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Independent and Interactive Effects of Smoking Bans and Tobacco Taxes on a Cohort of US Young Adults

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Abstract

Objectives—Most tobacco policy studies neither examine the impact of smoking bans and taxes on individual behavior over time nor consider their interactive effects, and often overlook city-level contexts. We examine the mutual effects of these policies on smoking among a longitudinal cohort of young adults.

Methods—Combining a repository of U.S. tobacco policies with the nationally-representative geocoded National Longitudinal Survey of Youth 1997 from ages 19–31 and Census data, we use multilevel logistic regression to examine the impact of tobacco policies on any current and daily pack smoking.

Results—For current smoking, we find significant effects for comprehensive smoking bans, but not excise taxes. We also find an interaction effect, with bans being most effective in locales with no/low taxes. For daily pack smoking, we find significant effects for taxes, but limited support for bans.

Conclusions—Social smoking among young adults is primarily inhibited by smoking bans, but excise taxes only deter such smoking in the absence of a ban. Heavy smokers are primarily deterred by taxes. While both policies impact young adult smoking behaviors, their dual presence does not intensify each policy's efficacy.

Keywords

young adult smoking; smoking bans; excise taxes

The denormalization of tobacco use in Western nations has led to declines in both smoking and its public acceptability.[1] Even with overall reductions in smoking, tobacco use remains the leading cause of preventable illness and death in the United States,[2] making assessment of the efficacy of particular policies on actual smoking behavior an imperative. Tobacco control policies have been described as intensifying the process of denormalization of

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smoking among young people.[3] The focus on young people is much deserved, as those who begin smoking at younger ages are at higher risk for smoking, particularly heavy smoking, as adults.[4–5] The identification of policies that affect smoking behavior among young people can have long-term implications for public health as those individuals age into later life.

Estimates suggest that tobacco control policies have likely impacted tobacco consumption in the aggregate.[6] A wide array of research has suggested that excise taxes and clean air policies are efficacious tobacco control policy tools, but these studies have come with several limitations that prohibit linking policy with actual individual-level behavior. For clean air policies, studies have inferred the effects of such prohibitions through cohort effects,[7] relied on cross-sectional data,[8–10] have not considered city-level policy,[9–13] or used data within a single locality.[14–15] Studies have also found robust effects of excise taxes on tobacco use.[10,12–13,16–29] We note, however, that most studies of excise taxes utilized either aggregate time-series or repeated cross-sectional data, and often at the state or national level. Thus, for both bans and taxes, the literature has yet to link policy contexts at the local level to a longitudinal dataset of the same individuals over time as well as account for potential interactive effects of these policies. Even studies using the same datasets utilized herein have not considered the interaction between smoking bans and excise taxes.[12]

The local level is critically important, yet often overlooked in studies of both clean air policies and excise taxes. Cities led the way in enacting smoking bans in the U.S, such that the diffusion of clean air regulations began at the local level and spread vertically up to the state in an unusual example of “bottom-up federalism.”[30] Chahine and colleagues suggested that, “contextual covariates play a larger role more locally, for example at the level of towns or neighborhoods. This may especially be the case for indoor smoking restrictions, which are highly variable within states.”[9:757] They later suggest that future research should consider contextual variables at the local level in order to “fully characterize social determinants of smoking variability across populations and places.”[9:758] Furthermore, although prohibited in some states, cities in several states may levy taxes on tobacco products in addition to those imposed by the state, creating similar variability on the issue of taxation. Thus, without accounting for the city-level, the policies to which an individual is subjected may be mischaracterized.

Our study overcomes the limitations of past studies by, first, combining a repository of all tobacco ordinances in the U.S. with a nationally representative annual survey of a single cohort of youth, allowing us to directly link a multilevel policy context to individual-level behavior over time in a manner not possible through aggregate or repeated cross-sectional data. Second, we consider the critical but underexplored policy context of the city-level. Third, no studies consider the independent and interactive effects of taxes and bans simultaneously. This is important as interaction analyses may lead to the identification of potential synergistic effects of tobacco policies. Thus, we utilize multilevel statistical modeling to identify the impact of these two important tobacco control policies on smoking behaviors over time in a nationally-representative sample of U.S. youth.

Methods

Individual-level data source

The individual-level data come from the National Longitudinal Survey of Youth 1997 (NLSY97). The NLSY97 has a large nationally representative, geocoded sample (*N*=8,984) designed to track the transition of youth into adulthood, with an oversample of Black and Latino youth. Adolescents from ages 12 to 16 were randomly sampled in 1997 and have been surveyed annually. The retention rate was nearly 83% in 2011. The restricted-access, geocoded NLSY97 identifies the respondents' core-based statistical area (CBSA; i.e. metropolitan or micropolitan area), county, and state. We analyzed a subset of respondents whose city of residence could be identified by combining CBSA and county information with a variable assessing whether the respondent lived in a principal city within the metro area. Thus, our analyses focus on those living in the largest principal city of a CBSA, given the importance of the local level within a broader multilevel policy context. We also restrict analyses to waves 2004 and later (ages 19–31), as this was the first year in which CBSA data is available. This subset amounts to 19,668 observations among 4,341 individuals within 487 cities. We note that respondents only contribute in years in which they live in these cities; that is, respondents move in and out of the defined subset. Among the subset of individuals that contribute at least once, 33.6% live in such a city within a CBSA in all years with valid data, while 59.6% live in such a city in at least half of all years with valid data.

Dependent Variables

Each year, respondents who indicated they ever smoked an entire cigarette were asked the number of days they had smoked during the 30 days prior to the interview, and the number of cigarettes they had smoked each day on those 30 days. We created two outcome variables based upon these self-reports: one indicating any cigarette use during the past 30 days (pooled mean=34.5%) and a second variable for heavy use for those who reported smoking at least a pack per day (pooled mean=4.9%).

Individual-Level Covariates

In all models, we included a considerable battery of control variables at both the individual-level and the city-level. Given that age is central to patterns of substance use among young adults, we chose age as our time metric,[31] including a quadratic term as this fit the data better than any other polynomial for age. Age in 1997 is also included in the models to control for cohort effects. We included several other individual-level risk factors for tobacco use in the models. Regarding family, we included time-varying indicator variables for whether the respondent lived with a parent, was married, and had children.[32–34] We also accounted for recent moves via a dummy variable for a past year move across at least one county. For work-related risk factors, we included time-varying categorical variables for job status and job schedule.[35] To assess peer-related influences, we included the percentage of peers who smoked in 1997, the only year it was measured.[36] For academic performance, we included a dummy variable for receiving "mostly A's" in high school.[37] To control for the respondent's mental health,[38] the dataset included a five-item scale for depression asking whether the respondent in the last month has been a very nervous person, felt calm and peaceful, felt downhearted and blue, has been a happy person, and felt so down in the dumps

that nothing could cheer you up, of which we use the 2004 baseline measure (alpha=0.77). To account for intergenerational health influences,[39–44] we included parents' self-reported health from 1997. We included several measures for socioeconomic status. We measured SES of household of origin by respondent-reported parents' education level.[45–47] The respondent's SES was assessed by a time-varying measure that combined school enrollment status and degree attainment.[32,37,47–48] Finally, we included controls for race/ethnicity,[49–50] U.S. nativity, and gender.[51] Appendix A, available as a supplement to the online version of this article, shows the descriptive statistics for all predictors and outcomes.

City-Level Data and Measures

City-level policy data come from the Americans for Nonsmokers' Rights Foundation (ANRF) tobacco policy database. ANRF collected a complete national repository of tobacco-related ordinances and regulations within the country by date. The main predictor variables are (1) whether or not the respondent lived in a city with a comprehensive smoking ban, defined as policies mandating that workplaces, bars, and restaurants are 100% smoke-free with no indoor exceptions (pooled mean=35.8%); and, (2) the total excise taxes in that locale (pooled mean=$1.26; s.d.=1.05). From the ANRF repository, we created a location-year dataset at the state- and city-level for each data year using the effective date for the policies. Since the state policies are not independent of city policy (i.e., a state ban automatically implies a city ban, and therefore, the dummy variables must match), we recoded cities in states with bans to reflect this status. Similarly, total excise taxes reflect the per pack sum of state taxes, from the Center for Disease Control and Prevention, and city taxes, from ANRF. Thus, all policy information is statistically at the city-level, but accounts for both state and local policies. We used FIPS codes to link the geocoded NLSY97 to ANRF data at the city-level, allowing us to determine the tobacco policy context within which respondents were located. Figure 1 displays both smoking bans and tax amounts by year for our respondents. There is a rapid increase over the observation period in both measures. The percentage living in a city with a comprehensive ban increased from 14.9% to 58.7% from 2004 to 2011, while average taxes increased from $0.81 to $1.65.

Several city-level measures from Census data are included as controls.[52] Census data come from the 2000 and 2010 decennial censuses, with linear interpolation for in-between years and official estimates used for 2011. To include both population size and density, we created a categorical measure of population, while density is considered continuous (logged due to skewness). We included the percentage of female-headed households, as a useful proxy for other economic measures such as poverty and income.[53] To measure ties to the community, we used the percentage of owner-occupied housing. Finally, we included the percentage of non-Hispanic whites and percentage of minors to account for community racial and age composition, respectively.

Methods

Given the various levels of analysis and a binary outcome, we used multilevel logistic regression models, also known as mixed effects models, to estimate the effects of clean air policies and excise taxes on young adult smoking. Although respondents can move across cities and thus the structure is more akin to a cross-classified model, the loss in precision of

the estimation of the variance components from using the typical multilevel structure is slight relative to the great computational advantage.[54:117] Among years spent within the subset located in the largest city within a CBSA, 15.3% were located among two cities, 2.3% among three, and 0.4% among four, such that the cross-classification of individual and city is of little consequence. Still, for robustness, we checked models for those who do and do not move and found similar results, and also included a fixed-effect in all models to adjust for the average effect of moving across geographic units since the last survey.

In our analysis using a typical hierarchical structure then, observations are nested within individuals, whom are nested within cities. Our three level model thus includes random intercepts for both the individual-level (Level 2) and the city-level (Level 3). These models adjust for the person- and city-level averages through a variance parameter that defines a normal distribution for each of those averages. At the lowest level of observation (Level 1), the predictors represent time-varying measures for both the city and the individual. At the individual-level, we have the time-invariant characteristics of the respondent. Because we do not include static city characteristics, the random intercept is the only term at Level 3. All models used the “xtmelogit” procedure in Stata 14.0, with the “margins” post-estimation command used to estimate predicted values. The study was approved by the university Institutional Review Board.

Results

Table 1 shows the coefficients from our models for our policy variables of interest (see Appendix B, available as a supplement to the online version of this article, for the full table with all control variables). According to Model 1 for the outcome of current smoking, even controlling for a robust set of covariates and excise taxes, there is a significant effect of comprehensive smoking bans. Those residing in cities with bans are 21.1% less likely to currently smoke. By comparison, there is no significant effect from taxes. Turning to Model 2, however, we find a significant interaction effect of the two tobacco policies, with the odds ratios for the interaction displayed in Figure 2. The main effect for excise taxes represents the slope for cities with no smoking ban. In such cities, an increase of $1 in taxes results in a 19.7% lower odds of individual-level current smoking ([1 – 0.803]*100% = −19.7%). The coefficient for bans now represents the effect when taxes are zero. In the absence of a tax then, the odds of currently smoking are 39.7% lower when a smoking ban is in effect. By the definition of an interaction effect, the sum of the excise tax main effect (−.220) and the interaction effect (.222) represents the slope for taxes in cities with a comprehensive smoking ban, which is virtually zero (−.220 + .222 = .002). In other words, taxes are of little consequence in cities with smoking bans, as reflected in the equal odds ratios for locations with comprehensive smoking bans in Figure 2. Figure 2, however, only displays the differences for a $1 increase in taxes. To understand the effect across the distribution of excise taxes, we display the predicted probability of current smoking by taxes and the presence of a ban in Figure 3. As reflected in the zero slope noted above, the tax effect in cities with bans is negligible. Relative to the line for cities without bans, the largest effect of bans occurs in cities with no to low excise taxes. The effect of the ban becomes smaller as taxes increase, such that the effect of a ban becomes negligible relative to a city without a ban when taxes are just over $2 per pack. We note that the shorter length of the line for

locales with no bans reflects the fact that the maximum excise taxes in such places is $3.40, compared to $5.85 for locales with a ban.

The results for smoking a pack daily are shown in Model 3. Without the interaction, we find the opposite effect in comparison with any current smoking: excise taxes significantly reduce the odds of daily pack smoking, while smoking bans do not. A $1 increase in taxes is associated with 17.9% lower odds of daily pack smoking. Model 4 shows that the interactive effect is non-significant, although the significant main effects are still informative, yet should be interpreted with caution. When taxes are zero, we again find a significant effect of smoking bans, such that those in cities with bans are 43.6% less likely to smoke a pack daily. Similarly, there is a significant reduction in daily pack smoking as taxes increase in cities with no bans (by 30.0% per $1), though the interaction term tells us that this slope is not significantly different in cities with smoking bans. We note that we also interacted the policy terms by time to determine if these effects vary across the period of observation; these terms were non-significant.

Discussion

These findings provide further evidence for the efficacy of comprehensive clean air policies and excise taxes as tobacco control tools. Yet, we find that their influence is dependent upon the form of smoking under consideration. Our results indicate that any smoking in the past 30 days among young adults is inhibited by comprehensive smoking bans. The outcome of any current smoking includes a large pool of young adults who smoke, but do not smoke at a daily pack level. This indicates that smoking bans may be most effective in deterring social smoking young adults, which may be an important point of early intervention. Given the interaction, comprehensive clean air policies are most pertinent as a tobacco control strategy in locations with low excise taxes. Excise taxes only deter such social smoking in the absence of a ban, and the impact eventually converges with that of smoking bans at high enough tax rates. This finding does not imply that bans are ineffective in high tax environments, but simply that the addition of higher excise taxes does not further deter young adult social smoking. By contrast, heavy smokers are primarily deterred by economic costs incurred through higher excise taxes. We also found limited support for the influence of bans on heavy smoking in places with no taxes, though given the non-significant interaction term, we interpret this finding with caution. Importantly, these policy effects were robust to the inclusion of a considerable battery of control variables at both the individual and city levels.

While both policies impact young adult smoking behaviors, their dual presence does not intensify each policy’s efficacy. In other words, smoking bans and high excise taxes together do not appear to have an additional effect beyond that of each policy in the absence of the other. This finding reiterates that either tobacco control policy can have some impact, as exemplified by the highest levels of smoking occurring in cities with low taxes and no smoking bans. Importantly, there are multiple policy pathways to reducing young people’s smoking, with variation depending on the outcome measure, giving policymakers several effective options for tobacco control. Further, even though the effect of bans and taxes on young adult smoking may converge at high enough tax levels, studies have found other

health benefits to passing comprehensive clean air policies, often related to reductions in secondhand smoke intake,[55–57] and excise taxes, such as reductions in prenatal exposure.[58] Yet, the uneven geographic distribution of these laws may reinforce health disparities given that these policies are more likely to be passed in locations with higher per capita incomes, higher education, and lower percentage of non-Hispanic Blacks after accounting for urbanity.[59–60] Considering that clean air policies both directly inhibit smoking and foster the denormalization of tobacco use, policymakers should work to ensure a fair distribution of such tobacco controls in order to promote the health of all.

We are careful to note limitations within our study. First, we only included young adults whose city we could identify. The subset of analyzed respondents is similar on almost all individual-level variables as the sample as a whole, with two exceptions. Given our focus on cities, unsurprisingly Blacks are somewhat overrepresented (34% in subset vs. 27% in whole sample), while Whites are underrepresented (40% vs. 50%) relative to the entire sample. The subset is also more likely to work. We are careful to limit our generalizability to young people living in such locales. Further, CBSAs were first measured in 2004, such that we examine ages 19–31. While restricting the data to age 19 and older, we do not view this restriction as negative given that this constitutes an age when young adults begin to frequent establishments, such as bars and nightclubs, with the most between-city variation in clean air policy and can legally purchase tobacco products. Additionally, members of the longitudinal cohort self-reported smoking behaviors, which may be subject to recall and social desirability biases, as is common in behavioral research.

This article has taken an important next step in the analysis of excise taxes and comprehensive clean air policies as a means of tobacco control among young adults. The strengths include directly linking policy and individual behavior over time, examining the important city-level policy context, and modeling the potential interactive impact of both policies. In sum, we find comprehensive smoking bans and excise taxes to be important forms of tobacco control for young people, but there appear to be no synergistic effects in locations with both policies. Further, each policy impacts a different form of tobacco use.

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Appendix A: Descriptive Statistics at Age 26

Variable	Percentage or Mean (SD)
City-Level	
Comprehensive ban	45.34%
Excise Tax	$1.43 (1.15)
Population	

Variable	Percentage or Mean (SD)
Less than 100,000	21.98%
100,000–250,000	17.70%
250,000–500,000	13.16%
500,000–1,000,000	19.48%
1,000,000 or greater	27.68%
Population density (persons/mi^2)	5,730.48 (6,860.56)
Owner-occupied housing (%)	50.09 (9.76)
Minors (%)	23.46 (3.48)
Female-headed households (%)	11.57 (3.48)
Non-Hispanic Whites (%)	47.81 (20.57)
Individual-Level	
Past 30 days any tobacco use	34.62%
Past 30 days smoked pack daily	5.34%
Gender: Female	50.52%
Race/Ethnicity	
White	39.87%
Black	34.28%
American Indian	0.72%
Asian or Pacific Islander	1.76%
Hispanic	21.94%
Other	1.43%
US native	95.84%
Age in 1997	
12	20.76%
13	20.51%
14	20.26%
15	20.05%
16	18.41%
Parents' education	
Less than HS	16.84%
High school	29.62%
Some college	24.52%
Bachelor's	29.02%
Parent health	
Good-Excellent	76.63%
Fair-poor	12.99%
No parent health info	10.38%
Baseline depression (0–15)	4.37 (2.45)
HS grades: mostly A's	12.45%
Peers smoking – 1997	
Almost none – less than 10%	28.47%
About 25%	21.80%

Variable	Percentage or Mean (SD)
About half – 50%	24.41%
About 75%	17.31%
Almost all – more than 90%	8.00%
Living with parent	21.83%
Education	
HS dropout	10.57%
HS or GED	25.08%
Some college, not enrolled	23.29%
Two-year degree	4.91%
Four-year degree	25.69%
Enrolled in HS	0.39%
Enrolled in college	10.07%
Moved between counties	12.55%
Employment status	
None	24.74%
Part-time	20.39%
Full-time	54.87%
Job schedule	
None	17.29%
Day	54.18%
Night	4.93%
Irregular	23.61%
Married	24.05%
Parent	45.00%

Note: We report descriptive statistics at age 26 to best represent all respondents in the sample given the rapid change in many of these variables from ages 19 to 31.

Appendix B: Multilevel Logistic Regression of Smoking Outcomes in NLSY97

	Any Tobacco Use				Pack Daily			
	Model 1		Model 2		Model 3		Model	
	Coefficient (SE)	OR	Coefficient (SE)	OR	Coefficient (SE)	OR	Coefficient (SE)	
City-Level								
Comprehensive ban	−0.224* (0.104)	0.799	−0.506** (0.170)	0.603	−0.281 (0.173)	0.755	−0.573* (0.279)	
Excise Tax	−0.039 (0.059)	0.961	−0.220* (0.104)	0.803	−0.197* (0.100)	0.821	−0.357* (0.157)	
Comprehensive ban * Excise Tax			0.222* (0.105)	1.249			0.231 (0.173)	
Population (vs. 100,000 or less)								
100,000–250,000	−0.216 (0.223)	0.806	−0.226 (0.224)	0.798	−0.142 (0.272)	0.868	−0.151 (0.271)	
250,000–500,000	−0.499 (0.279)	0.607	−0.507 (0.279)	0.602	0.411 (0.326)	1.508	0.402 (0.324)	

	Any Tobacco Use				Pack Daily			
	Model 1		Model 2		Model 3		Model 4	
	Coefficient (SE)	OR	Coefficient (SE)	OR	Coefficient (SE)	OR	Coefficient (SE)	OR
500,000–1,000,000	−0.308 (0.288)	0.735	−0.290 (0.288)	0.748	−0.299 (0.343)	0.742	−0.278 (0.339)	0.757
1,000,000 or greater	−0.210 (0.391)	0.811	−0.224 (0.392)	0.799	0.203 (0.451)	1.225	0.179 (0.446)	1.196
Population density (logged)	−0.021 (0.149)	0.979	0.025 (0.150)	1.025	0.060 (0.170)	1.062	0.092 (0.171)	1.096
Owner-occupied housing	0.020 (0.013)	1.020	0.019 (0.013)	1.019	0.007 (0.016)	1.007	0.007 (0.015)	1.007
Minors	−0.060 (0.034)	0.942	−0.054 (0.034)	0.947	−0.082 (0.043)	0.921	−0.076 (0.043)	0.927
Female-headed households	0.010 (0.033)	1.010	0.015 (0.033)	1.015	0.144*** (0.043)	1.155	0.145*** (0.043)	1.156
Non-Hispanic Whites	−0.003 (0.007)	0.995	−0.002 (0.007)	0.998	0.020* (0.009)	1.020	0.021* (0.009)	1.021
Individual-Level								
Gender: Female	−0.657*** (0.141)	0.518	−0.658*** (0.142)	0.518	−0.928*** (0.199)	0.395	−0.928*** (0.199)	0.395
Race/Ethnicity (vs. White)								
Black	−1.873*** (0.196)	0.154	−1.893*** (0.196)	0.151	−2.470*** (0.264)	0.085	−2.485*** (0.263)	0.083
American Indian	−0.235 (0.705)	0.791	−0.204 (0.706)	0.815	−1.936* (0.969)	0.144	−1.893* (0.965)	0.151
Asian or Pacific Islander	−0.283 (0.583)	0.753	−0.267 (0.584)	0.766	−2.783 (1.645)	0.062	−2.749 (1.637)	0.064
Hispanic	−1.398*** (0.224)	0.247	−1.388*** (0.224)	0.250	−2.668*** (0.344)	0.069	−2.662*** (0.343)	0.070
Other	1.289* (0.543)	3.628	1.293* (0.543)	3.644	−0.200 (0.718)	0.819	−0.208 (0.719)	0.812
US native	1.042* (0.411)	2.835	1.046* (0.411)	2.846	1.225 (0.905)	3.404	1.221 (0.902)	3.391
Age in 1997								
13	−0.580** (0.215)	0.560	−0.592** (0.215)	0.553	−0.369 (0.291)	0.691	−0.379 (0.291)	0.685
14	−0.402 (0.227)	0.669	−0.423 (0.227)	0.655	−0.778* (0.315)	0.459	−0.789* (0.315)	0.454
15	−0.423 (0.239)	0.655	−0.452 (0.240)	0.636	−0.663* (0.330)	0.515	−0.679* (0.330)	0.507
16	−0.038 (0.254)	0.962	−0.074 (0.255)	0.929	−0.796* (0.349)	0.451	−0.815* (0.350)	0.443
Parents' education (vs. < HS)								
High school	0.122 (0.235)	1.130	0.123 (0.235)	1.131	0.307 (0.317)	1.359	0.306 (0.316)	1.358
Some college	0.584* (0.247)	1.793	0.588* (0.248)	1.800	0.728* (0.335)	2.071	0.724* (0.335)	2.062
Bachelor's	0.523* (0.261)	1.687	0.533* (0.261)	1.704	0.183 (0.364)	1.201	0.183 (0.364)	1.201
Parent health (vs. Good-Excellent)								
Fair-poor	0.422* (0.213)	1.525	0.425* (0.213)	1.530	0.635* (0.272)	1.887	0.640* (0.271)	1.896
No parent health info	0.439 (0.248)	1.550	0.430 (0.248)	1.537	0.122 (0.348)	1.130	0.115 (0.347)	1.122
Baseline depression	0.288*** (0.028)	1.334	0.288*** (0.028)	1.334	0.137*** (0.036)	1.147	0.137*** (0.036)	1.147
HS grades: mostly A's	−1.148*** (0.225)	0.317	−1.147*** (0.225)	0.318	−1.710*** (0.451)	0.181	−1.698*** (0.450)	0.183
Peer smoking (vs. Almost none)								
About 25%	0.509* (0.202)	1.663	0.511* (0.202)	1.667	0.528 (0.292)	1.696	0.526 (0.292)	1.692
About half – 50%	0.872*** (0.209)	2.391	0.872*** (0.209)	2.392	0.833** (0.292)	2.300	0.832** (0.292)	2.298
About 75%	1.060*** (0.228)	2.887	1.058*** (0.228)	2.881	0.819** (0.313)	2.268	0.815** (0.313)	2.259
Almost all – >90%	1.391*** (0.297)	4.019	1.389*** (0.297)	4.011	1.435*** (0.375)	4.200	1.433*** (0.375)	4.191
Age	0.586*** (0.181)	1.797	0.637*** (0.183)	1.891	0.435 (0.312)	1.545	0.473 (0.314)	1.605
Age^2	−0.012*** (0.004)	0.988	−0.013*** (0.004)	0.987	−0.007 (0.006)	0.993	−0.007 (0.006)	0.993
Living with parent	0.058 (0.099)	1.060	0.060 (0.099)	1.062	0.073 (0.159)	1.076	0.072 (0.159)	1.075

	Any Tobacco Use				Pack Daily			
	Model 1		Model 2		Model 3		Model	
	Coefficient (SE)	OR	Coefficient (SE)	OR	Coefficient (SE)	OR	Coefficient (SE)	
Education (vs. 4-yr degree)								
HS dropout	3.434*** (0.256)	31.181	3.459*** (0.257)	31.785	4.402*** (0.468)	81.614	4.410*** (0.468)	
HS or GED	2.458*** (0.200)	11.678	2.475*** (0.200)	11.882	3.720*** (0.418)	41.264	3.731*** (0.418)	
Some college, not enrolled	1.805*** (0.177)	6.078	1.817*** (0.177)	6.153	2.907*** (0.405)	18.302	2.919*** (0.405)	
Two-year degree	0.850** (0.270)	2.341	0.864** (0.270)	2.373	1.697** (0.582)	5.458	1.697** (0.583)	
Enrolled in HS	3.740*** (0.466)	42.096	3.7774*** (0.466)	43.685	3.438*** (0.984)	31.125	3.469*** (0.984)	
Enrolled in college	1.070*** (0.161)	2.915	1.086*** (0.161)	2.962	1.935*** (0.412)	6.924	1.943*** (0.412)	
Moved between counties	0.155 (0.093)	1.168	0.155 (0.093)	1.168	−0.058 (0.159)	0.944	−0.063 (0.159)	
Employment status (vs. None)								
Part-time	0.165 (0.121)	1.179	0.160 (0.121)	1.174	0.254 (0.207)	1.289	0.250 (0.207)	
Full-time	0.082 (0.114)	1.085	0.080 (0.114)	1.083	0.223 (0.195)	1.250	0.223 (0.195)	
Job schedule (vs. None)								
Day	−0.179 (0.125)	0.836	−0.174 (0.125)	0.840	−0.313 (0.212)	0.731	−0.305 (0.212)	
Night	0.394* (0.178)	1.482	0.398* (0.178)	1.489	−0.083 (0.289)	0.920	−0.076 (0.289)	
Irregular	−0.208 (0.137)	0.812	−0.206 (0.137)	0.814	−0.229 (0.229)	0.795	−0.223 (0.229)	
Married	−0.624*** (0.112)	0.536	−0.629*** (0.113)	0.533	−0.433* (0.194)	0.649	−0.439* (0.194)	
Parent	0.169 (0.116)	1.185	0.164 (0.116)	1.178	0.266 (0.181)	1.305	0.260 (0.181)	
(Intercept)	−11.036*** (2.978)		−12.201*** (3.031)		−17.754*** (4.593)		−18.553*** (4.630	
Level 2 Variance	3.833 (0.094)		3.837 (0.094)		3.299 (0.146)		3.299 (0.146)	
Level 3 Variance	0.669 (0.130)		0.670 (0.131)		0.275 (0.264)		0.225 (0.324)	
Log Likelihood	−8095.673		−8093.448		−2599.158		−2598.271	

* $p<.05$;
** $p<.01$;
*** $p<.001$ (two tailed).

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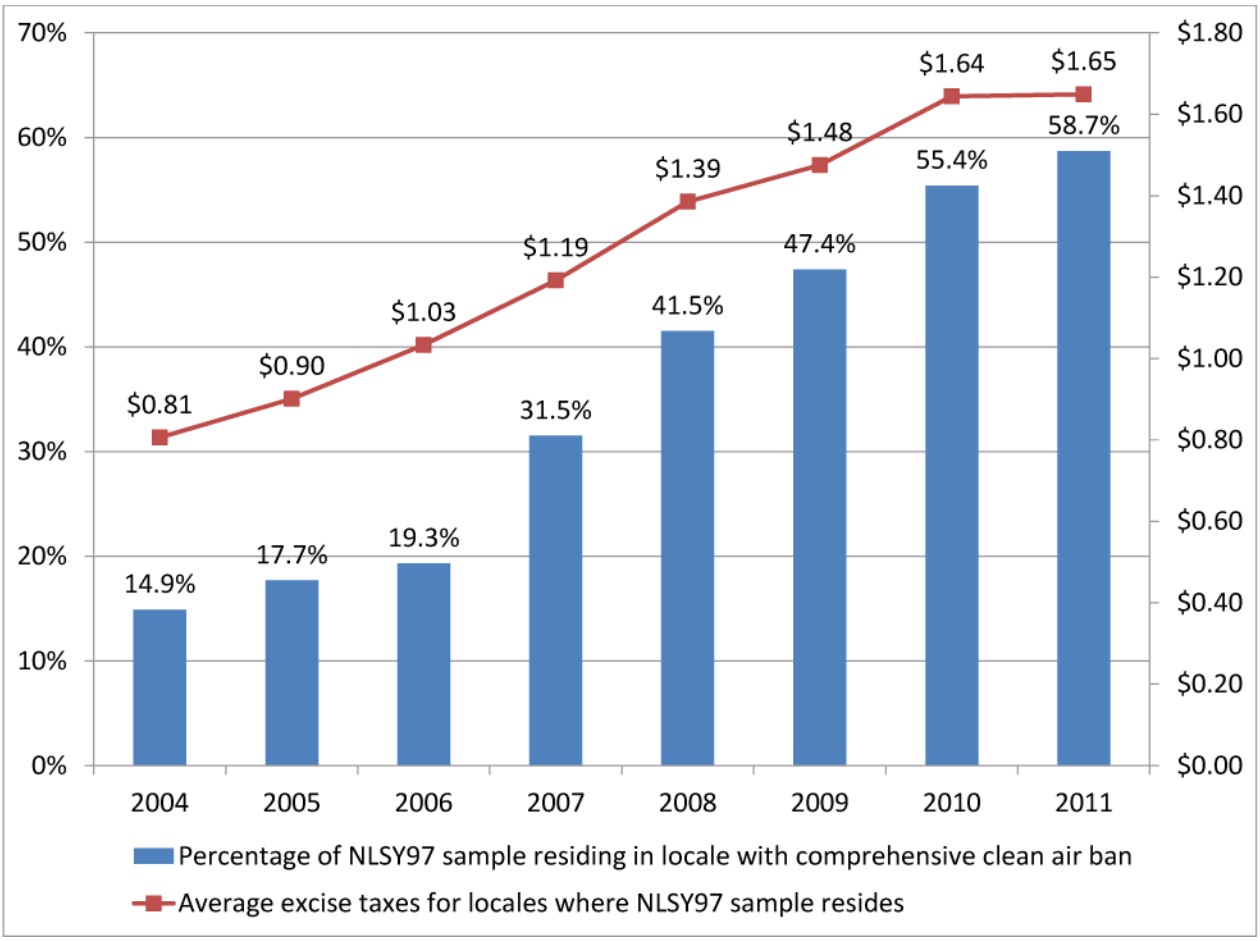

Figure 1.
Average Excise Tax and Percentage Subject to Comprehensive Clean Air Ban for NLSY97 Respondents by Year

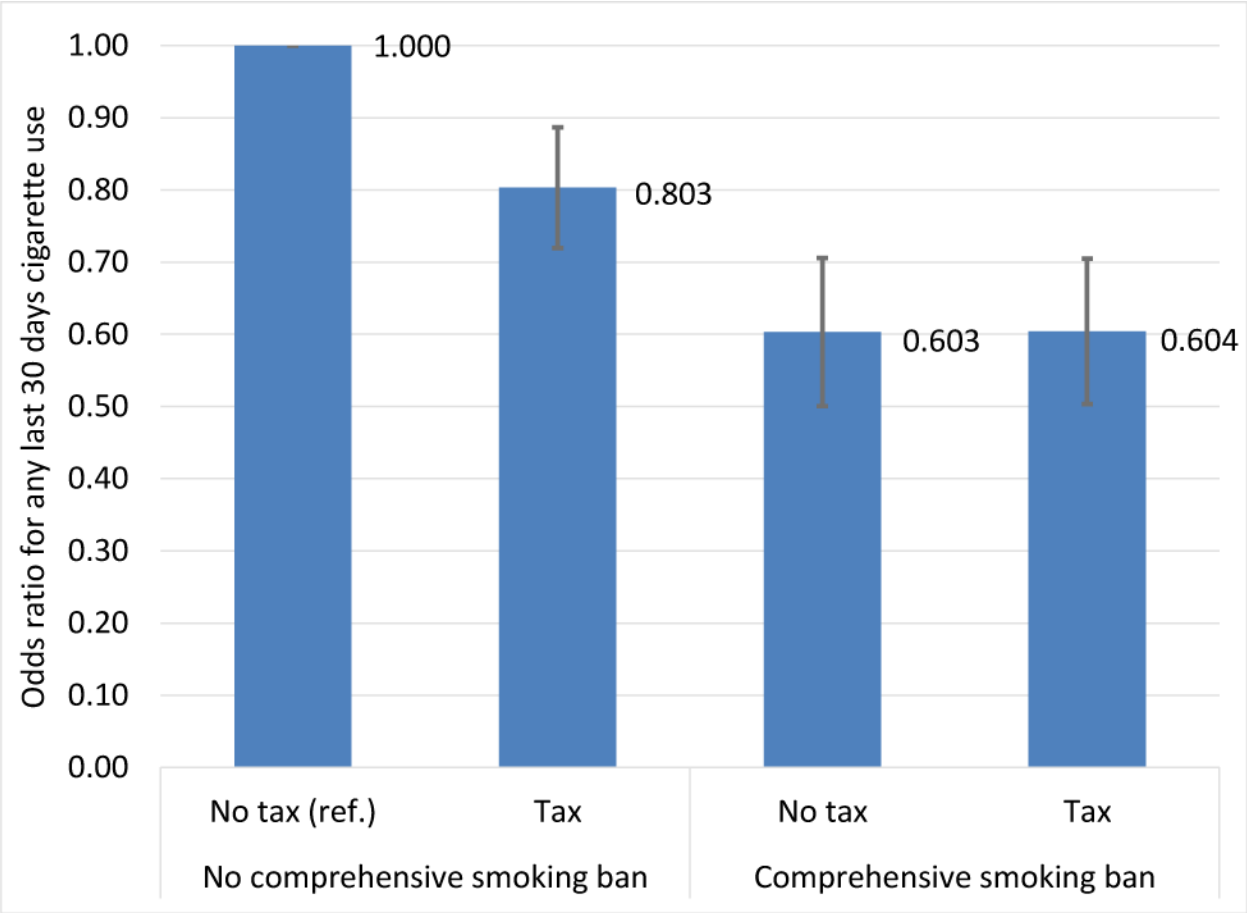

Figure 2. Odds Ratios for Interaction between City Comprehensive Smoking Ban and Tobacco Excise Tax

Note: Tax effect represents the difference for a $1 increase. The reference group is no tax, no comprehensive smoking ban. The error bars represent the 95% confidence interval for the odds ratio.

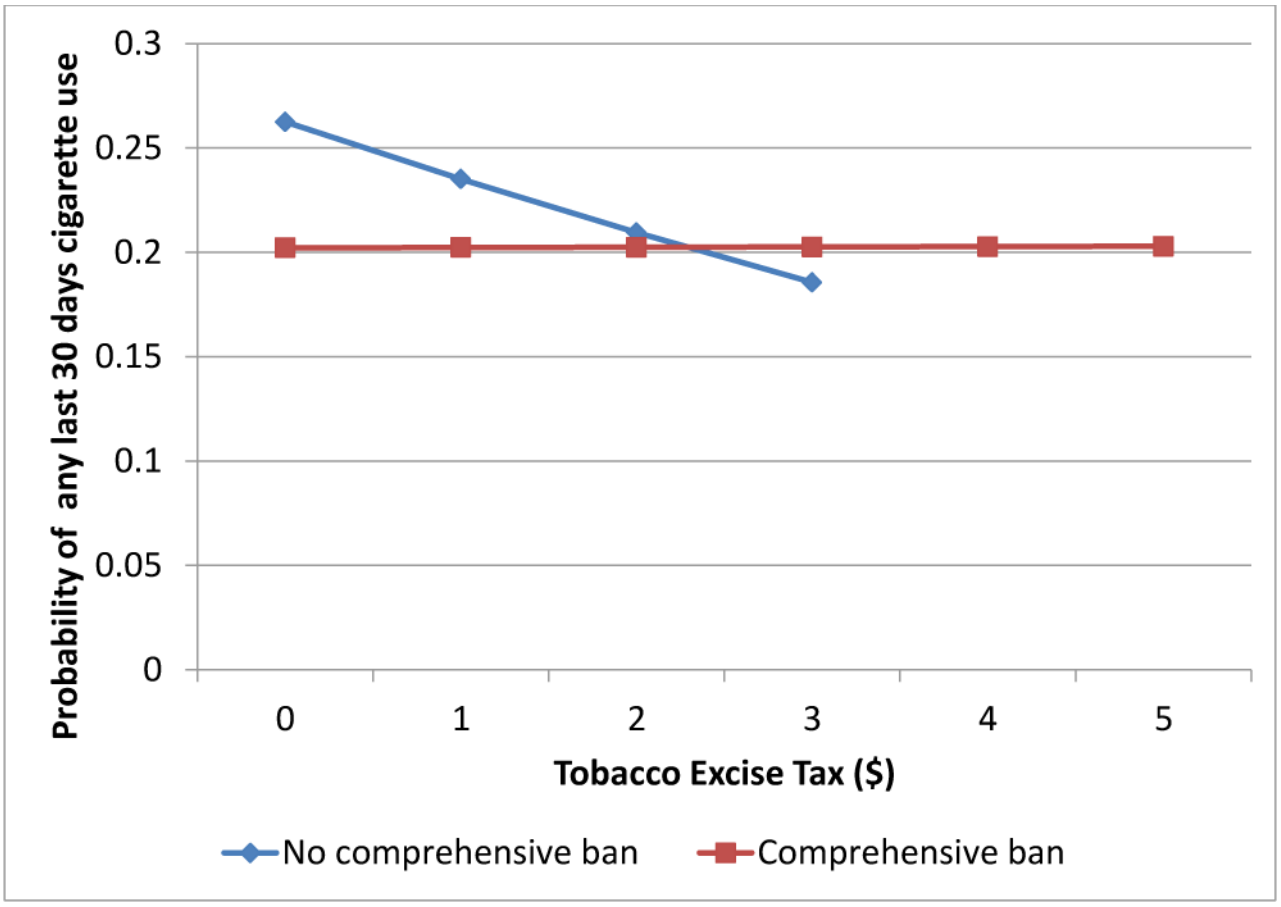

Figure 3. Interaction between City Comprehensive Smoking Ban and Tobacco Excise Tax

Note: The length of the line for locales with no comprehensive smoking bans is shorter to avoid extrapolation due to the lower maximum for taxes in such places ($3.40), compared to locales with bans ($5.85).

Table 1

Multilevel Logistic Regression of Smoking Outcomes

	Any Tobacco Use				Pack Daily			
	Model 1		Model 2		Model 3		Model 4	
	Coefficient. (SE)	Odds Ratio	Coefficient (SE)	Odds Ratio	Coefficient (SE)	Odds Ratio	Coefficient (SE)	Odds Ratio
Comprehensive smoking ban	−0.224* (0.104)	0.799	−0.506** (0.170)	0.603	−0.281 (0.173)	0.755	−0.573* (0.279)	0.564
Excise taxes ($)	−0.039 (0.059)	0.962	−0.220* (0.104)	0.803	−0.197* (0.100)	0.821	−0.357* (0.157)	0.700
Ban*Taxes			0.222* (0.105)	1.249			0.231 (0.173)	1.260
Level 2 Variance	3.833 (0.094)		3.837 (0.094)		3.299 (0.146)		3.299 (0.146)	
Level 3 Variance	0.669 (0.130)		0.670 (0.131)		0.275 (0.264)		0.225 (0.324)	
Log Likelihood	−8095.674		−8093.448		−2599.158		−2598.271	

* $p<.05$;

** $p<.01$;

*** $p<.001$ (two tailed).

Note: The displayed variance components account for the differences in averages on the outcomes across individuals (Level 2) and cities (Level 3).

Note: All models contain time-invariant controls for gender, race/ethnicity, US nativity, age cohort, parents' education, parent self-reported health, baseline depression, high school grades, and peer smoking in 1997; time-varying respondent controls for age, living with a parent, education, recent move between counties, employment status, job schedule, marital status, and parent status; and time-varying city control for population, population density, owner-occupied housing, percentage minors, female-headed households, and percentage Non-Hispanic Whites. See Appendix B, available as a supplement to the online version of this article, for the full model with all controls displayed.