	0.015	0.002	0.001	0.003
	(0.011)	(0.010)	(0.010)	(0.017)	(0.016)	(0.016)
State Cigarette tax	0.024***	0.025***	0.026***	0.011	0.012	0.013
	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)
Mean	0.489	0.489	0.489	0.745	0.745	0.745
Number of obs	279,170	278,505	278,505	89,142	88,914	88,914
R-squared	0.002	0.022	0.022	0.004	0.021	0.021
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	Yes	No	Yes	Yes
State UI generosity	No	No	Yes	No	No	Yes
Smoke-free policies	No	No	Yes	No	No	Yes

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Columns (1)–(3) restrict the sample to daily smokers, and Columns (4)–(6) restrict the sample to some-day smokers. Recession equals one for interviews conducted between December 2007 and June 2009. Each column reports a separate regression with the set of controls listed in the table. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: State cigarette taxes and quit attempts by socioeconomic status

Dependent variable: quit attempt	Educational background			Household income		
	(1)	(2)	(3)	(4)	(5)	(6)
	HS or less	Some college	College+	<$35k	$35k–$75k	>$75k
Recession × State Cigarette tax	-0.014**	-0.010*	-0.006	-0.017***	-0.009	-0.001
	(0.005)	(0.006)	(0.007)	(0.004)	(0.007)	(0.008)
Recession	0.010	0.025**	-0.004	0.012	0.010	0.003
	(0.016)	(0.012)	(0.016)	(0.010)	(0.016)	(0.022)
State Cigarette tax	0.033***	0.019**	0.003	0.026***	0.031***	0.002
	(0.008)	(0.009)	(0.009)	(0.005)	(0.009)	(0.011)
Mean	0.544	0.566	0.546	0.570	0.533	0.532
Number of obs	193,992	109,225	64,202	175,133	108,396	50,107
R-squared	0.024	0.023	0.021	0.023	0.023	0.021

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Columns (1)–(3) split the sample by educational background: high school or less, some college, and college or more. Columns (4)–(6) split the sample by annual household income: less than $35,000, $35,000 to $75,000, and $75,000 or more. Recession equals one for interviews conducted between December 2007 and June 2009. Each column reports a separate regression controlling for year and state fixed effects, demographic characteristics, state UI generosity, and smoke-free policies. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: State cigarette taxes and quit attempts by gender and race

Dependent variable: quit attempt	Gender		Race and ethnicity				
	(1) Male	(2) Female	(3) White	(4) Black	(5) Hispanic	(6) Asian	(7) Other
Recession × State Cigarette tax	-0.006	-0.015***	-0.012**	-0.015*	0.001	0.033	-0.013
	(0.005)	(0.004)	(0.005)	(0.009)	(0.015)	(0.038)	(0.011)
Recession	0.019	0.008	0.014	-0.009	0.036	-0.035	0.001
	(0.012)	(0.011)	(0.011)	(0.026)	(0.037)	(0.082)	(0.030)
State Cigarette tax	0.024***	0.024***	0.028***	0.026*	-0.018	-0.014	0.016
	(0.006)	(0.006)	(0.006)	(0.015)	(0.014)	(0.054)	(0.015)
Mean	0.526	0.570	0.528	0.664	0.630	0.606	0.593
Number of obs	153,618	213,801	286,889	32,268	21,706	3,070	23,486
R-squared	0.027	0.017	0.016	0.008	0.013	0.046	0.018

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Columns (1)–(2) split the sample by gender. Columns (3)–(7) split the sample by race and ethnicity. Recession equals one for interviews conducted between December 2007 and June 2009. Each column reports a separate regression controlling for year and state fixed effects, demographic characteristics, state UI generosity, and smoke-free policies. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

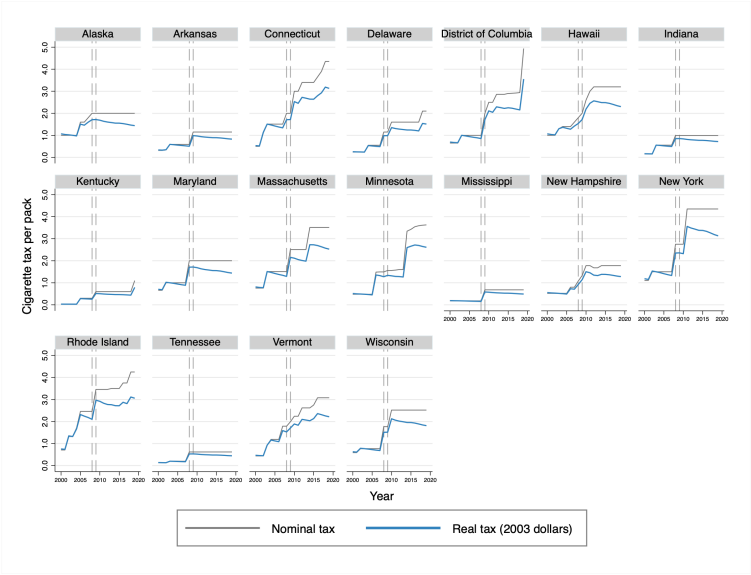
Table 6: Illustrative revenue-maximizing cigarette tax with tax-base erosion

Elasticity	Optimal tax ($)	Additional tax ($)	$\tilde{Q}^*$ (billion packs)	Total tax revenue (billion $)
−0.50	2.75	0.75	8.39	23.06
−0.40	2.87	0.87	8.14	23.34
−0.30	3.00	1.00	7.89	23.67
−0.25	3.07	1.07	7.77	23.85
−0.20	3.14	1.14	7.65	24.05
−0.15	3.22	1.22	7.53	24.26
−0.10	3.30	1.30	7.42	24.48

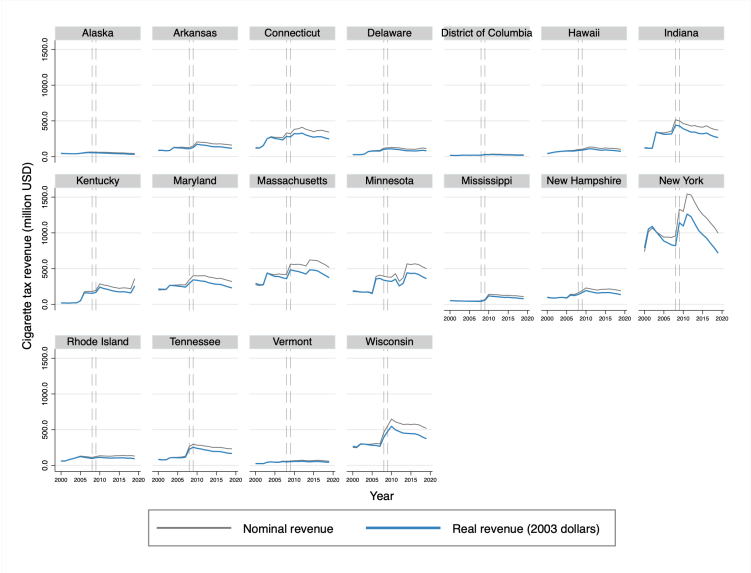
Notes: Baseline values are $P_0 = \$7.00$, $\tau_0 = \$2.00$, $c = \$5.00$, and $Q_0 = 11$ billion packs. Demand is given by $Q(P) = a - bP$, where $b = -\varepsilon Q_0/P_0$ and $a = Q_0 + bP_0$. Taxable quantity is $\tilde{Q}(\tau) = Q(c + \tau)\exp\{-\kappa(\tau - \tau_0)\}$ and tax revenue is $R(\tau) = \tau\tilde{Q}(\tau)$. The parameter κ is calibrated so that under $\varepsilon = -0.30$, the revenue-maximizing tax equals \$3.00, implying $\kappa \approx 0.2886$. For each value of ε, τ^* solves $1/\tau - b/[a - b(c + \tau)] - \kappa = 0$, and $\tilde{Q}^*$ and R^* are evaluated at τ^*.

A Appendix Figures and Tables

Figure A1: States that increased cigarette taxes in 2008 or 2009



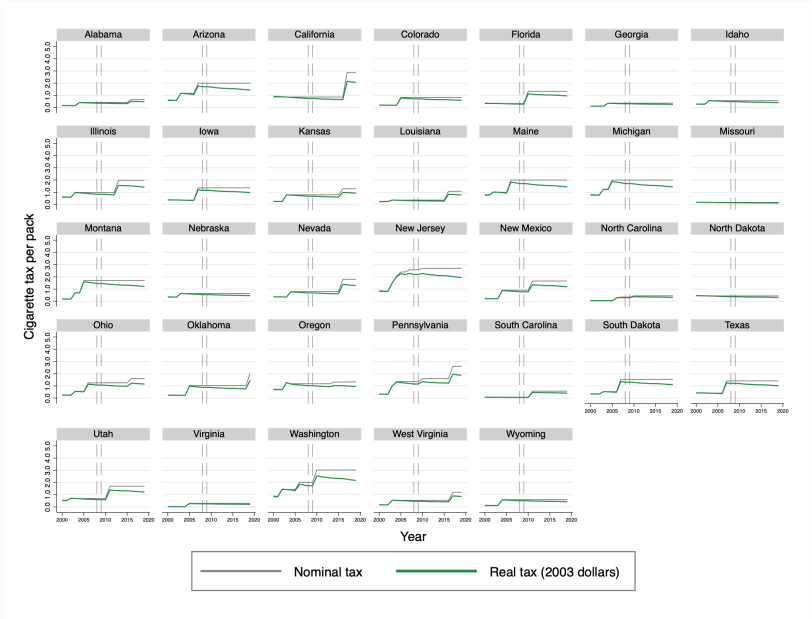
(a) Cigarette tax trends



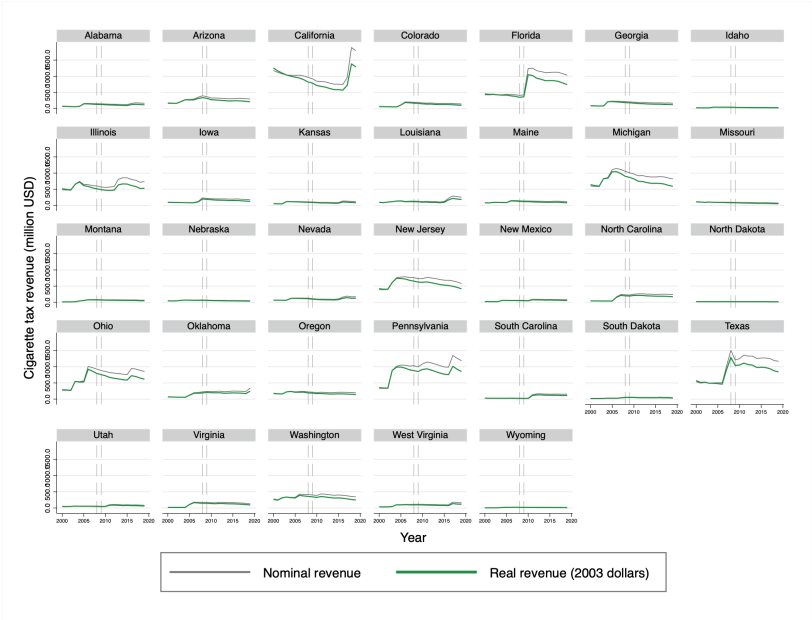
(b) Cigarette tax revenue trends

Notes: The top panel shows annual state cigarette excise taxes, and the bottom panel shows annual cigarette tax revenue. In each panel, the gray line reports the nominal series and the colored line reports the series adjusted to 2003 dollars. Vertical dashed lines mark 2008 and 2009. The sample is restricted to states that increased cigarette taxes in either 2008 or 2009.

Figure A2: States without cigarette tax increases in 2008 or 2009



(a) Cigarette tax trends



(b) Cigarette tax revenue trends

Notes: The top panel shows annual state cigarette excise taxes, and the bottom panel shows annual cigarette tax revenue. In each panel, the gray line reports the nominal series and the colored line reports the series adjusted to 2003 dollars. Vertical dashed lines mark 2008 and 2009. The sample is restricted to states that did not increase cigarette taxes in either 2008 or 2009.

Table A1: State cigarette tax increases, 2008–2009

			Tax rate (USD per pack)		
Year	State	Effective date	Increase	Previous	New
2009	Arkansas	Mar 2009	0.56	0.59	1.15
	Connecticut	Oct 2009	1.00	2.00	3.00
	Delaware	Aug 2009	0.45	1.15	1.60
	Washington, DC	Oct 2009	0.50	2.00	2.50
	Florida	Jul 2009	1.00	0.34	1.34
	Hawaii	Jul 2009	0.60	2.00	2.60
	Kentucky	Apr 2009	0.30	0.30	0.60
	Mississippi	May 2009	0.50	0.18	0.68
	New Hampshire	Jul 2009	0.45	1.33	1.78
	New Jersey	Jul 2009	0.13	2.58	2.70
	North Carolina	Sep 2009	0.10	0.35	0.45
	Pennsylvania	Nov 2009	0.25	1.35	1.60
	Rhode Island	Apr 2009	1.00	2.46	3.46
	Vermont	Jul 2009	0.25	1.99	2.24
	Wisconsin	Sep 2009	0.75	1.77	2.52
2008	Washington, DC	Oct 2008	1.00	1.00	2.00
	Hawaii	Sep 2008	0.20	1.80	2.00
	Maryland	Jan 2008	1.00	1.00	2.00
	Massachusetts	Jul 2008	1.00	1.51	2.51
	New Hampshire	Oct 2008	0.25	1.08	1.33
	New York	Jun 2008	1.25	1.50	2.75
	Wisconsin	Jan 2008	1.00	0.77	1.77
	Vermont	Jul 2008	0.20	1.79	1.99

Notes: This table reports state cigarette tax increases implemented between 2008 and 2009. "Increase" denotes the nominal change in the state cigarette excise tax, while "Previous" and "New" report the tax rates immediately before and after the change. All amounts are in nominal U.S. dollars per pack. Data source: Campaign for Tobacco-Free Kids (2025), Cigarette Tax Increases by State per Year 2000–2025, available at https://assets.tobaccofreekids.org/factsheets/0275.pdf.

Table A2: Summary statistics

	Full sample		Current smokers	
	Pre-rec.	Recession	Pre-rec.	Recession
Age	44.26	46.52	43.17	45.57
Female	0.61	0.61	0.58	0.59
Race/Ethnicity				
White	0.78	0.78	0.78	0.78
Black	0.08	0.08	0.09	0.09
Hispanic	0.07	0.07	0.06	0.06
Asian	0.02	0.02	0.01	0.01
Other	0.04	0.04	0.06	0.06
Educational Background				
HS or less	0.37	0.35	0.53	0.52
Some college	0.28	0.28	0.30	0.30
College+	0.35	0.37	0.18	0.17
Marital Status				
Married/unmarried couple	0.62	0.64	0.50	0.50
Divorced/separated/widowed	0.21	0.21	0.31	0.32
Never married	0.16	0.15	0.19	0.18
Number of Children in Household				
No children	0.56	0.59	0.57	0.61
1 child	0.17	0.16	0.18	0.17
2 or more children	0.26	0.25	0.24	0.22
Household Income				
< $35k	0.33	0.30	0.48	0.47
$35k–$75k	0.33	0.31	0.30	0.29
$75k+	0.24	0.30	0.13	0.16
Refused	0.10	0.09	0.09	0.09
Smoking Status				
Everyday smoker	0.18	0.15	0.76	0.75
Some-day smoker	0.06	0.05	0.24	0.25
Former smoker	0.24	0.25	0.00	0.00
Never smoked	0.53	0.55	0.00	0.00
Quit attempt	0.55	0.57	0.55	0.57
Observations	1,205,578	450,819	277,400	91,814

Notes: The table reports mean values from the Behavioral Risk Factor Surveillance System (BRFSS). Statistics are shown separately for the full sample of adults and for the subsample of current smokers. The pre-recession period covers interviews conducted between 2003 and November 2007. The recession period covers interviews conducted between December 2007 and June 2009. Quit attempt is an indicator equal to one if the respondent reported stopping smoking for at least one day during the past 12 months in an attempt to quit. Sample sizes are reported in individual-level observations and are unweighted.

Table A3: State cigarette taxes and quit attempts during the extended recession period

Dependent variable: quit attempt					
	(1)	(2)	(3)	(4)	(5)
Recession × State Cigarette tax	-0.013***	-0.012***	-0.012***	-0.011***	-0.012***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)
Recession	0.012	0.013	0.013	0.012	0.013
	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
State Cigarette tax	0.023***	0.024***	0.023***	0.025***	0.023***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Mean	0.553	0.553	0.553	0.553	0.553
Number of obs	395,214	394,242	394,242	394,242	394,242
R-squared	0.003	0.022	0.022	0.022	0.022
Year fixed effects	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	Yes	Yes	Yes
State UI generosity	No	No	Yes	Yes	Yes
Smoke-free policies	No	No	No	Yes	Yes
State-specific linear trends	No	No	No	No	Yes

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Recession equals one for interviews conducted between December 2007 and December 2009. Columns (1)–(4) report the main specifications. Column (5) adds state-specific linear trends. Standard errors are clustered at the state level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: State cigarette taxes and quit attempts with unemployment rate

Dependent variable: quit attempt	(1)	(2)	(3)	(4)	(5)
Unemp Rate × State Cigarette tax	-0.003***	-0.003**	-0.003**	-0.003**	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Unemp Rate	0.003	0.002	0.002	0.002	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
State Cigarette tax	0.032***	0.032***	0.032***	0.033***	0.035***
	(0.007)	(0.008)	(0.008)	(0.008)	(0.009)
Mean	0.551	0.551	0.551	0.551	0.551
Number of obs	368,312	367,419	367,419	367,419	367,419
R-squared	0.003	0.022	0.022	0.022	0.022
Year fixed effects	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	Yes	Yes	Yes
State UI generosity	No	No	Yes	Yes	Yes
Smoke-free policies	No	No	No	Yes	Yes
State-specific linear trends	No	No	No	No	Yes

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. This table uses the annual state-level unemployment rate and its interaction with the state cigarette tax as a measure of economic conditions. Each column reports a separate regression with the set of controls listed in the table. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: Wild-cluster-bootstrap p-values for the main specification

Dependent variable: quit attempt	(1)	(2)	(3)	(4)	(5) + Trends	(6) + Weights
State Cigarette tax × Recession	-0.013	-0.012	-0.012	-0.011	-0.013	-0.016
	⟨0.005⟩	⟨0.005⟩	⟨0.004⟩	⟨0.007⟩	⟨0.008⟩	⟨0.026⟩
Recession	0.012	0.013	0.013	0.012	0.013	0.027
	⟨0.278⟩	⟨0.227⟩	⟨0.227⟩	⟨0.250⟩	⟨0.235⟩	⟨0.358⟩
State Cigarette tax	0.022	0.023	0.023	0.024	0.023	0.018
	⟨0.000⟩	⟨0.000⟩	⟨0.000⟩	⟨0.000⟩	⟨0.001⟩	⟨0.091⟩
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	Yes	Yes	Yes	Yes
State UI generosity	No	No	Yes	Yes	Yes	Yes
Smoke-free laws	No	No	No	Yes	Yes	Yes
State-specific linear trends	No	No	No	No	Yes	Yes
Mean dep. var.	0.551	0.551	0.551	0.551	0.551	0.551
Observations	368,312	367,419	367,419	367,419	367,419	367,419
R-squared	0.003	0.022	0.022	0.022	0.022	0.028

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Each column corresponds to the specification shown in Table 1. Wild-cluster-bootstrap p-values are reported beneath each coefficient. Bootstrap p-values are based on state-level clustering and 9,999 replications. Column (6) re-estimates Column (5) using BRFSS sampling weights.

Table A6: State cigarette taxes and quit attempts with alternative tax measures

Dependent variable: quit attempt						
	(1)	(2)	(3)	(4)	(5)	(6)
	Current-month	Log tax	1-month lag	3-month lag	6-month lag	12-month avg.
Recession	-0.011***					
× Current-month tax	(0.004)					
Recession		-0.005*				
× Log tax		(0.003)				
Recession			-0.011***			
× 1-month lagged tax			(0.004)			
Recession				-0.010**		
× 3-month lagged tax				(0.004)		
Recession					-0.011**	
× 6-month lagged tax					(0.004)	
Recession						-0.011**
× 12-month avg. tax						(0.004)
Recession	0.012	0.000	0.011	0.011	0.012	0.012
	(0.010)	(0.008)	(0.010)	(0.010)	(0.010)	(0.010)
Current-month tax	0.024***					
	(0.005)					
Log tax		0.008**				
		(0.003)				
1-month lagged tax			0.020***			
			(0.005)			
3-month lagged tax				0.014***		
				(0.005)		
6-month lagged tax					0.011**	
					(0.005)	
12-month avg. tax						0.015***
						(0.005)
Mean dep. var.	0.551	0.551	0.551	0.551	0.551	0.551
Observations	367,419	367,419	367,419	367,419	367,419	367,419
R-squared	0.022	0.022	0.022	0.022	0.022	0.022

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Each column reports a separate regression using an alternative measure of state cigarette tax exposure: the current-month tax used in Table 1, the log tax, the 1-month lagged tax, the 3-month lagged tax, the 6-month lagged tax, and the average tax over the current and previous 11 months. All columns control for year and state fixed effects, demographic characteristics, state UI generosity, and smoke-free policies. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: State cigarette taxes and quit attempts by marital status and number of children

Dependent variable: quit attempt	Marital status			Number of children		
	(1)	(2)	(3)	(4)	(5)	(6)
	Married	Div./Sep./ Widowed	Never married	No children	One child	Two or more
Recession × State Cigarette tax	-0.012***	-0.018***	0.003	-0.010**	-0.006	-0.018***
	(0.004)	(0.006)	(0.008)	(0.004)	(0.006)	(0.006)
Recession	0.012	0.008	0.017	0.028**	0.010	-0.028
	(0.012)	(0.014)	(0.016)	(0.011)	(0.017)	(0.018)
State Cigarette tax	0.023***	0.027***	0.019**	0.023***	0.026***	0.024***
	(0.007)	(0.006)	(0.009)	(0.006)	(0.008)	(0.009)
Mean	0.548	0.541	0.576	0.524	0.576	0.598
Number of obs	182,393	115,290	69,736	213,679	66,001	87,530
R-squared	0.020	0.021	0.031	0.020	0.020	0.018

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Columns (1)–(3) split the sample by marital status: married, divorced/separated/widowed, and never married. Columns (4)–(6) split the sample by number of children: no children, one child, and two or more children. Recession equals one for interviews conducted between December 2007 and June 2009. Each column reports a separate regression controlling for year and state fixed effects, demographic characteristics, state UI generosity, and smoke-free policies. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: State cigarette taxes and quit attempts by age group

Dependent variable: quit attempt				
	Age group			
	(1)	(2)	(3)	(4)
	18–24	25–39	40–49	50–64
Recession × State Cigarette tax	-0.019	-0.007	-0.016**	-0.011**
	(0.013)	(0.006)	(0.007)	(0.004)
Recession	0.017	-0.010	0.004	0.030**
	(0.029)	(0.021)	(0.016)	(0.012)
State Cigarette tax	0.014	0.029***	0.029***	0.018**
	(0.016)	(0.008)	(0.010)	(0.007)
Mean	0.657	0.592	0.528	0.516
Number of obs	27,362	102,596	102,910	134,551
R-squared	0.010	0.015	0.017	0.019

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. Columns (1)–(4) split the sample by age group: 18–24, 25–39, 40–49, and 50–64. Recession equals one for interviews conducted between December 2007 and June 2009. Each column reports a separate regression controlling for year and state fixed effects, demographic characteristics, state UI generosity, and smoke-free policies. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A9: State cigarette taxes and health outcomes

Dependent variables: health outcomes	Full sample			Current smokers only		
	(1) Self rated health	(2) Poor physical health	(3) Poor mental health	(4) Self rated health	(5) Poor physical health	(6) Poor mental health
Recession × State Cigarette tax	0.002	-0.003	-0.007	0.004	-0.007	-0.010
	(0.002)	(0.004)	(0.005)	(0.003)	(0.005)	(0.007)
Recession	-0.002	0.016***	0.003	0.005	0.019**	0.013
	(0.004)	(0.006)	(0.007)	(0.009)	(0.009)	(0.010)
State Cigarette tax	0.002	-0.006	0.010	-0.000	0.011*	0.017**
	(0.003)	(0.005)	(0.006)	(0.003)	(0.006)	(0.007)
Mean	0.564	0.363	0.368	0.427	0.420	0.456
Number of obs	1,647,817	1,633,269	1,632,168	367,150	363,306	362,538
R-squared	0.110	0.018	0.044	0.067	0.023	0.047

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. Columns (1)–(3) use the full sample. Columns (4)–(6) restrict the sample to current smokers. Good self-rated health is an indicator equal to one for respondents reporting excellent or very good health. Poor physical health and poor mental health are indicators equal to one if the respondent reports any poor physical or mental health days, respectively. Recession equals one for interviews conducted between December 2007 and June 2009. Each column reports a separate regression controlling for year and state fixed effects, demographic characteristics, state UI generosity, and smoke-free policies. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A10: State cigarette taxes, unemployment, UI generosity, and quit attempts

Dependent variable: quit attempt				
	(1)	(2)	(3)	(4)
Log(UI) × Unemp Rate × State Cigarette tax	0.004	0.004	0.003	0.001
	(0.004)	(0.004)	(0.004)	(0.004)
Unemp Rate × State Cigarette tax	-0.026	-0.026	-0.022	-0.011
	(0.022)	(0.022)	(0.023)	(0.026)
Log(UI) × Unemp Rate	-0.003	-0.004	-0.003	-0.004
	(0.005)	(0.005)	(0.005)	(0.006)
Unemp Rate	0.018	0.022	0.022	0.023
	(0.028)	(0.026)	(0.027)	(0.034)
State Cigarette tax	0.291*	0.275*	0.227	0.109
	(0.147)	(0.152)	(0.156)	(0.180)
Log(UI)	0.036	0.023	0.016	-0.035
	(0.043)	(0.040)	(0.041)	(0.052)
Mean	0.551	0.551	0.551	0.551
Number of obs	368,312	367,419	367,419	367,419
R-squared	0.003	0.022	0.022	0.022
Year fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Demographic controls	No	Yes	Yes	Yes
Smoke-free policies	No	No	Yes	Yes
State-specific linear trends	No	No	No	Yes

Notes: The data come from the Behavioral Risk Factor Surveillance System for 2003–2009. The dependent variable is an indicator equal to one if the respondent reports a quit attempt during the past 12 months. This table examines whether the interaction between state cigarette tax and the unemployment rate varies with state UI generosity. UI generosity is proxied by the log of the maximum weekly unemployment insurance benefit amount in the respondent's state. Each column reports a separate regression with the set of controls listed in the table. Standard errors are clustered at the state level and reported in parentheses. All specifications are unweighted. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B Framework

This section describes the calibration used to interpret the fiscal implications of cigarette tax responsiveness in the empirical analysis. The goal is not to derive a normative tax rule, but to provide a simple partial-equilibrium framework linking behavioral responsiveness to revenue outcomes. The exercise is therefore best viewed as an interpretive complement to the empirical results rather than as a structural optimal-tax model.

Baseline Quantities

The calibration is anchored to recent U.S. market aggregates:

- Retail price (tax inclusive): $P_0 = \$7.00$ per pack
- Specific excise tax: $\tau_0 = \$2.00$ per pack
- Producer price: $c = P_0 - \tau_0 = \$5.00$
- Annual cigarette sales: $Q_0 = 11$ billion packs
- Benchmark elasticities evaluated at (P_0, Q_0):

$$\varepsilon \in \{-0.50, -0.40, -0.30, -0.25, -0.20, -0.15, -0.10\}$$

These values reflect the empirical range commonly reported in the tobacco demand literature and are used to study local comparative statics rather than large out-of-sample extrapolations (Centers for Disease Control and Prevention, 2023; U.S. Department of the Treasury, Alcohol and Tobacco Tax and Trade Bureau, 2025).

Behavioral Demand and Taxable Quantity

Retail price is determined by the statutory tax:

$$P = c + \tau.$$

Consumer demand is approximated locally by a linear function:

$$Q(P) = a - bP,$$

with parameters chosen to match the point elasticity at the baseline:

$$b = -\varepsilon \frac{Q_0}{P_0}, \qquad a = Q_0 + bP_0.$$

Government revenue depends on taxable purchases rather than physical demand alone. In practice, higher excise taxes can reduce taxable sales not only by lowering cigarette consumption, but also through cross-border shopping, product substitution, and illicit market activity. To incorporate these channels, taxable sales are defined as

$$\tilde{Q}(\tau) = Q(c + \tau) \exp\{-\kappa(\tau - \tau_0)\},$$

where $\kappa > 0$ governs the semi-elasticity of tax-base erosion.
Revenue is therefore

$$R(\tau) = \tau \tilde{Q}(\tau).$$

This formulation preserves the usual price channel while allowing the tax base to shrink endogenously as taxes rise.

Optimal Tax Characterization

Revenue maximization implies the first-order condition

$$\frac{d \ln R(\tau)}{d\tau} = \frac{1}{\tau} - \frac{b}{a - b(c + \tau)} - \kappa = 0.$$

The erosion parameter is calibrated so that the revenue-maximizing tax is approximately \$3 when $\varepsilon = -0.30$, which is broadly consistent with observed U.S. tax magnitudes:

$$\kappa = 0.2886.$$

Revenue-maximizing tax rates are then obtained numerically for each elasticity value.

Laffer Curve Visualization

Figure A3 illustrates simulated revenue schedules across elasticity values. Each curve incorporates both price responsiveness and tax-base erosion, producing interior revenue maxima at empirically plausible tax levels.

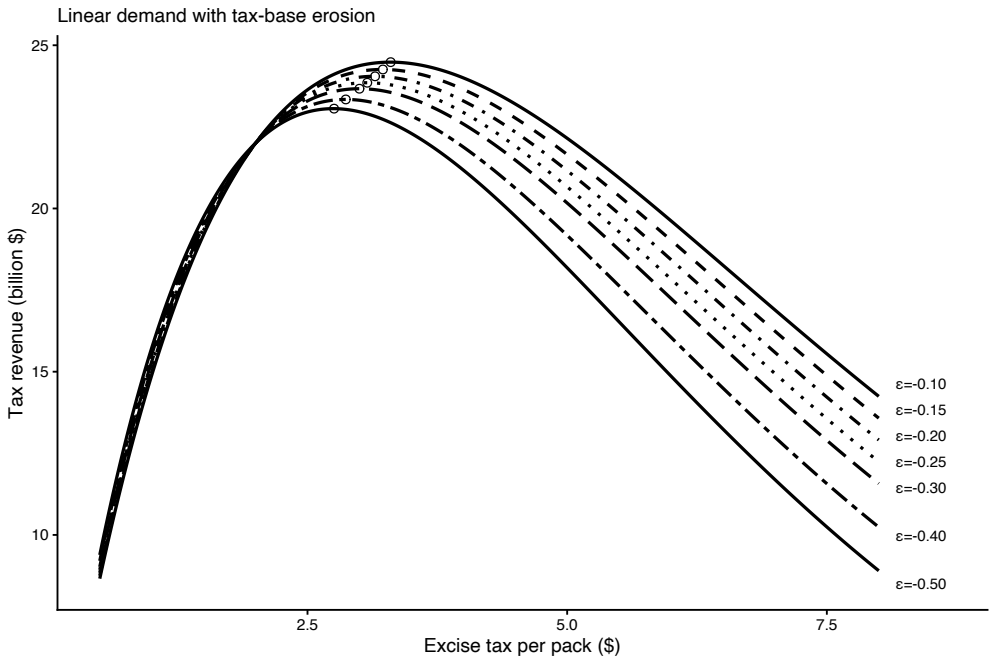


Figure A3: Simulated Laffer Curves for Cigarette Excise Taxation

As demand becomes more inelastic, the revenue peak shifts rightward because higher taxes generate less contraction in the taxable base. Once leakage channels are incorporated, the simulated revenue curves remain concave and display interior maxima over a plausible range of tax rates.

Interpretation and Limitations

The calibration highlights three mechanisms central to cigarette tax policy:

1. Revenue depends on retail price rather than the statutory tax alone.
2. Market leakage reduces taxable sales as taxes rise.
3. Revenue-maximizing taxes increase as behavioral responsiveness becomes more inelastic.

The framework is intentionally parsimonious. It abstracts from heterogeneity in pass-through, addiction dynamics, general-equilibrium feedback, and enforcement differences. Simulated tax levels should therefore be interpreted as illustrative comparative statics rather than normative policy recommendations.

Alternative Functional Form: Why Not Isoelastic Demand in Tax?

An alternative specification would model demand as isoelastic in the statutory tax:

$$Q(\tau) = Q_0 \left(\frac{\tau}{\tau_0} \right)^{\varepsilon}.$$

This formulation is analytically convenient but not well suited to the present exercise. Under this specification,

$$R(\tau) \propto \tau^{1+\varepsilon},$$

so for empirically relevant values $-1 < \varepsilon < 0$, revenue increases monotonically in τ and no interior maximum exists. The absence of a finite optimum arises because demand is modeled as responding directly to the tax rather than to the retail price, and because no choke price is imposed.

By contrast, the specification used here models demand in retail price and embeds tax-base erosion directly, yielding economically interpretable behavioral channels and interior revenue maxima more consistent with standard public-finance treatments of excise taxation.

Relation to Optimal Sin Tax Frameworks

The calibration isolates the revenue channel emphasized in the policy discussion. In the broader literature, optimal cigarette taxation reflects not only revenue needs but also the correction of externalities or internalities associated with addictive consumption (Gruber and Koszegi, 2002; Chaloupka et al., 2012). The welfare-maximizing tax depends on marginal social harm, behavioral bias, and heterogeneity in responsiveness, and therefore cannot be inferred from revenue considerations alone.

By holding these welfare components fixed, the present exercise maps empirically estimated responsiveness into fiscal capacity without imposing a full structural model of health harms or self-control problems. The resulting revenue peak should therefore not be interpreted as a Pigouvian optimum.

Behavioral Internalities and Taxation

Behavioral public-finance models emphasize that cigarette taxes may correct not only external health costs but also internalities arising from time-inconsistent preferences or self-control failures (Gruber and Koszegi, 2002). In these models, taxes can serve as commitment devices that help individuals curb present-biased consumption. Our empirical finding that responsiveness weakens during recessions is consistent with this perspective, in the sense that financial strain may reduce the effectiveness of price-based incentives. The calibration does not model internalities structurally, but it provides a simple mapping from weaker responsiveness to fiscal capacity. A full treatment of these mechanisms would require a dynamic structural model and lies beyond the scope of the present study. The calibration should therefore be interpreted as a reduced-form bridge between the empirical results and the broader behavioral sin-tax literature rather than as a substitute for welfare-based tax design.