The Distributional Effects of Tobacco Control Policies

On Adult Smoking Behavior

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Abstract

This paper uses quantile regression to estimate whether adult smokers' responses to tobacco control policies change across the distribution of smoking levels. I measure smoking behavior with the number of cigarettes smoked per day and also with serum cotinine levels, a continuous biomarker of nicotine exposure, using individual level repeated cross-section data from the National Health and Nutritional Examination Surveys. I find that higher cigarette excise taxes reduce smoking prevalence, and both higher cigarette prices and excise taxes reduce the number of cigarettes smoked per day among smokers. Using quantile regression, I find that the reductions in cigarette smoking are concentrated among the heaviest smokers. However, using serum cotinine levels, I find little evidence that cigarette excise taxes or prices affect smokers' intake of nicotine at any smoking level. I directly test whether the amount of nicotine smokers ingest from each cigarette is affected by tobacco control policies, and in fact I find evidence that the heaviest smokers consume more nicotine from each cigarette in response to higher cigarette prices. Additionally, I find evidence that smoke-free air laws in private workplaces and restaurants or bars are associated with reduced smoking prevalence, but not reductions in cigarette smoking or serum cotinine levels among smokers.

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I. Introduction

A large body of economic research finds that tobacco control policies decrease the number of cigarettes that smokers consume. However, although heavy smokers are almost four times more likely than light smokers to develop lung cancer and twice as likely to develop coronary heart disease, little research addresses whether light and heavy smokers respond differently to tobacco control policies (Hammond et al. 1976). Additionally, while a large body of medical literature suggests that smokers are adept at changing smoking habits to inhale a preferred amount of nicotine when faced with reductions in the available number of cigarettes, few economic studies account for this compensating behavior.

This paper aims to fill these two gaps in the economic literature. I use quantile regression to provide new evidence on how tobacco control policies, in particular cigarette prices, cigarette excise taxes, and smoke-free air laws, affect smokers' cigarette demand and intake of nicotine, and how the effects of tobacco control policies vary across the distribution of smoking levels. My data come from six waves of the National Health and Nutritional Examination Surveys (NHANES) covering the years 1988 to 1994 and 1999 to 2008. In addition to measuring smoking behavior through the number of cigarettes smoked per day, NHANES contains individuals' serum cotinine levels. Cotinine is a direct and continuous biomarker of smokers' intake of nicotine with a relatively long half-life in the body, and cotinine is a well-established bio-marker of smoking exposure in the medical literature.

I find that cigarette excise taxes are associated with reduced smoking prevalence, and both cigarette prices and excise taxes are associated with reductions in the quantity of cigarettes demanded by smokers. Moreover, using quantile regression, I find that the reductions in the number of cigarettes smoked per day are concentrated among heavier smokers. However, I find

little evidence that cigarette prices or excise taxes affect smokers' intake of nicotine at any smoking level, indicating that smokers compensate for reduced cigarette consumption by inhaling more nicotine from each cigarette by either switching to cigarette brands with higher nicotine contents or smoking each cigarette more intensely. In specifications that directly test whether smokers change the amount of nicotine they ingest from each cigarette in response to tobacco control policies, I find evidence that the heaviest smokers indeed ingest more nicotine from each cigarette in response to higher cigarette prices. I find that smoke-free air laws in private workplaces and restaurants or bars are associated with reductions in smoking prevalence, but I find little evidence that smoke-free air laws affect cigarette smoking or cotinine levels among smokers.

This study provides three main contributions to the literature. First, I use quantile regression to examine how the responses of smokers to tobacco control policies differ across the distribution of smokers. It is important for policy makers to understand how light and heavy smokers respond to tobacco control policies, because heavy smokers are much more likely to suffer adverse effects from smoking than light smokers. While heavy smokers are more likely to develop lung cancer and coronary heart disease, heavy smokers may also be more addicted to nicotine and thus have lower cigarette price elasticities. On the other hand, all else equal, cigarettes comprise a larger share of heavy smokers' budgets, so heavy smokers may have higher price elasticities. Second, I extend the literature estimating smokers' compensating behavior. Although smokers have a lot of control over how much nicotine they consume from each cigarette, only a few economic studies examine whether smokers compensate for tobacco control policies by ingesting more nicotine from each cigarette (Harris 1980; Benowitz et al. 1983a;

Benowitz and Jacob 1984; Benowitz et al. 1986b; Zacny and Stitzer 1988; Evans and Farrelly 1998; Farrelly et al. 2004; Adda and Cornaglia 2006, 2010).

The third contribution is that I provide direct estimates of how much smokers change the amount of nicotine they ingest from each cigarette in response to tobacco control policies. A few previous papers provide indirect estimates of smokers' compensating behavior through examining changes in the tar or nicotine contents of cigarettes or regressing the log of the ratio of smokers' cotinine levels and the number of cigarettes smoked per day on cigarette taxes (Evans and Farrelly 1998; Farrelly et al. 2004; Adda and Cornaglia 2006). However, indirectly measuring compensating behavior cannot account for changes in smokers' inhalation patterns, and neither method allows for an examination of whether compensating behavior differs between light and heavy smokers. I circumvent these problems by estimating specifications using serum cotinine concentration as the dependent variable and including the number of cigarettes smoked per day and interaction terms between the number of cigarettes smoked per day and the tobacco control policies as independent variables. In these specifications, the coefficients on the interaction terms show the effects of tobacco control policies on the amount of nicotine extracted from each cigarette. Also, as the dependent variable in these specifications is the serum cotinine concentration, these specifications naturally allow an examination of compensating behavior across the distribution of smoking levels.

The rest of this paper is organized as follows. Section II provides an overview of the relevant medical and economics research examining the effects of tobacco control policies on smoking outcomes, smoker compensation, cotinine, and the link between smoking intensity and mortality. Section III explains the identification strategy, Section IV describes the data sources used and summarizes the data set, Sections V, VI and VII review the results, and Section VIII concludes.

II. Background

Understanding whether heavy and light smokers respond differently to tobacco control policies is important because heavy smokers are more likely than light smokers to suffer adverse effects from smoking. In one of the landmark studies linking smoking to lung cancer, Hammond et al. (1976) find that while male smokers of less than 20 cigarettes a day are about four times as likely to die from lung cancer as non-smokers, male smokers of between 20 and 39 cigarettes a day are almost 15 times more likely to die from lung cancer as non-smokers. Smoking is also related to other diseases, including many other cancers and coronary heart disease. Compared to non-smokers, smokers of less than one half of a pack of cigarettes per day are 1.8 times more likely to develop coronary heart disease, smokers of one pack of cigarettes a day are two times more likely to develop coronary heart disease, and smokers of more than one pack a day are 3.2 times more likely to develop coronary heart disease (Pooling Project Research Group 1978).

Recent medical research suggests that biomarkers of smoking exposure are better predictors of adverse effects from smoking that self-reported smoking levels (Perez-Stable, Benowitz and Marin 1995; Boffetta et al. 2006). The amount of nicotine and harmful chemicals that may be ingested from a single cigarette varies widely, and it is smokers' intake of harmful chemicals, and not the number of cigarettes consumed, per se, that leads to adverse outcomes. Laboratory experiments document that smokers compensate for changes to preferred cigarette brands or number of available cigarettes by inhaling more deeply or smoking more of each cigarette (Benowitz et al. 1983a; Benowitz and Jacob 1984; Benowitz et al. 1986a; Benowitz et al. 1986b; Zacny and Stitzer 1988). Benowitz et al. (1986a) find when smokers who smoked on average 37 cigarettes per day were permitted to smoke only five cigarettes per day, a decrease of over 85

percent, they consumed three times as much nicotine per cigarette compared with their normal smoking exposure, and their nicotine intake only decreased by 50 percent.

In the economics literature, research on smoking focuses mainly on the effects of tobacco control policies on smoking behavior. With respect to taxes and prices, the literature has established a negative price elasticity of adult cigarette demand of around -0.4 at the mean number of cigarettes (Chaloupka and Warner 2000). With respect to the effects of smoke-free air laws, the economics literature is more mixed. Earlier studies tend to find that smoke-free air laws reduce smoking (Chaloupka 1992; Chaloupka and Saffer 1992; Evans, Farrelly and Montgomery 1999; Farrelly, Evans and Sfekas 1999; Tauras 2005, 2006). However, later papers find less evidence that smoke-free air laws reduce smoking (Carpenter 2009; Adda and Cornaglia 2010; Bitler, Carpenter and Zavodny 2010; Anger, Kvasnicka and Siedler 2011; Carpenter, Postolek and Warman 2011).

Despite the breadth of previous research, a few important areas remain largely unexplored. First, the economics literature largely ignores the potential heterogeneity in smokers' responses to tobacco control policies. A few papers in the economics literature do examine heterogeneous responses to tobacco control policies, but these papers largely focus on adolescent smokers and delineate smokers into categorical smoking levels. Ross, Chaloupka and Wakefield (2006), Liang and Chaloupka (2002) and Tauras (2005) categorize young adult smokers into groups based on the number of cigarettes smoked per day and find that prices and taxes have larger effects at higher levels of smoking. Their results are confirmed by Emery, White and Pierce (2001), who find that price only affects older, established smokers.[1] Consistent with the finding

[1] Katzman, Markowitz and McGeary (2007) and Emery et al. (1999) suggest that the reason for the heterogeneity in price elasticities among adolescents is due to a social market for cigarettes among adolescents, where many adolescents borrow cigarettes from their friends. Emery et al. (1999) find that adolescent smokers loan at most 10 cigarettes a month, and at roughly $0.13 a cigarette, the price of loaning cigarettes is likely not high.

that heavier smokers are more price sensitive, Katzman, Markowitz, and McGeary (2007) find that cigarette borrowers are lighter smokers than cigarette buyers. In contrast to the above studies, Fletcher, Deb and Sindelar (2009) find that finite mixture models delineate adolescents into two groups. One group is responsive to cigarette prices and another group is not. The responsive group smokes less than one cigarette per day while the unresponsive group smokes almost eight cigarettes a day.[2] Laporte, Karimova and Ferguson (2010) use quantile regression to estimate a rational addiction model of smoking. Using panel data from Canada, they find that forward looking behavior declines as smoking increases, indicating that heavier smokers are less forward looking than light smokers. Additionally, the authors find that price has an insignificant effect on cigarette consumption, although the study time period is limited, and the price may not have sufficient variation for identification. Lastly, Laporte, Karimova and Ferguson (2010) find that smoking restrictions at work reduce cigarette consumption, and the effect is most pronounced at the upper quantiles.[3]

In addition to heterogeneity in the responses to tobacco control policies, the economics literature only recently started examining the robustness of using the number of cigarettes smoked per day to measure smoking behavior. Evans and Farrelly (1998) find that although smokers living in states with higher cigarette excise taxes smoke fewer cigarettes, they tend to smoke cigarettes with higher tar and nicotine contents. The increase in tar and nicotine intake per cigarette completely offsets the reduction in tar and nicotine intake from smoking fewer

[2] A few papers also examine heterogeneity in adult smoking in the framework of consumer search for lower cigarette prices. Chiou and Muehlegger (2008) use data from the 2003 wave of the Current Population Survey Tobacco Use Supplement and find that heavy smokers are more likely to cross state borders to buy cigarettes in lower tax venues. DeCicca et al. (2010a) confirm these results using data from the 2003 and 2006-2007 waves of the Current Population Survey Tobacco Use Supplement. DeCicca et al. find suggestive evidence that excise taxes are passed on to consumers that engage in less searching, such as non-daily smokers.

[3] There is one additional paper that uses quantile regression to estimate the effects of cigarette prices on smoking outcomes. Goel and Ram (2004) use aggregate state per-capita cigarette sales and state average prices from 1993 to 1999 and find price elasticities ranging from -1.3 at the 25th quantile to -1.0 at the 75th quantile. However, the use of both state-level per-capita sales and state-level prices raises concerns about endogeneity.

cigarettes. Farrelly et al. (2004) use longitudinal data from the COMMIT project and also find that smokers facing higher cigarette prices decrease the number of cigarettes smoked but increase the tar and nicotine content of the cigarettes to keep daily estimated nicotine intake unchanged.

However, using cigarette characteristics cannot take into account changes in how smokers smoke each cigarette and may provide an incomplete picture of smokers' responses to cigarette excise taxes. Another way to measure smoking behavior is through biomarkers of nicotine intake. The most popular biomarker of nicotine exposure is the level of cotinine in an individual's system. Cotinine is the major metabolite of nicotine, and approximately 70 percent of ingested nicotine is converted into cotinine (Benowitz and Jacob 1994; Benowitz et al. 1994). Although nicotine is rapidly metabolized by the body, with a half-life of about two hours, cotinine has a much longer half-life of about 16 to 20 hours. Smokers often have a fairly stable level of cotinine in their systems which does not vary much during the day or even across days (Kemmeren et al. 1994). Measuring smoking levels through cotinine offers several advantages over measuring smoking through the self-reported number of cigarettes smoked. As noted above, smokers can vary the amount of nicotine and harmful chemicals they ingest from each cigarette. Since cotinine measures the amount of nicotine metabolized, it is a direct measure of nicotine intake. Moreover, cotinine is not a self-reported measure and is robust to underreporting, misremembering, or rounding of the self-reported number of cigarettes smoked. Cotinine levels have been used in the medical and epidemiology literature since the 1970s to measure smoking behavior (Williams et al. 1979; Benowitz et al. 1983a; Benowitz et al. 1983b; Benowitz and Jacob 1984; McNeill et al. 1987; Blackford et al. 2006; Benowitz et al. 2009).

Despite its popularity in the medical and epidemiology literature, Adda and Cornaglia (2006) is the only paper in the economics literature to use cotinine as a measure of smoking behavior. Adda and Cornaglia (2006) use NHANES data from 1988 to 1994 and 1999 to 2000 and serum cotinine as a measure of nicotine intake.[4] They find that while increased cigarette excise taxes decrease the number of cigarettes smoked, cigarette excise taxes do not change the average level of serum cotinine found in smokers. Adda and Cornaglia (2006) also construct a ratio of the serum cotinine level and the number of cigarettes smoked to measure smoking "intensity," and they find that increased cigarette excise taxes increase this measure of smoking intensity.

Many aspects of the economics literature examining smoker compensation warrant reexamination. First, these studies generally use data ending in 2000. As I document below, cigarette excise taxes and prices have changed dramatically in the past decade, providing more variation to identify effects. Second, the few economics papers examining smokers' compensation do not examine the effects of smoke-free air laws. Conceptually, smoke-free air laws could be thought of as an increase in the full price of smoking a cigarette. Instead of an increase in the monetary price of a cigarette, smoke-free air laws increase the opportunity cost, as smokers must go outside to smoke during work or while at a restaurant or bar. If smokers reduce the number of cigarettes they consume because of smoke-free air laws, they may offset that reduction by smoking more intensely.[5] Third, these studies measure the effects of tobacco control policies at the mean. If smokers respond differently to tobacco control policies based on

[4] Adda and Cornaglia use a subsample of publicly-available NHANES data covering 1988 to 1994 from respondents living in counties with more than 500,000 residents. A recent working paper by Abrevaya and Puzzello (2010) finds that Adda and Cornaglia's results are unstable when the sample is increased to all respondents in the applicable NHANES waves.

[5] Farrelly et al. (2004) provide some empirical evidence that smoke-free air laws could affect smokers' compensating behavior. They find that an index of community-level clean air regulations decreases the tar and nicotine contents of smokers' cigarettes.

their smoking level, estimating effects at the mean could provide an incomplete picture of how smokers respond to tobacco control policies.

III. Identification Strategy

To identify the effects of changes in tobacco control policies on smoking behavior, I use a two-part model. I split smoking behavior into an individual's decision to smoke, and given that an individual smokes, that individual's smoking level. I model the decision to smoke separately from the decision of how much to smoke because a large percent of my sample does not smoke. Not accounting for the large number of non-smokers in the sample could lead to biased coefficients. Moreover, the two-part model allows me to examine whether tobacco control policies affect smoking behavior through the extensive margin or the intensive margin.

The first part of the model estimates a linear probability model of the decision to smoke for individual *i* in state *j*, quarter *q* and year *t*:

$$E(Smk|x) = \alpha_0 + \alpha_1 P_{jqt} + \alpha_2 SFA_{jqt} + \alpha_3 X_{ijqt} + \mu_s + \delta_t + \gamma_q \,, \qquad (1)$$

where Smk is an indicator variable for whether an individual is a current smoker, P is a measure of the monetary price of smoking, SFA measures smoke-free air laws, X is a matrix of individual and geographic characteristics, and μ_s, δ_t, and γ_q are state, year and quarter fixed effects. Next, I model the decision of how much to smoke given smoking participation. I first estimate an ordinary least squares regression model conditional on smoking participation,

$$E(Y|Smk = 1; x) = \beta_0 + \beta_1 P_{jqt} + \beta_2 SFA_{jqt} + \beta_3 X_{ijqt} + \mu_s + \delta_t + \gamma_q \,, \qquad (2)$$

where Y is the smoking behavior of interest for an individual conditional on that individual smoking, and the other variables are as defined above. I cluster the standard errors at the state

level in all linear probability and ordinary least squares specifications (Bertrand, Duflo and Mullainathan 2004).

Equation (2) will estimate changes in the conditional mean of the smoking outcome of interest, but it is possible that smokers of different smoking levels may respond differently to tobacco control policies. Since equation (2) does not allow the coefficients to vary across the distribution of the smoking dependent variables, I use quantile regression to estimate the impacts of tobacco control policies over the distribution of smoking behaviors. First developed by Koenker and Bassett (1978), quantile regression predicts the quantiles of a conditional distribution as a function of explanatory variables instead of predicting the conditional mean as a function of the explanatory variables. For quantile τ of the conditional distribution of a smoking outcome, *Y*, the quantile regression model can be written as,

$$Q_{(Y|Smk=1)}(\tau|x) = \beta_{0\tau} + \beta_{1\tau}P_{jqt} + \beta_{2\tau}SFA_{jqt} + \beta_{3\tau}X_{ijqt} + \sigma_{s\tau} + \phi_{t\tau} + \eta_{q\tau}. \qquad (3)$$

In Equation (3), the marginal effect of a change in cigarette monetary cost on the conditional quantile function is $\frac{\partial Q_{(Y|Smk=1)}(\tau|x)}{\partial P} = \beta_{1\tau}$, so in Equation (3) the marginal effects of the explanatory variables may change for each conditional quantile, τ, of the smoking outcome. I estimate quantile regressions at every 5th quantile between the 5th and 95th quantiles and calculate standard errors using 299 bootstrap replications.[6]

Aside from allowing the marginal effects to change across the distribution of the dependent variable, quantile regression offers other advantages. First, quantile regression is more robust to outliers than ordinary least squares. Second, quantile regression uses the entire distribution of the outcome variable to calculate the coefficients at each quantile. Other avenues to calculating heterogeneous marginal effects, such as running separate OLS regressions over different parts of

[6] The number of bootstrap replications should be chosen so that $\alpha(N+1)$ is an integer, where α is the level of the test and N is the number of bootstrap replications (Davidson and MacKinnon 2000).

the distribution of the dependent variable, exclude information by segmenting the dependent variable. Along the same lines, quantile regression does not split the dependent variable into categories as in a generalized ordered logit model. Thus, quantile regression preserves all the within-category information lost through categorization. Lastly, while quantile regression estimates coefficients across the distribution of the dependent variable, quantile regression also preserves a parametric framework. Unlike non-parametric estimation, the parametric framework of quantile regression makes estimation feasible in a situation with many thousands of observations and many independent variables.

IV. Data

A. Tobacco Control Policies

The tobacco control policies I focus on are the monetary cost of cigarettes and smoke-free air laws. To measure the monetary cost of cigarettes, I run separate models using cigarette prices and cigarette excise taxes. Cigarette prices are the most direct measure of cigarette cost and include more information than cigarette excise taxes (Chou, Grossman and Saffer 2004, 2006). However, prices may be related to aggregate state characteristics that determine cigarette demand and thus endogenous (Gruber and Frakes 2006). Cigarette excise taxes, while potentially politically endogenous, likely suffer from less bias than cigarette prices. Moreover, the effects of cigarette excise taxes on smoking behaviors measure what policy makers control.

I use state-level cigarette price and excise tax data compiled by the Tax Burden on Tobacco (TBOT) output by Orzechowski and Walker (2009).[7] I transform the cigarette prices into the real (2009 dollars) average annual price paid for a pack of cigarettes. I transform the taxes into the

[7] I add city taxes for municipalities and counties which make up large proportions of their respective state populations. I add excise taxes for the five counties which comprise New York City, NY; Cook County, IL; Anchorage and Juneau, AK; Arlington and Fairfax Counties, VA; and Cuyahoga County, OH.

real quarterly state cigarette excise taxes paid on a pack of cigarettes and add imputed taxes from the 1998 Master Settlement Agreement between state attorneys general and tobacco manufacturers (Lillard and Sfekas 2010).[8] I measure smoke-free air laws in three common venues: private workplaces, restaurants and bars using data from Project ImpacTeen. ImpacTeen records the presence of smoke-free area laws in different venues for each state, and I construct indicator variables denoting whether a state has smoking restrictions in private workplaces and restaurants or bars in each year.[9]

Figure 1 shows a time series of changes in tobacco control policies from 1988 to 2008. Both prices and taxes rose through the sample period, but prices and taxes both rose rapidly after the Master Settlement Agreement in 1998. The average cigarette excise tax rose from $0.83 in 1998 to $1.92 in 2008, and the average price rose from $2.85 in 1998 to $4.50 in 2008. As with cigarette excise taxes, the prevalence of smoke-free air laws increased after the 1998 Master Settlement Agreement. The prevalence of smoke-free area laws in private workplaces, and restaurants or bars increased from 51 percent and 59 percent, respectively, in 1998 to 75 percent and 81 percent, respectively, in 2008.

B. NHANES Data

I use six waves of the NHANES data sets covering 1988 to 1994 and 1999 to 2008. NHANES is a cross-sectional survey of health and nutritional information conducted by the CDC which combines surveys, physical examinations, and laboratory measurements. NHANES III, conducted between 1988 and 1994, consists of about 33,000 respondents. Starting in 1999,

[8] The Master Settlement Agreement required cigarette manufacturers to pay into an escrow account an amount proportional to the number of cigarettes they sell. As Lillard and Sfekas point out, including the implicit taxes from the MSA will not change the tax coefficients if year fixed effects are included in the model, but they will affect calculated elasticities.

[9] The ImpacTeen data is available at http://www.impacteen.org/tobaccodata.htm. I aggregate the restaurant and bar SFA laws because all states with bar SFA laws also have restaurant SFA laws.

NHANES switched to releasing waves every two years. Each wave is nationally representative and contains about 10,000 individuals.

I define a respondent as a current smoker if the respondent reports they have smoked cigarettes in the past 30 days.[10] I construct two main variables to measure smoking behavior among current smokers. First, I measure the average number of cigarettes smoked per day by multiplying the reported number of cigarettes smoked per day on the days respondents smoked in the past 30 days by the percent of days the respondent smoked in the past 30 days. Second, I use the level of serum cotinine, collected by NHANES, measured in nanograms per milliliter. NHANES collects blood samples from individuals age three and older as part of its examinations, and the samples are sent to the CDC for analysis. Serum cotinine levels as low as 0.035 ng/ml can be detected in the NHANES data.

C. Demographics

State and county of residence information for the NHANES data is available through the NCHS Restricted Data Center which allows me to merge the tobacco control policy information and geographic characteristics with the individual level data. NHANES provides detailed demographic characteristics, and using these I include variables for gender, age, race, ethnicity, height, marital status, family income, and education.[11]

[10] I remove individuals who self-report as non-smokers but have serum cotinine levels above 10 ng/ml, a common cutoff in the medical literature to distinguish between smokers and non-smokers. I retain individuals who self-report as smokers but have serum cotinine levels below 10 ng/ml as to not remove light smokers from the analysis.

[11] One drawback of the NHANES data is that the 2005-2006 and 2007-2008 survey waves do not contain information on an individual's occupation. Omitting occupation variables should not bias the coefficients on tobacco control policies as long as an individual's occupation is not related to aggregate-level tobacco control policies. However, omitting occupation information could increase the standard errors of the coefficients. Additionally, the other demographic variables included in the regression models should proxy for much of the variation contained in an individual's occupation category. To check this, I ran simple regressions using as outcome variables an indicator variable for whether an individual was employed, and given employment, that individual's employment category and using as explanatory variables the other demographic controls. These regressions yielded adjusted r-squared statistics of around 0.35. Nonetheless, I tested the robustness of my results to excluding the 2005-2006 and 2007-2008 survey waves and including occupation information and found similar results both in magnitude and statistical significance.

Additionally, previous research suggests that omitting state anti-smoking sentiment may bias the coefficients of tobacco control policies, as anti-smoking sentiment may both drive the adoption of tobacco control policies and reductions in smoking outcomes (DeCicca et al. 2008). I follow the methodology of DeCicca et al. (2008) to construct a measure of state anti-smoking sentiment, and I include this measure in all models.[12]

Previous research also suggests that cigarette smuggling may bias the coefficients of cigarette prices and taxes (Baltagi and Levin 1986; Baltagi and Goel 1987; Chiou and Muehlegger 2008; Colman and Remler 2008; Chiou and Muehlegger 2010; DeCicca, Kenkel and Liu 2010). To account for cigarette smuggling, I use each individual's county of residence and calculate the difference between the cigarette price or excise tax and the price or excise tax in the nearest state with a lower cigarette price or excise tax. I include this tax or price difference in all models.

D. Summary Statistics

Table 1 shows summary statistics for the sample. After removing all individuals with missing values on demographic controls and all individuals indicating the use of other tobacco products, 33,201 individuals remain, 7,874 of which are current smokers.[13] Table 1 shows that smokers are

[12] I use questions about attitudes towards smoking in various places to measure anti-smoking sentiment from the 1992-1993, 1995-1996, 1998-1999, 2000-2001, 2002-2003, and 2006-2007 waves of the Current Population Survey Tobacco Use Supplement (TUS-CPS). The TUS-CPS is a nationally representative sample of tobacco use covering about 240,000 individuals in each survey period. For restaurants, bars and cocktail lounges, work places, and sporting events, respondents answer whether they think smoking should be allowed in all areas, allowed in some areas, or not allowed at all. Lastly, respondents answer whether smoking is allowed anywhere inside their home, in certain areas inside their home, or not allowed at all inside their home. I combine the answers to these questions into one latent variable using factor analysis, and I find that one latent factor best explains the variation of the five smoking attitude questions. I compute this latent variable for each respondent, take the average of the latent variable for each state and year, and linearly impute missing year and state observations. DeCicca et al. (2008) also include questions pertaining to smoking in hospitals and shopping malls, as well as whether cigarette companies should be allowed to give away free samples or advertise. However, more recent versions of the TUS-CPS do not consistently ask these questions. To check whether using five variables rather than nine materially changed results, I ran a regression of the anti-smoking index using the nine variables on the anti-smoking index using the five variables. The t-statistic on the five variable index is 73.46 and the r-squared is 0.97.

[13] The total number of individuals interviewed in the NHANES surveys is 85,617. However, NHANES does not interview individuals in all 50 states in each survey cycle. There are ten states that contain interviews in only one year and two years containing interviews from only one state. I drop these 4,334 observations, as including state and year fixed effects necessitates that each state span at least two years and each year span at least two states. Of the

generally younger, less likely to be married, and less educated. While men and African Americans are more likely to smoke, Hispanics are less likely to smoke. Current self-reported smokers smoke about 16 cigarettes per day and have an average cotinine concentration of about 217 ng/ml compared with an average concentration of 0.26 ng/ml for self-reported non-smokers. Cotinine works well in distinguishing smokers from non-smokers. Figure 2 shows the kernel density functions for the log of the cotinine concentration for current smokers and current non-smokers. The density function for cotinine is clearly bi-modal with a mass at low cotinine concentrations for self-reported non-smokers and a mass at higher cotinine levels for self-reported smokers. Cotinine also matches well to the number of cigarettes individuals smoke. Figure 3 shows a scatter plot of the total number of cigarettes self-reported smokers consumed over the past 30 days compared with the individuals' log cotinine levels.

V. OLS Results

Table 2 shows baseline results from the regressions described in Equations (1) and (2) to test the impact of tobacco control policies on smoking outcomes. Table 2 has nine columns. The first three columns show regressions including smoke-free air law variables in both private workplaces and restaurants or bars. The first column reports coefficients from a linear probability model on whether an individual is a current smoker, and the second and third columns report coefficients from OLS regressions using as dependent variables the average number of cigarettes smoked per day and the serum cotinine level, conditional on current smoking participation, respectively. In the top panel, the independent variables of interest are the real average cigarette price and indicator variables for the presence of smoke-free air laws in private workplaces and

81,283 remaining observations, 36,489 are over age 20 and contain information on smoking and geographic residence. Just over 2,500 individuals in the sample report using other tobacco products which include cigars, pipes, chewing tobacco, snuff and nicotine gum.

restaurants or bars. The bottom panel shows results analogous to the top panel, but replaces the average real cigarette price with the average real cigarette excise tax in each state. All regressions also control for gender, age, age squared (divided by 100), race, ethnicity, education, income-to-poverty ratio, whether the serum cotinine sample was drawn on a weekday or weekend, the time of day the serum cotinine sample was drawn (morning, afternoon, or evening), marital status, state unemployment rate, state anti-smoking sentiment, the difference between the state's cigarette price or cigarette excise tax and the nearest lower price or tax in surrounding states, and state, year and quarter fixed effects. The standard errors are clustered at the state level (Bertrand, Duflo and Mullainathan 2004), and t-statistics are shown in parentheses.

The results in column one show that cigarette excise taxes are negatively and stastically significantly related to smoking prevalence, and although cigarette prices are negatively related, the coefficients are not statistically significant. A $1.00 increase in cigarette excise taxes is related to a 2.4 percentage point decrease in smoking prevalence. In column two, both cigarette prices and cigarette excise taxes are negatively related to conditional cigarette demand. For smokers, a $1.00 increase in cigarette prices is associated with a 1.7 cigarette decrease in the average number of cigarettes smoked per day, and a $1.00 increase in cigarette excise taxes is associated with a 1.1 cigarette per day decrease. Since the smoking prevalence is 25 percent, the tax coefficient from the linear probability model translates to a semi-elasticity of roughly -0.10. For the conditional demand models, the conditional price semi-elasticity for the number of cigarettes smoked per day is -0.12, and the tax semi-elasticity is roughly -0.08. These conditional price and tax semi-elasticities are consistent with previous estimates from the literature, for example tax elasticities of -0.15 and -0.14 from Evans and Farrelly (1998) and -0.15 from Adda and Cornaglia (2006).

While cigarette prices and excise taxes are negatively related to the average number of cigarettes smoked per day for smokers, there is no evidence that prices or excise taxes affect cotinine levels. A $1.00 increase in cigarette prices leads to a decrease in cotinine concentration of 8.1 ng/ml, and a $1.00 increase in cigarette excise taxes leads to a decrease of 8.5 ng/ml. However, the coefficients are not significant at conventional levels. The insignificant coefficients support previous research that argues that smokers' compensation undercuts the effects of cigarette excise taxes and prices (Evans and Farrelly 1998; Farrelly et al. 2004; Adda and Cornaglia 2006).

In columns one and two, smoke-free air laws are not related with either smoking participation or conditional cigarette demand. Column three suggests that smoke-free air laws affect cotinine concentrations in divergent ways. In column three, smoke-free air laws in private workplaces increase cotinine concentrations while smoke-free air laws in restaurants or bars decrease cotinine concentrations. To test whether these results could be due to multicollinearity among the smoke-free air laws in the sample, I calculated variance inflation factors and correlation coefficients for the smoke-free air law variables. In the linear probability model, the variance inflation factors for the private workplace and restaurant or bar smoke-free air laws are 45 and 46, respectively, and in the OLS specifications the variance inflation factors are both 39. The high variance inflation factors are supported by correlation coefficients of approximately 0.75 between the two smoke-free air law variables.

Thus, I re-estimate the models from columns one through three using each smoke-free air law variable separately. Columns four through nine in Table 2 show results from these regressions. The effects of cigarette prices and excise taxes are very similar to the first three columns. The tax semi-elasticity for participation is -0.10, and the price and tax semi-elasticities

for conditional cigarette demand are -0.12 and -0.07 (The semi-elasticities for the coefficients in Tables 2 through 6 are displayed in Table 7). However, now both private workplace and restaurant or bar smoke-free air laws are negatively associated with smoking prevalence. The presence of either category of smoke-free air law is associated with a 2.2 to 2.6 percentage point reduction in smoking prevalence, depending on the specification. Neither category of smoke-free air law affects conditional cigarette demand or cotinine concentration.

In models not shown but available upon request, I re-estimate Table 2 using different specifications to check the robustness of the findings. First, I re-estimate the linear probability models using logistic models. The marginal effects of cigarette excise taxes are similar to the coefficients in the linear probability model and statistically significant at the five percent level. As in Table 2, cigarette prices are not statistically related to smoking prevalence. In the logit regressions, private workplace smoke-free air laws are negatively related to smoking prevalence both with and without including restaurant or bar smoke-free air laws, while restaurant or bar smoke-free air laws are negatively related with smoking prevalence in specifications without private workplace smoke-free air laws.

Next, I re-estimate Table 2 using NHANES survey weights. Cigarette prices are not associated with a decrease in smoking prevalence, but a $1.00 increase in cigarette prices leads to a 2.2 cigarette decrease in the conditional demand for cigarettes in all specifications, and the effects are significant at the ten percent level. A $1.00 increase in cigarette excise taxes is associated with a 3.0 to 3.3 percentage point decrease in smoking prevalence and a 1.5 to 1.6 cigarette decrease in the conditional demand for cigarettes, depending on which smoke-free air laws are included, although the conditional cigarette demand coefficients are not statistically significant. Private workplace smoke-free air laws are negatively related to smoking prevalence

both with and without including restaurant or bar smoke-free air laws, while restaurant or bar smoke-free air laws are negatively related with smoking prevalence in specifications without private workplace smoke-free air laws.

Lastly, I re-estimate the OLS models from Table 2 using the log of the average number of cigarettes smoked per day and the log of the serum cotinine levels. A $1.00 increase in the cigarette price (excise tax) leads to a 7 (9) percent decrease in the average number of cigarettes smoked per day by smokers, but the effects are not statistically significant at conventional levels. However, workplace smoke-free air laws are associated with reductions in the log of the average number of cigarettes smoked per day. The presence of a workplace smoke-free air law is associated with a 10 to 12 percent decrease in conditional cigarette demand, depending on the specification. Additionally, restaurant or bar smoke-free air laws reduce conditional cigarette demand by 12 percent in the cigarette excise tax specifications. As in Table 2, I find little evidence that any tobacco control policies affect the log of serum cotinine concentrations.

The results from the OLS regressions confirm previous economic studies which find that cigarette excise taxes and prices reduce the number of cigarettes consumed. I also find that smoke-free air laws reduce smoking prevalence but not conditional cigarette demand. However, using serum cotinine levels I find no evidence that tobacco control policies are related to smokers' intake of nicotine.

VI. Quantile Regression Results

A. Baseline Results

Next I turn to estimating how the effects in Table 2 vary across the distribution of the two main dependent variables of interest, the average number of cigarettes smoked per day and

individuals' serum cotinine levels, conditional on smoking participation. Figures 4 through 7 and Tables 3 through 6 show results from quantile regressions estimating how the effects of tobacco control policies change across the distributions of the two dependent variables. As collinearity between the smoke-free air law variables led to divergent coefficients in Table 2, I focus on estimating quantile regression models including the smoke-free air laws separately.

In each figure, the solid line represents the quantile regression coefficients for cigarette excise taxes or cigarette prices at every 5^{th} quantile between the 5^{th} and 95^{th} quantiles, and the shaded area represents the 95 percent confidence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence intervals, calculated from standard errors clustered at the state level. For brevity, I show figures for quantile regressions using cigarette prices, although the corresponding tables outline both the cigarette price and cigarette tax models. Tables 3 through 6 each have eight columns. Column one repeats the relevant OLS results from Table 2, and columns two through eight show results for quantile regressions at the 5^{th}, 10^{th}, 25^{th}, 50^{th}, 75^{th}, 90^{th}, and 95^{th} quantiles. All regressions control for the same demographic variables in Table 2. Tables 3 and 5 show results from quantile regressions using private workplace smoke-free air laws, and Tables 4 and 6 show results using restaurant or bar smoke-free air laws.

Figure 4 and Tables 3 and 4 show that the decreases in the average number of cigarettes smoked per day associated with higher cigarette monetary costs are concentrated among heavier smokers. In Figure 4, the strength of the association between the cigarette price and the average number of cigarettes smoked per day grows steadily across the quantiles of cigarette consumption. The coefficients are insignificant in the lower part of the distribution but

significant at the 75th through 95th quantiles. A $1.00 increase in cigarette prices decreases conditional cigarette demand by 1.7 cigarettes per day at the 75th quantile, 3.7 to 3.8 cigarettes at the 90th quantile, and 3.9 to 4.3 cigarettes at the 95th quantile. The coefficients for cigarette excise taxes follow a similar pattern, decreasing steadily across the distribution of smoking level. The coefficients on cigarette excise taxes increase from a 1.7 cigarette per day decrease in conditional demand for every $1.00 increase in taxes at the 75th quantile to more than a 2.3 cigarette per day decrease in conditional demand for every $1.00 increase in taxes at the 90th quantile. A Wald test confirms that the cigarette price coefficients are statistically different at the 10th and 90th quantiles at the five percent level, although the cigarette excise tax coefficients are not statistically different.[14] Figure 5 and Tables 3 and 4 indicate that neither smoke-free air law has an effect on the average number of cigarettes smoked per day.[15] In terms of semi-elasticities, a $1.00 increase in cigarette prices (cigarette excise taxes) is associated with a 6 percent (7 percent) decrease in the number of cigarettes smoked per day at the median, a 9 percent (10 percent) decrease at the 75th quantile, and a 12 percent (9 percent) decrease at the 90th quantile.

Figure 6 and Tables 5 and 6 show the effects of tobacco control policies on smokers' serum cotinine levels across the cotinine distribution. Neither cigarette prices nor excise taxes are associated with cotinine concentrations at any part of the cotinine distribution. The effects for both prices and excise taxes are constant around the OLS estimates and insignificant for almost

[14] As with Table 2, I also estimate Tables 3 and 4 using the log of the number of cigarettes smoked. I find similar results both in terms of magnitude and statistical significance. The coefficients on cigarette excise taxes and cigarette prices are not significant at lower quantiles, but significant for most upper quantiles. A $1.00 increase in cigarette excise taxes (prices) leads to a 10 percent (5 percent) decrease in the average number of cigarettes smoked at the median, a 15 percent (12 percent) decrease at the 75th quantile, and a 9 percent (14 percent) decrease at the 90th quantile.

[15] The coefficients for cigarette prices and excise taxes are similar when both smoke-free air laws are included in the quantile regressions. A $1.00 increase in prices decreases conditional cigarette demand by 1.75 cigarettes per day at the 75th quantile, 3.47 cigarettes at the 90th quantile, and 4.18 cigarettes at the 95th quantile. A $1.00 increase in cigarette excise taxes decreases conditional demand by 2 cigarettes at the 75th quantile and more than 2.5 cigarettes at the 90th quantile. A Wald test confirms that the coefficients at the 10th and 90th quantiles are statistically different at the 10 percent level for cigarette excise taxes and at the 5 percent level for prices.

all the quantiles. Figure 7 and Tables 5 and 6 illustrate that neither smoke-free air law is associated with serum cotinine levels. [16]

B. Demographic Characteristics

Figures 8 and 9 plot the quantile regression and OLS coefficients for the individual demographic characteristics included in Tables 3 and 5.[17] Conditional on smoking, OLS results indicate that females smoke fewer cigarettes than men and have lower cotinine concentrations. Quantile coefficients indicate that the differences between men and women increase for heavier smokers, although the coefficients are not statistically significant. Older people smoke more cigarettes and have higher serum cotinine concentrations, and both relationships are concave. Taller people smoke more cigarettes at all levels, but height does not affect cotinine concentrations. This is perhaps because taller people, with more body mass, need more cigarettes to achieve the same amount of nicotine stimulation as shorter people. African Americans and Hispanics smoke fewer cigarettes at all quantiles, and the effects grow at higher levels of smoking. But while Hispanics also have lower cotinine concentrations at all levels, African Americans' serum cotinine concentrations are higher at most parts of the distribution. This discrepancy between self-reported smoking status and cotinine concentration could be due to the popularity of menthol cigarettes in the African American community or differences in smoking habits (Caraballo et al. 1998). Marital status has little effect on either conditional cigarette

[16] I also estimate Tables 3 and 4 using the log of the number the serum cotinine level. I find similar results both in terms of magnitude and statistical significance. Neither cigarette excise taxes nor cigarette prices have an effect on log cotinine levels.

[17] Appendix Tables 1 and 2 show full results from the linear probability, OLS, and quantile regressions in Tables 3 and 5.

demand or cotinine concentration. Income, like marital status, has little effect on conditional cigarette demand or cotinine concentration.[18]

C. Changes in Smoking Behavior

The results from the previous section show that although smokers reduce their cigarette consumption in response to higher cigarette prices and excise taxes, they do not inhale less nicotine. These results indicate that smokers change their smoking behavior in response to higher prices and taxes to inhale more smoke from each cigarette. In this section, I directly test whether smokers inhale more nicotine from each cigarette in response to increased cigarette excise taxes and prices, either through switching to cigarette brands with higher nicotine contents or smoking each cigarette more intensely, and test how these changes vary across the smoking distribution.

I modify Equation (3), using serum cotinine concentrations as the dependent variable, and I include the average number of cigarettes smoked per day and interaction terms between the tobacco control policies and the average number of cigarettes smoked per day as additional independent variables. I estimate the following equation:

$$Q_{(Cot|Smk=1)}(\tau|x) = \beta_{0\tau} + \beta_{1\tau}Cigs + \beta_{2\tau}P + \beta_{3\tau}SFA + \beta_{4\tau}Cigs \times P + \beta_{5\tau}Cigs \times SFA + \beta_{6\tau}X + \sigma_{s\tau} + \phi_{t\tau} + \eta_{q\tau} \quad (4)$$

In Equation (4), the derivative of cotinine levels with respect to the average number of cigarettes smoked per day is $\frac{\partial Q_{(Cot|Smk=1)}(\tau|x)}{\partial Cigs} = \beta_{1\tau} + \beta_{4\tau} \times P + \beta_{5\tau} \times SFA$. Thus, Equation (4) estimates whether the impact of the number of cigarettes smoked per day on cotinine levels changes based on the level of tobacco control policies. Put another way, the cross-partial derivative of cotinine levels with respect to the average number of cigarettes smoked per day and cigarette price is

[18] Neither the time of day when the serum cotinine sample is drawn nor the weekday on which the sample is drawn have large effects on cotinine concentrations (results not shown in graphs). However, an evening examination increases cotinine levels by 15 to 17 ng/ml for individuals in the 50th and 75th quantiles.

$\frac{\partial^2 Q_{(Cot|Smk=1)}(\tau|x)}{\partial Cigs\, \partial P} = \beta_{4\tau}$, and the cross-partial derivative of cotinine levels with respect to the average number of cigarettes smoked per day and smoke-free air laws is $\frac{\partial^2 Q_{(Cot|Smk=1)}(\tau|x)}{\partial Cigs\, \partial SFA} = \beta_{5\tau}$. Thus, if $\beta_{4\tau}$ is positive, an increase in cigarette price increases the amount of nicotine a smoker draws from each cigarette, and if $\beta_{5\tau}$ is positive, an increase in smoke-free air laws increases the amount of nicotine a smoker draws from each cigarette.

An alternative to estimating Equation (4) could be to estimate Equation (3) using the log ratio of cotinine to cigarettes smoked per day ("smoking intensity") as the dependent variable. This is the strategy undertaken by Adda and Cornaglia (2006). However, Equation (4) offers three main advantages. First, using Equation (4) allows me to examine the effects of tobacco control policies across the distribution of cotinine concentrations rather than distribution of smoking intensities. This is advantageous since the quantiles of smoking intensity do not necessarily correspond to the quantiles of smoking amounts. Figure 10 plots the relationship between the number of cigarettes smoked per day and smoking intensity. There is not much of a relationship between the number of cigarettes smoked and smoking intensity, and if anything, as the number of cigarettes increases, the average smoking intensity slightly decreases.

Second, using cotinine as a dependent variable allows a test of whether cigarette policies directly affect cotinine levels or only affect cotinine through changes in smoking behaviors. In Equation (4), the derivative of cotinine with respect to cigarette price is $\frac{\partial Q_{(Cot|Smk=1)}(\tau|x)}{\partial P} = \beta_{2\tau} + \beta_{4\tau} \times Cigs$. Thus, if $\beta_{2\tau}$ is statistically significantly different from zero, tobacco control policies affect smokers intake of cotinine directly and not only through $\beta_{4\tau}$ or $\beta_{5\tau}$, which measure changes in cigarette smoking behaviors.

Third, Equation (4) allows a direct examination of how much nicotine smokers inhale from each cigarette across the distribution of smoking levels. As noted in Section II, the medical literature suggests that heavier smokers ingest less nicotine from each cigarette in order to smooth their nicotine consumption. If this hypothesis is correct, the coefficient for cigarettes smoked per day in Equation (4), $\beta_{1\tau}$, should follow a decreasing or concave pattern across the distribution of cotinine levels.

Figures 11 through 13 and Tables 8 and 9 show results from quantile regressions estimating Equation (4) and the corresponding OLS regressions. As with the quantile regressions in the previous section, I estimate Equation (4) including the smoke-free air law coefficients separately. Figure 11 plots the quantile regression coefficients for the direct price effect coefficient, $\beta_{2\tau}$, and the price-cigarette interaction coefficient, $\beta_{4\tau}$. Figure 11 plots the quantile regression coefficients for the direct smoke-free air law coefficient, $\beta_{3\tau}$, and the smoke-free air law-cigarette interaction coefficient, $\beta_{5\tau}$. Table 8 shows quantile regression and OLS results using private workplace smoke-free air laws, and Table 9 shows results using restaurant or bar smoke-free air laws.

The coefficients on cigarette prices and excise taxes are insignificant, indicating that cigarette prices and excise taxes are not directly related to cotinine concentrations, but rather are indirectly related through changes in cigarette smoking behavior. The coefficients for the interaction between the cigarettes smoked per day and cigarette prices are significant at the upper quantiles, indicating that heavier smokers adjust their smoking behavior in response to higher cigarette prices. At the median, every $1.00 increase in cigarette prices increases the cotinine extracted from each cigarette by 0.45 to 0.49 ng/ml, and at the 95th quantile, every $1.00 increase in cigarette prices increases the cotinine extracted from each cigarette by 1.18 to 1.24 ng/ml. Table 8 shows that every cigarette smoked per day adds about 5.6 ng/ml of cotinine at the 95th quantile

in the corresponding regression, so an increase of 1.24 ng/ml corresponds to a change of 20 percent off the value of cotinine per cigarette. The coefficients for cigarette excise taxes follow a similar pattern, but are generally not significant at conventional levels. Lastly, similar to the previous quantile regression results, smoke-free air laws do not have an effect on smoking behavior. The coefficients are all small and statistically insignificant.[19]

Figure 13 shows results estimating the amount of cotinine that smokers ingest from each additional cigarette along the conditional cotinine distribution. The amount of cotinine from each cigarette smoked first increases as the total amount of cotinine increases, but decreases at the very upper quantiles. At the 5th quantile every additional cigarette per day adds 3.4 to 3.5 ng/ml of cotinine, at the median every additional cigarette per day adds 5.9 to 6.0 ng/ml of cotinine, and at the 90th quantile every additional cigarette per day adds between 5.7 to 5.9 ng/ml of cotinine. A Wald Test confirms that the coefficients for the cigarettes smoked per day at the 10th and 90th quantiles are statistically different at the one percent level. These results confirm previous medical research suggesting that heavier smokers ingest less nicotine from each cigarette, preferring to smooth their consumption of nicotine (Law et al. 1997).

VII. Robustness Checks

My results could suffer from a few additional potential issues. First, as the NHANES data are a repeated cross section, I cannot observe individuals over time. The ideal statistical design for examining individuals' responses to tobacco control policies would be a panel of individuals,

[19] The coefficients for cigarette prices and excise taxes are similar when both smoke-free air laws are included in the quantile regressions. The coefficients on cigarette prices and taxes are insignificant, indicating the cigarette excise taxes and prices only affect cotinine levels through changes in cigarette smoking. The coefficients for the interaction between cigarettes smoked per day and prices are significant at the upper quantiles. At the median, every $1.00 increase in cigarette prices increases the cotinine extracted from each cigarette by 0.48 ng/ml, and at the 95th quantile, every $1.00 increase in cigarette prices increases the cotinine extracted from each cigarette by 1.24 ng/ml.

allowing direct examination of how an individual behaves before and after changes in tobacco control policies. This is a problem in most papers estimating the effects of tobacco control policies, but it may be an additional problem as my paper uses a biomarker of nicotine consumption. Unobservable individual differences in nicotine metabolism may add measurement error to the observed cotinine concentrations. However, the medical literature suggests cotinine levels in smokers are fairly consistent across time (Kemmeren et al. 1994). Moreover, the individual differences in cotinine metabolism will not bias my coefficients as long as these differences in nicotine metabolism are unrelated to tobacco control policies.

Another potential issue arising from the use of repeated cross section data is selection. If tobacco control policies induce more light smokers than heavy smokers to quit, changes in smokers' outcomes may be due to changes in the pool of smokers and not actual behavioral changes. However, previous studies estimate that it is light smokers and not heavy smokers that are more likely to quit in response to tobacco control policies (Paterson et al. 2008; Coggins et al. 2009; Adda and Cornaglia 2012). Additionally, if selection was an issue and either light or heavy smokers were quitting, that should manifest itself in the OLS and quantile regressions for cotinine concentrations. Lastly, I would expect to see changes in the conditional distribution of cotinine concentrations for smokers over time, as cigarette excise taxes and prices have generally increased. Figure 11 plots the log of smokers' serum cotinine concentrations for each NHANES survey wave. There is not a clear pattern of a change in the distributions over the survey waves.

Lastly, policy endogeneity may affect my results. If cigarette excise taxes, prices or smoke-free air laws are related to state anti-smoking sentiment, then anti-smoking sentiment could drive both reductions in smoking outcomes and the enactment of tobacco control policies. I account for anti-smoking sentiment by including state and year fixed effects, which will control for any

time-invariant, state-specific, characteristics and aggregate trends, and by including a time-varying measure of state-level anti-smoking sentiment following the methodology of DeCicca et al. (2008). This measure of anti-smoking sentiment is generally insignificant, indicating that additional, unobservable anti-smoking sentiment is not an issue.

VIII. Conclusion

This paper uses quantile regression to examine how tobacco control policies affect smoking behavior across the distribution of smoking levels. I use individual level repeated cross-section data from NHANES, and I measure smoking behavior both using the traditional metric of cigarettes smoked per day and also using levels of serum cotinine, a direct and continuous biomarker of nicotine intake.

On the surface, my results suggest that cigarette excise taxes are an effective policy instrument for reducing smoking behavior, as higher cigarette prices and excise taxes reduce the number of cigarettes smokers consume per day. Using quantile regression, I find that the reductions in cigarette consumption are concentrated among heavier smokers. I generally find similar results when examining cigarette excise taxes and cigarette prices, although heavy smokers are generally more responsive to cigarette prices. These results agree with the results of Ross, Chaloupka, and Wakefield (2006), Liang and Chaloupka (2002) and Tauras (2005), who find that cigarette prices have larger effects for heavier youth smokers.

However, in stark contrast to the results using the number of cigarettes smoked per day as the dependent variable, I find that tobacco control policies are not associated with the nicotine intake of smokers at any level. Although smokers consume fewer cigarettes, I find that for every $1.00 increase in cigarette prices, the heaviest smokers may inhale as much as 20 percent more nicotine

from each cigarette through switching brands or smoking more intensely. Thus, my results indicate that cigarette excise taxes and smoke-free air laws are not an effective means to reduce the nicotine consumption of smokers.

My results do indicate that cigarette excise taxes are effective at reducing smoking prevalence. I also find that smoke-free air laws in private workplaces and restaurants or bars reduce smoking prevalence when examining the laws separately in regressions. However, collinearity between the smoke-free air laws inflates the standard errors when the variables are both included in regression models.

My results add to the growing literature estimating the distributional effects of public policies and illustrate that only examining effects at the mean may provide an incomplete picture of the effects of public policies. For example, as heavy smokers are the most likely to develop cancer or other adverse effects from smoking, policy makers may be most interested in curbing the smoking behavior of heavy smokers. The well-established finding in the economics literature that tobacco control policies reduce cigarette consumption at the mean does not reveal whether heavy smokers, light smokers, or both are driving the reductions. However, my results also illustrate the importance of considering substitution effects. As cigarette excise taxes and smoke-free air laws do not directly raise the price of consuming nicotine, but rather raise the fixed cost of smoking a cigarette, smokers can compensate for increased tobacco control policies by inhaling more deeply or switching cigarette brands.

Policy makers should take note that cigarette excise taxes and smoke-free air laws reduce nicotine exposure at the extensive margin but not through the intensive margin. That is, my results suggest that although cigarette excise taxes and smoke-free air laws are not effective methods for reducing nicotine consumption among smokers, these policies can reduce smoking

prevalence. Although raising the cost of cigarettes is not effective at reducing smokers' intake of nicotine, policies that affect the demand for nicotine more directly may be effective at both reducing smoking prevalence and conditional cigarette demand. For example, a tax that is based on the nicotine content of cigarettes, rather than levied equally on each cigarette, may be more effective at reducing nicotine exposure.

Moreover, policy makers should consider that changing inhalation patterns by smokers could affect the development of adverse effects from smoking. While the medical literature has established that it is the amount of smoke and harmful chemicals inhaled, not the number of cigarettes smoked, that leads to the development of cancers and chronic obstructive pulmonary disease, the medical literature also suggests that different inhalation patterns of tobacco smoke lead to different types of lung cancers. Epidemiologists have connected the surge in adenocarcinomas of the lung, a lung cancer that typically develops in the peripheries of the lung, to changes in how smokers inhale cigarette smoke (Wald et al. 1983; Wynder and Muscat 1995; Burns, Anderson and Gray 2011). Adenocarcinoma of lung are harder to detect at earlier stages, since the common symptoms of lung cancer such as a chronic cough or coughing up blood, may not arise until the tumor has progressed to a later stage. My results suggest that cigarette excise taxes could increase the prevalence of these cancers that are harder to detect.

This paper calls for more research into the compensating behavior of smokers and the distributional effects of tobacco control policies. Future research could make use of data sources allowing for an examination of a panel of individuals' serum cotinine levels over time. More broadly, my results suggest that studies of the effects of other public policies may miss important heterogeneity if they only measure the effects at the mean or do not consider compensating behavior.

IX. References

Abrevaya, Jason and Laura Puzzello (2010). "Taxes, Cigarette Consumption, and Smoking Intensity: Comment." Working Paper.

Adda, Jerome and Francesca Cornaglia (2006). "Taxes, Cigarette Consumption, and Smoking Intensity." American Economic Review **96**(4): 1013-1013.

Adda, Jerome and Francesca Cornaglia (2010). "The Effect of Bans and Taxes on Passive Smoking." American Economic Journal: Applied Economics **2**(1): 1-32.

Adda, Jerome and Francesca Cornaglia (2012). "Taxes, Cigarette Consumption, and Smoking Intensity: Reply." Working Paper: 1-24.

Anger, S., M. Kvasnicka and T. Siedler (2011). "One last puff? Public smoking bans and smoking behavior." J Health Econ **30**(3): 591-601.

Baltagi, Badi H. and Rajeev K. Goel (1987). "Quasi-experimental Price Elasticities of Cigarette Demand and the Bootlegging Effect." American Journal of Agricultural Economics **69**(4): 750-754.

Baltagi, Badi H. and Dan Levin (1986). "Estimating Dynamic Demand for Cigarettes Using Panel Data: The Effects of Bootlegging, Taxation and Advertising Reconsidered." Review of Economics and Statistics **68**(1): 148-155.

Benowitz, N. L.J. T. BernertR. S. Caraballo, et al. (2009). "Optimal serum cotinine levels for distinguishing cigarette smokers and nonsmokers within different racial/ethnic groups in the United States between 1999 and 2004." Am J Epidemiol **169**(2): 236-248.

Benowitz, N. L.S. M. HallR. I. Herning, et al. (1983a). "Smokers of low-yield cigarettes do not consume less nicotine." N Engl J Med **309**(3): 139-142.

Benowitz, N. L. and P. Jacob, 3rd (1984). "Nicotine and carbon monoxide intake from high- and low-yield cigarettes." Clin Pharmacol Ther **36**(2): 265-270.

Benowitz, N. L. and P. Jacob, 3rd (1994). "Metabolism of nicotine to cotinine studied by a dual stable isotope method." Clin Pharmacol Ther **56**(5): 483-493.

Benowitz, N. L.P. Jacob, 3rdI. Fong, et al. (1994). "Nicotine metabolic profile in man: comparison of cigarette smoking and transdermal nicotine." J Pharmacol Exp Ther **268**(1): 296-303.

Benowitz, N. L.P. Jacob, 3rdL. T. Kozlowski, et al. (1986a). "Influence of smoking fewer cigarettes on exposure to tar, nicotine, and carbon monoxide." N Engl J Med **315**(21): 1310-1313.

Benowitz, N. L.P. Jacob, 3rdL. Yu, et al. (1986b). "Reduced tar, nicotine, and carbon monoxide exposure while smoking ultralow- but not low-yield cigarettes." JAMA **256**(2): 241-246.

Benowitz, N. L.F. KuytP. Jacob, 3rd, et al. (1983b). "Cotinine disposition and effects." Clin Pharmacol Ther **34**(5): 604-611.

Bertrand, Marianne, Esther Duflo and Sendhil Mullainathan (2004). "How Much Should We Trust Differences-in-Differences Estimates?" Quarterly Journal of Economics **119**(1): 249-275.

Bitler, Marianne P., Christopher S. Carpenter and Madeline Zavodny (2010). "Effects of Venue-Specific State Clean Indoor Air Laws on Smoking-Related Outcomes." Health Economics **19**(12): 1425-1440.

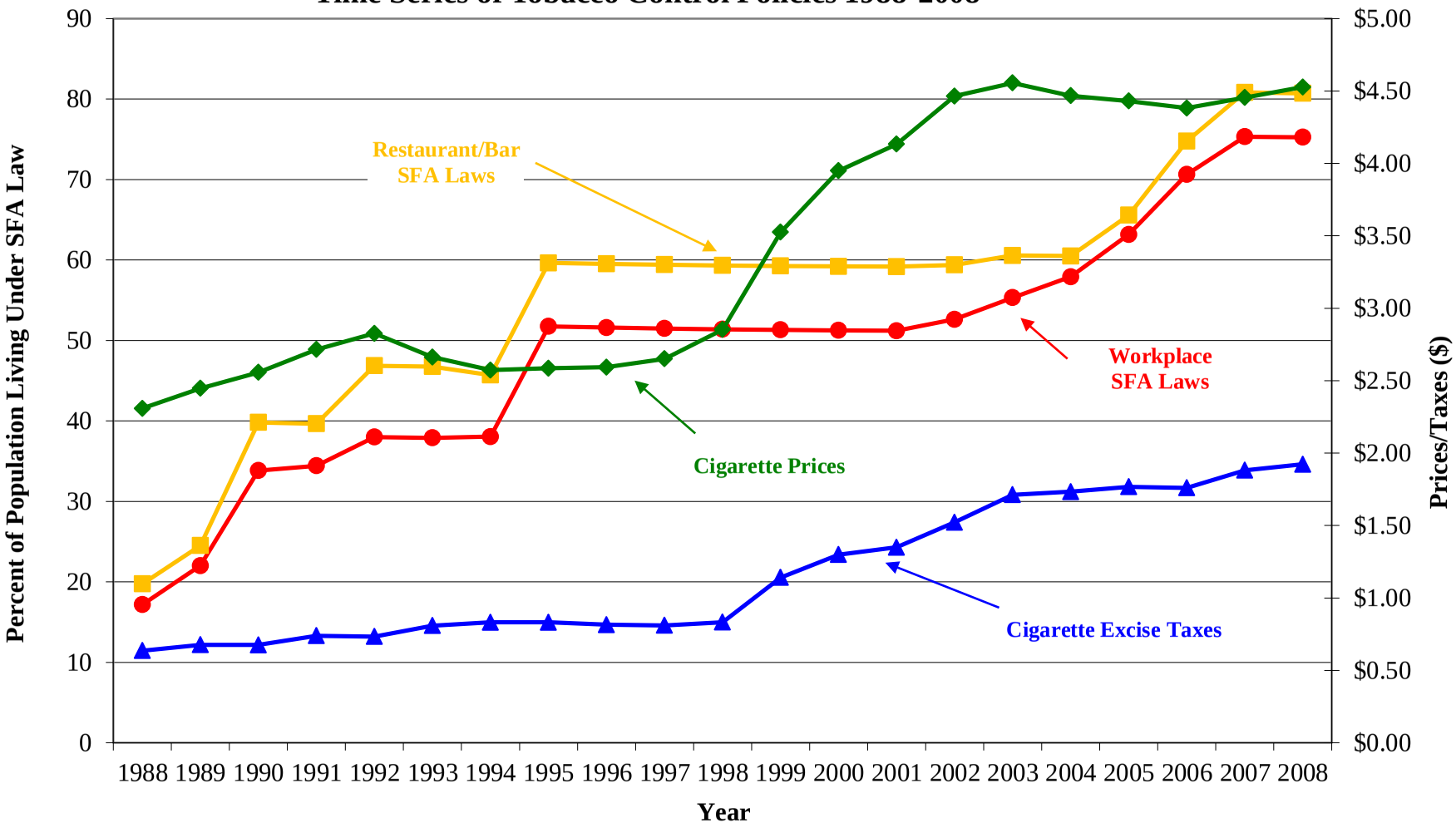
Blackford, A. L.G. YangM. Hernandez-Avila, et al. (2006). "Cotinine concentration in smokers from different countries: relationship with amount smoked and cigarette type." Cancer Epidemiol Biomarkers Prev **15**(10): 1799-1804.

Boffetta, P.S. ClarkM. Shen, et al. (2006). "Serum cotinine level as predictor of lung cancer risk." Cancer Epidemiol Biomarkers Prev **15**(6): 1184-1188.
Burns, D. M., C. M. Anderson and N. Gray (2011). "Do changes in cigarette design influence the rise in adenocarcinoma of the lung?" Cancer Causes Control **22**(1): 13-22.
Caraballo, R. S.G. A. GiovinoT. F. Pechacek, et al. (1998). "Racial and ethnic differences in serum cotinine levels of cigarette smokers: Third National Health and Nutrition Examination Survey, 1988-1991." JAMA **280**(2): 135-139.
Carpenter, Christopher, Sabina Postolek and Casey Warman (2011). "Public-Place Smoking Laws and Exposure to Environmental Tobacco Smoke (ETS) in Public Places." American Economic Journal: Economic Policy **3**(3): p. 35-61.
Carpenter, Christopher S. (2009). "The Effects of Local Workplace Smoking Laws on Smoking Restrictions and Exposure to Smoke at Work." Journal of Human Resources **44**(4): 1023-1046.
Chaloupka, Frank J. (1992). "Clean Indoor Air Laws, Addiction and Cigarette Smoking." Applied Economics **24**(2): 193-205.
Chaloupka, Frank J. and Henry Saffer (1992). "Clean Indoor Air Laws and the Demand for Cigarettes." Contemporary Policy Issues **10**(2): 72-83.
Chaloupka, Frank J. and Kenneth E. Warner (2000). The Economics of Smoking. Handbook of health economics. Volume 1B. A. J. Culyer and J. P. Newhouse, North-Holland, Elsevier Science B.V., New York**:** 1539-1627.
Chiou, Lesley and Erich Muehlegger (2008). "Crossing the Line: Direct Estimation of Cross-Border Cigarette Sales and the Effect on Tax Revenue." B.E. Journal of Economic Analysis and Policy: Contributions to Economic Analysis and Policy **8**(1).
Chiou, Lesley and Erich Muehlegger (2010). Consumer Response to Cigarette Excise Tax Changes, Harvard University, John F. Kennedy School of Government, Working Paper Series.
Chou, Shin-Yi, Michael Grossman and Henry Saffer (2004). "An economic analysis of adult obesity: results from the Behavioral Risk Factor Surveillance System." Journal of Health Economics **23**(3): 565-587.
Chou, Shin-Yi, Michael Grossman and Henry Saffer (2006). "Reply to Jonathan Gruber and Michael Frakes." Journal of Health Economics **25**(2): 389-393.
Coggins, C. R.E. L. MurrelleR. A. Carchman, et al. (2009). "Light and intermittent cigarette smokers: a review (1989-2009)." Psychopharmacology (Berl) **207**(3): 343-363.
Colman, Gregory J. and Dahlia K. Remler (2008). "Vertical Equity Consequences of Very High Cigarette Tax Increases: If the Poor Are the Ones Smoking, How Could Cigarette Tax Increases Be Progressive?" Journal of Policy Analysis and Management **27**(2): 376-400.
Davidson, Russell and James G. MacKinnon (2000). "Bootstrap Tests: How Many Bootstraps?" Econometric Reviews **19**(1): 55-68.
DeCicca, PhilipDonald KenkelAlan Mathios, et al. (2008). "Youth Smoking, Cigarette Prices, and Anti-smoking Sentiment." Health Economics **17**(6): 733-749.
DeCicca, Philip, Donald S. Kenkel and Feng Liu (2010). Excise Tax Avoidance: The Case of State Cigarette Taxes, National Bureau of Economic Research, Inc, NBER Working Papers: 15941.
Emery, S.E. A. GilpinM. M. White, et al. (1999). "How adolescents get their cigarettes: implications for policies on access and price." J Natl Cancer Inst **91**(2): 184-186.

Emery, Sherry, Martha M. White and John P. Pierce (2001). "Does Cigarette Price Influence Adolescent Experimentation?" Journal of Health Economics **20**(2): 261-270.
Evans, William N. and Matthew C. Farrelly (1998). "The Compensating Behavior of Smokers: Taxes, Tar, and Nicotine." RAND Journal of Economics **29**(3): 578-595.
Evans, William N., Matthew C. Farrelly and Edward Montgomery (1999). "Do Workplace Smoking Bans Reduce Smoking?" American Economic Review **89**(4): 728-747.
Farrelly, M. C., W. N. Evans and A. E. Sfekas (1999). "The impact of workplace smoking bans: results from a national survey." Tob Control **8**(3): 272-277.
Farrelly, M. C.C.T. NimschA. Hyland, et al. (2004). "The Effects of Higher Cigarette Prices on Tar and Nicotine Consumption in a Cohort of Adult Smokers." Health Economics **13**(1): 49-58.
Fletcher, Jason M., Partha Deb and Jody L. Sindelar (2009). Tobacco Use, Taxation and Self Control in Adolescence, National Bureau of Economic Research, Inc, NBER Working Papers: 15130.
Goel, Rajeev K. and Rati Ram (2004). "Quantile-Regression Estimates of Cigarette Demand Elasticities for the United States." Journal of Economics and Finance **28**(3): 413-421.
Gruber, Jonathan and Michael Frakes (2006). "Does falling smoking lead to rising obesity?" Journal of Health Economics **25**(2): 183-197.
Hammond, E. C.L. GarfinkelH. Seidman, et al. (1976). ""Tar" and nicotine content of cigarette smoke in relation to death rates." Environ Res **12**(3): 263-274.
Harris, Jeffrey E. (1980). "Taxing Tar and Nicotine." American Economic Review **70**(3): 300-311.
Katzman, Brett, Sara Markowitz and Kerry Anne McGeary (2007). "An Empirical Investigation of the Social Market for Cigarettes." Health Economics **16**(10): 1025-1039.
Kemmeren, J. M.G. van PoppelP. Verhoef, et al. (1994). "Plasma cotinine: stability in smokers and validation of self-reported smoke exposure in nonsmokers." Environ Res **66**(2): 235-243.
Koenker, Roger W. and Gilbert Bassett, Jr. (1978). "Regression Quantiles." Econometrica **46**(1): 33-50.
Laporte, Audrey, Alfia Karimova and Brian Ferguson (2010). "Quantile Regression Analysis of the Rational Addiction Model: Investigating Heterogeneity in Forward-Looking Behavior." Health Economics **19**(9): 1063-1074.
Law, M. R.J. K. MorrisH. C. Watt, et al. (1997). "The dose-response relationship between cigarette consumption, biochemical markers and risk of lung cancer." Br J Cancer **75**(11): 1690-1693.
Liang, L. and F. J. Chaloupka (2002). "Differential effects of cigarette price on youth smoking intensity." Nicotine Tob Res **4**(1): 109-114.
Lillard, Dean R. and Andrew Sfekas (2010). "Just Passing Through: The Effect of the Master Settlement Agreement on Estimated Cigarette Tax-Price Pass-through." Working Paper: 1-9.
McNeill, A. D.M. J. JarvisR. West, et al. (1987). "Saliva cotinine as an indicator of cigarette smoking in adolescents." Br J Addict **82**(12): 1355-1360.
Orzechowski, William and Robert C Walker (2009). The tax burden on tobacco, historical compilation. Arlington, VA, Orzechowski and Walker.
Paterson, Robert W.Kevin J. BoyleChristopher F. Parmeter, et al. (2008). "Heterogeneity in Preferences for Smoking Cessation." Health Economics **17**(12): 1363-1377.

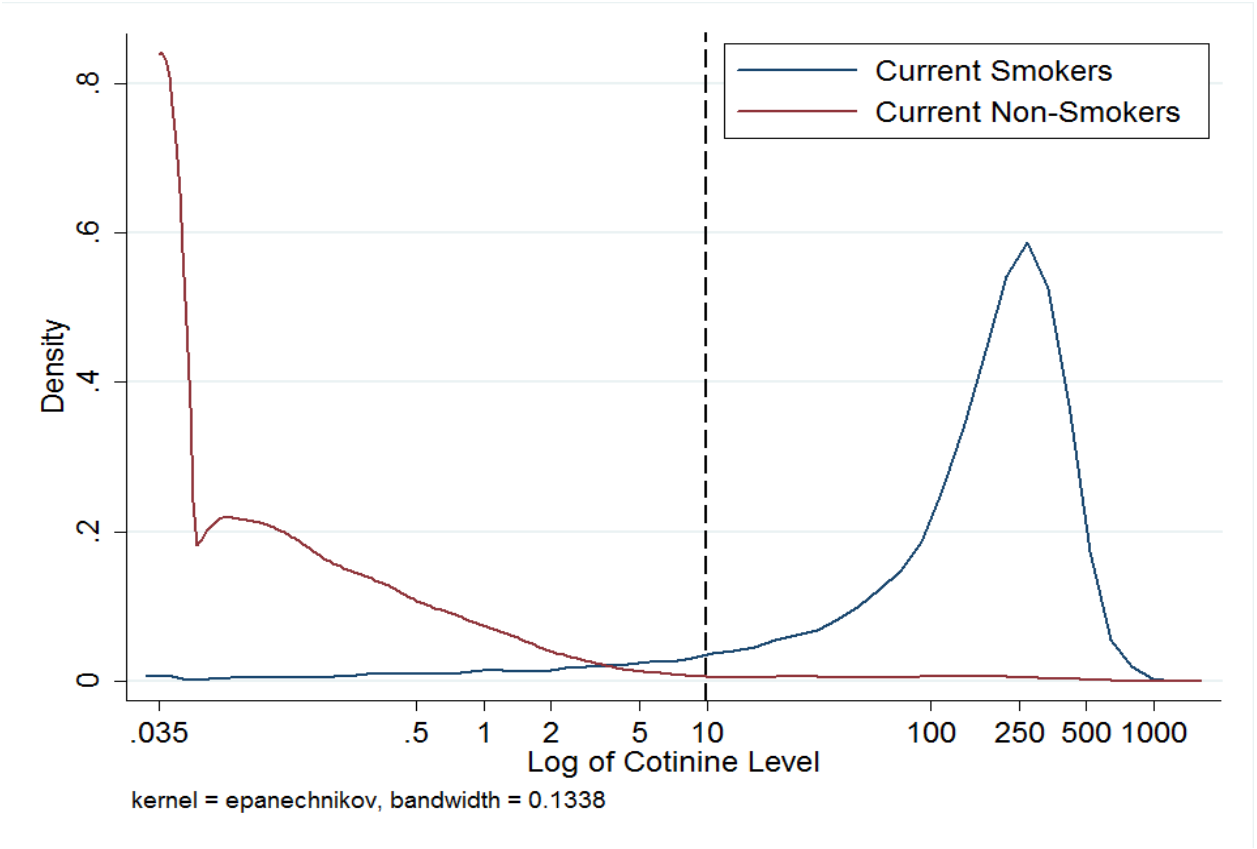
Perez-Stable, E. J., N. L. Benowitz and G. Marin (1995). "Is serum cotinine a better measure of cigarette smoking than self-report?" Prev Med **24**(2): 171-179.
Pooling Project Research Group (1978). "Relationship of blood pressure, serum cholesterol, smoking habit, relative weight and ECG abnormalities to incidence of major coronary events: final report of the pooling project. The pooling project research group." J Chronic Dis **31**(4): 201-306.
Ross, Hana, Frank J. Chaloupka and Melanie Wakefield (2006). "Youth Smoking Uptake Progress: Price and Public Policy Effects." Eastern Economic Journal **32**(2): 355-367.
Tauras, John A. (2005). "Can Public Policy Deter Smoking Escalation among Young Adults?" Journal of Policy Analysis and Management **24**(4): 771-784.
Tauras, John A. (2006). "Smoke-Free Air Laws, Cigarette Prices, and Adult Cigarette Demand." Economic Inquiry **44**(2): 333-342.
Wald, N. J.M. IdleJ. Boreham, et al. (1983). "Inhaling and lung cancer: an anomaly explained." Br Med J (Clin Res Ed) **287**(6401): 1273-1275.
Williams, C. L.A. EngG. J. Botvin, et al. (1979). "Validation of students' self-reported cigarette smoking status with plasma cotinine levels." Am J Public Health **69**(12): 1272-1274.
Wynder, E. L. and J. E. Muscat (1995). "The changing epidemiology of smoking and lung cancer histology." Environ Health Perspect **103 Suppl 8**: 143-148.
Zacny, J. P. and M. L. Stitzer (1988). "Cigarette brand-switching: effects on smoke exposure and smoking behavior." J Pharmacol Exp Ther **246**(2): 619-627.

Figure 1
Time Series of Tobacco Control Policies 1988-2008



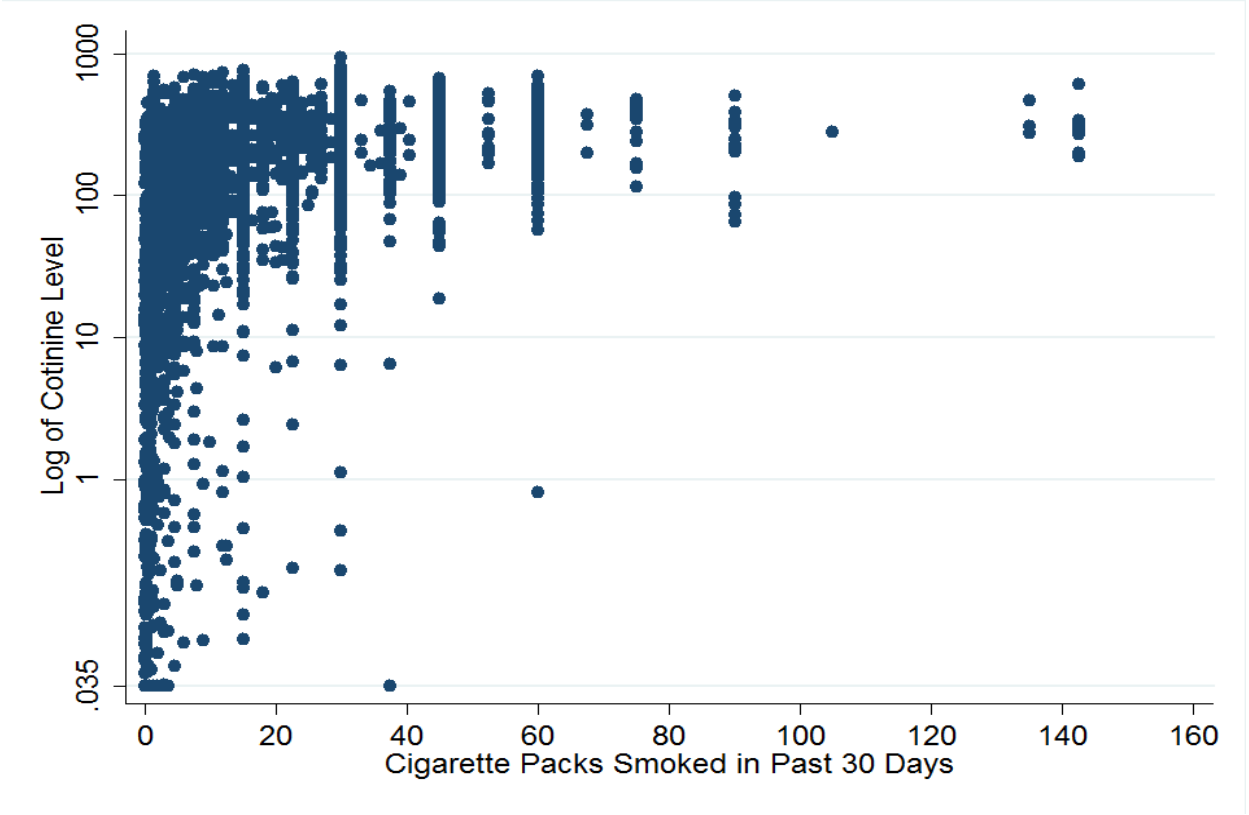
Notes:
Data from the Tax Burden on Tobacco output by Orzechowski and Walker, Project ImpacTeen, and Lillard and Sfekas (2010). All taxes and prices are in 2009 dollars. Cigarette taxes are the state excise tax paid on one pack of cigarettes, and cigarette prices are the weighted average price of one pack of cigarettes, excluding generic brands. All taxes, prices and SFA laws are aggregated across states using population weights.

Figure 2
Kernel Density Plot of Log Cotinine Levels by Smoking Status



Notes:
Data from NHANES III and NHANES 1999/2000 - NHANES 2007/2008. The black dashed line indicates a serum cotinine concentration of 10 mg/nl, the common cutoff for distinguishing smokers from non-smokers.

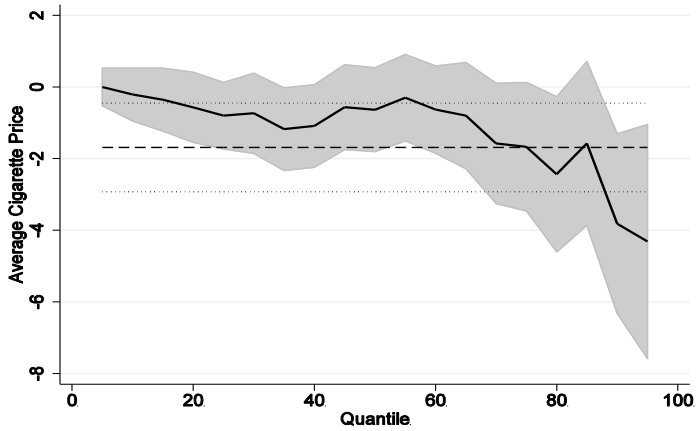
Figure 3
Scatter Plot of Cigarettes Smoked per Day and Log Cotinine Levels



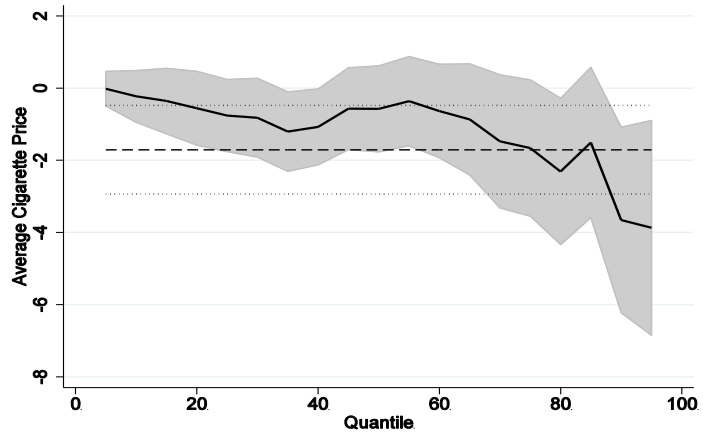
Notes:
Data from NHANES III and NHANES 1999/2000 - NHANES 2007/2008.

Figure 4
Quantile Regression Results of the Impact of Cigarette Prices on The Average Number of Cigarettes Smoked per Day

Panel A. Cigarette Prices in Work SFA Laws Model



Panel B. Cigarette Prices in Rest/Bar SFA Laws Model

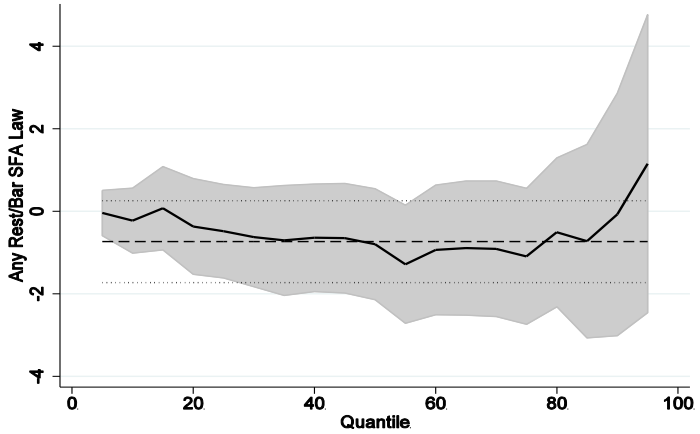


Notes:

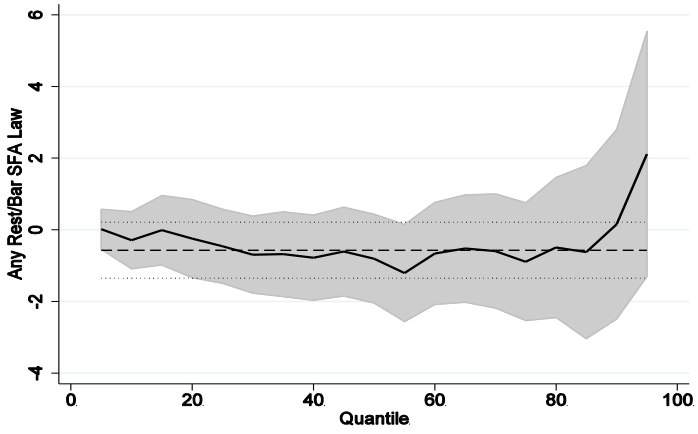
The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable in both plots is the average number of cigarettes smoked per day, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent confidence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for the presence of smoke-free air laws, gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the price and the nearest lower price in another state, and state, year and quarter fixed effects.

Figure 5
Quantile Regression Results of the Impact of Smoke-Free Air Laws on The Average Number of Cigarettes Smoked per Day

Panel A. Work SFA Laws in Cigarette Prices Model



Panel B. Rest/Bar SFA Laws in Cigarette Prices Model

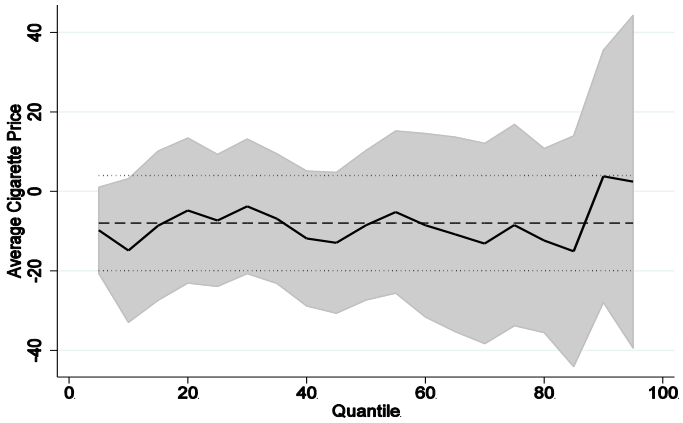


Notes:

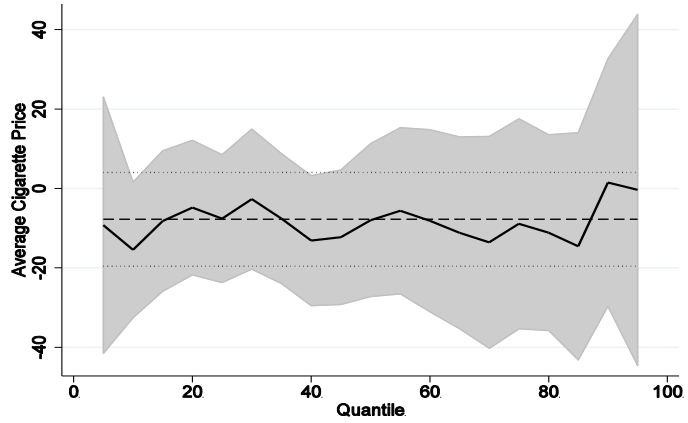
The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable in both plots is the average number of cigarettes smoked per day, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent confidence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for cigarette price, gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the price and the nearest lower price in another state, and state, year and quarter fixed effects.

Figure 6
Quantile Regression Results of the Impact of Cigarette Prices on Serum Cotinine Levels

Panel A. Cigarette Prices in Work SFA Laws Model



Panel B. Cigarette Prices in Rest/Bar SFA Laws Model

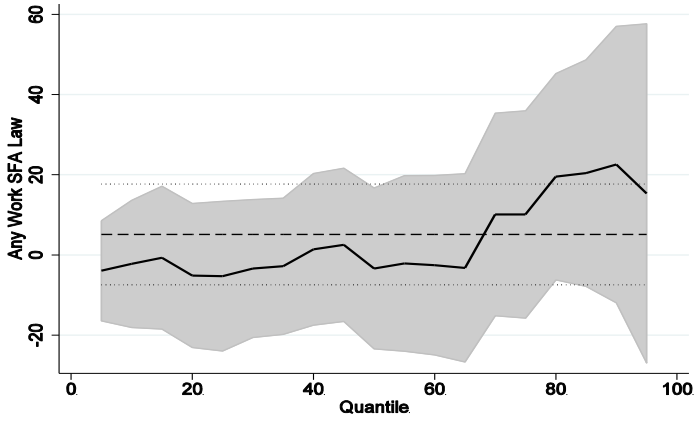


Notes:

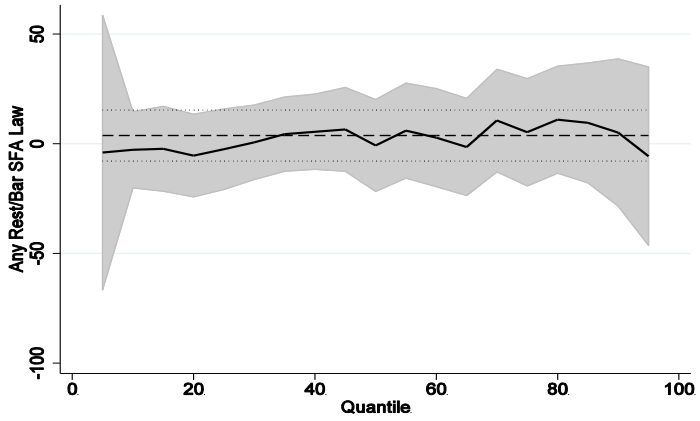
The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable in both plots is the serum cotinine concentration, measured in ng/ml, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent confidence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for the presence of smoke-free air laws, gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the price and the nearest lower price in another state, and state, year and quarter fixed effects.

Figure 7
Quantile Regression Results of the Impact of Smoke-Free Air Laws on Serum Cotinine Levels

Panel A. Work SFA Laws in Cigarette Prices Model



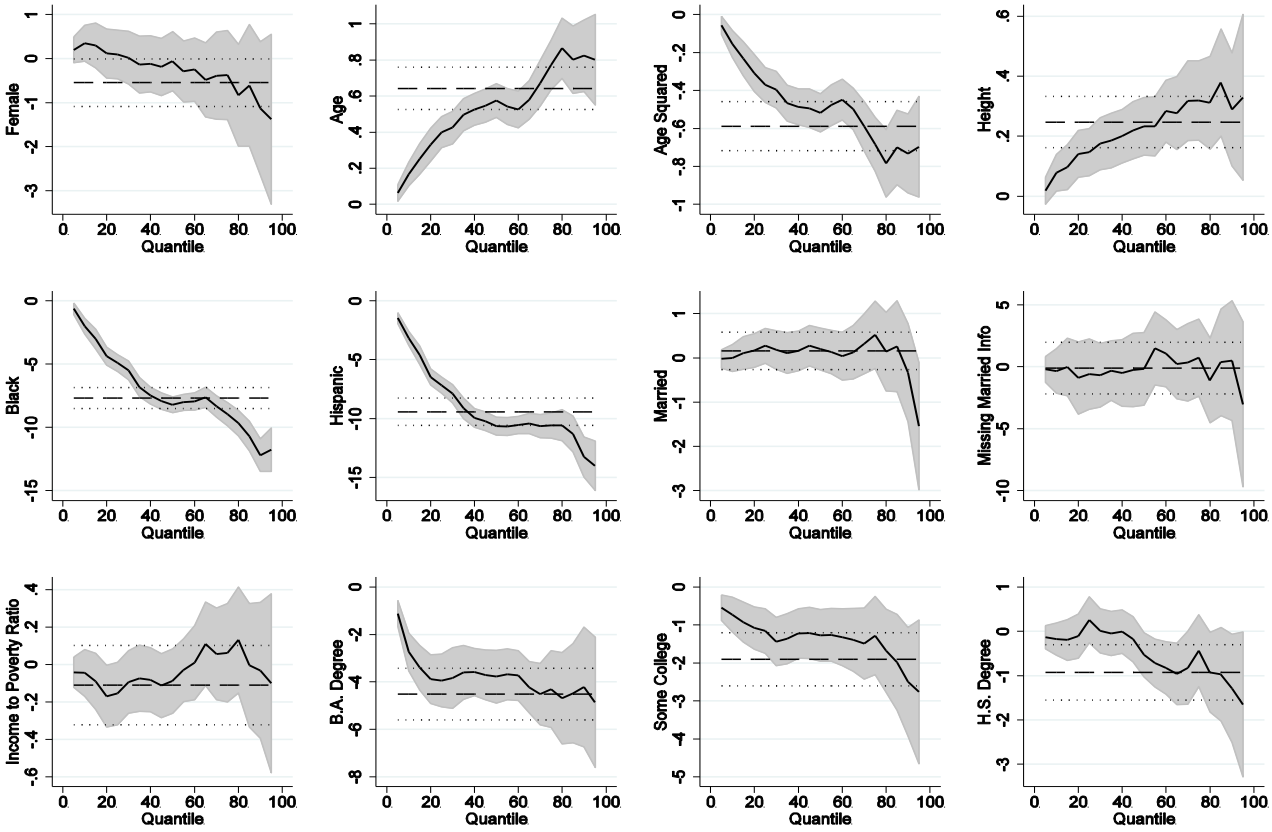
Panel B. Rest/Bar SFA Laws in Cigarette Prices Model



Notes:

The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable in both plots is the serum cotinine concentration, measured in ng/ml, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent confidence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for cigarette price, gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the cigarette price and the nearest lower price in another state, and state, year and quarter fixed effects.

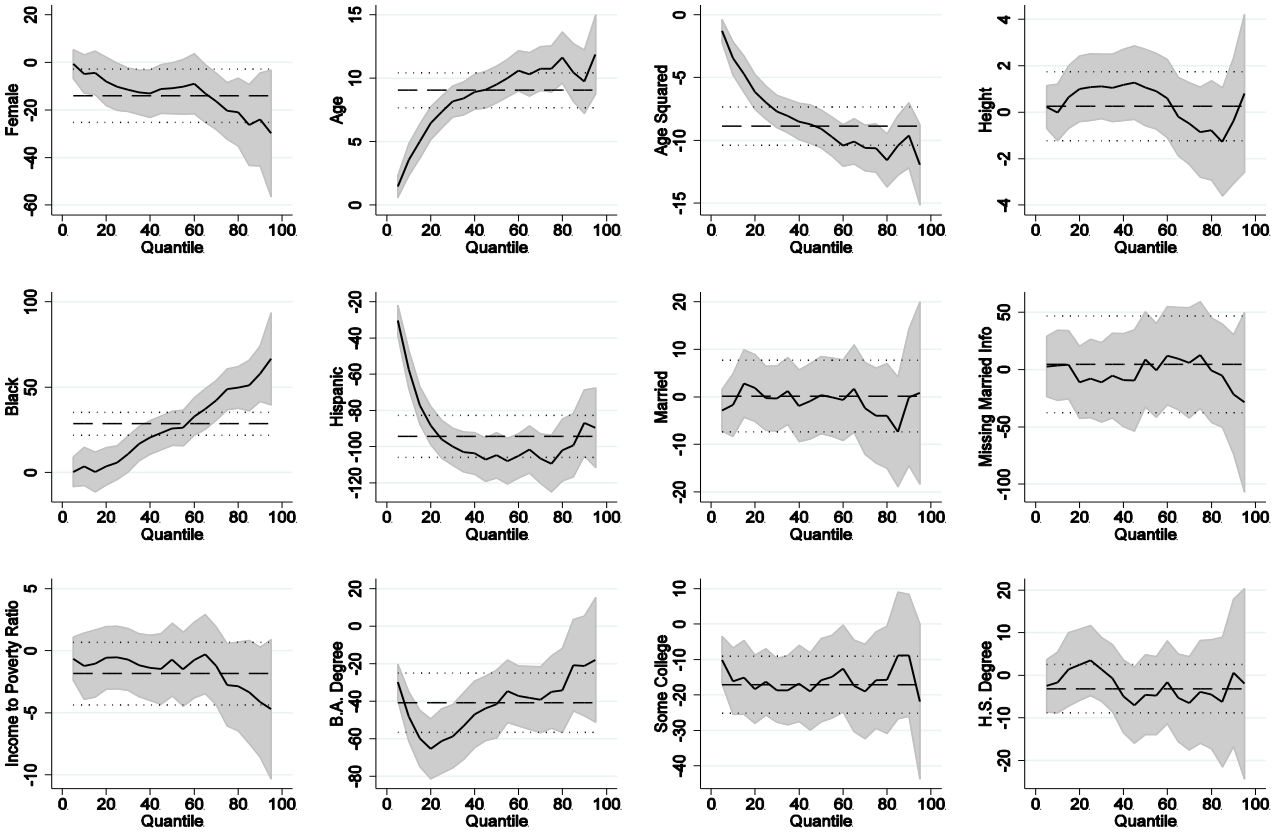
Figure 8
Quantile Regression Results of the Impact of Demographic Variables on The Average Number of Cigarettes Smoked Per Day



Notes:

The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable in all plots is the average number of cigarettes smoked per day, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent confidence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for cigarette prices, the presence of smoke-free air laws, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the cigarette price and the nearest lower price in another state, and state, year and quarter fixed effects.

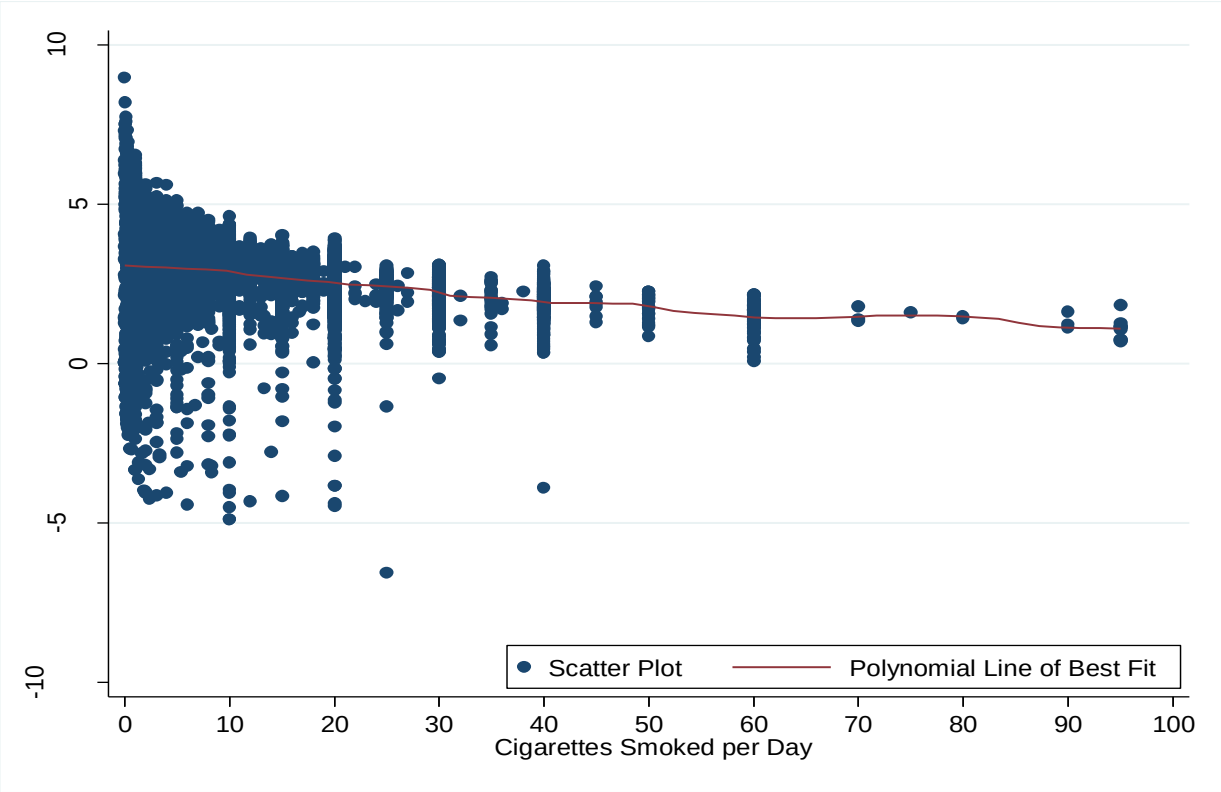
Figure 9
Quantile Regression Results of the Impact of Demographic Variables on Serum Cotinine Levels



Notes:

The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable in all plots is the serum cotinine concentration, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent confidence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for cigarette prices, the presence of smoke-free air laws, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the price and the nearest lower price in another state, and state, year and quarter fixed effects.

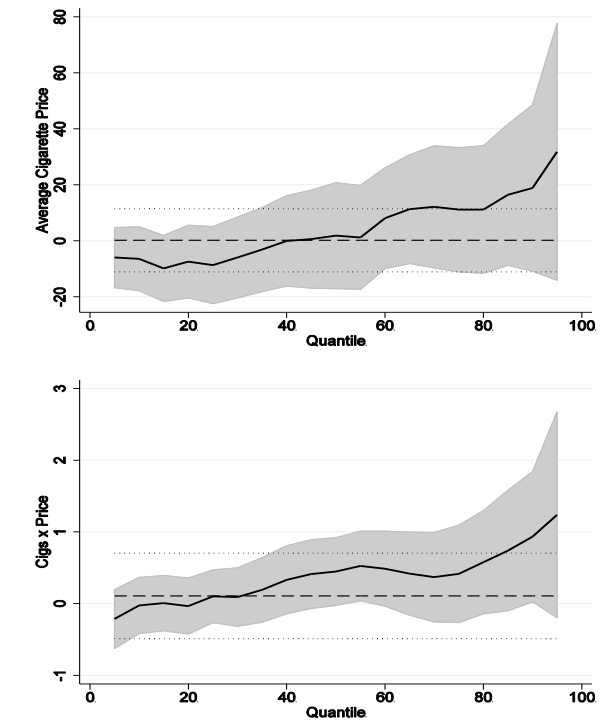
Figure 10
Smoking Intensity and Cigarettes Smoked Per Day



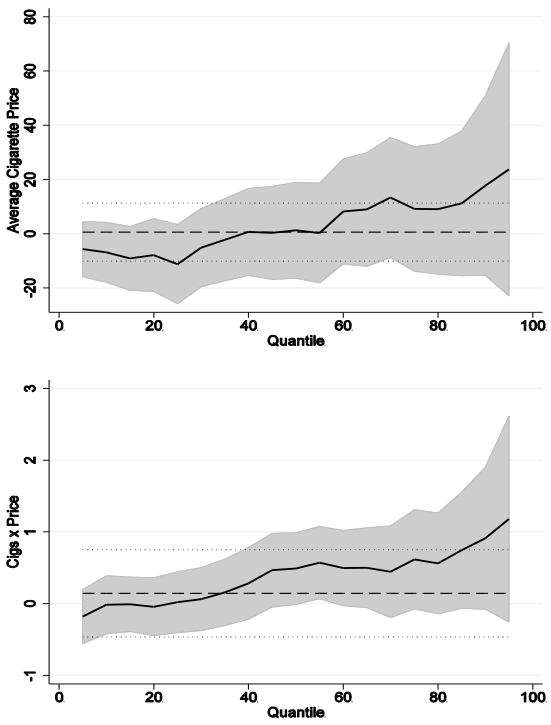
Notes:
Data from NHANES. Smoking intensity is defined as the log of the cotinine concentration minus the log of cigarettes smoked per day.

Figure 11
Quantile Regression Results of the Impact of Cigarette Prices on Changes in Smoking Behavior

Panel A. Cigarette Prices in Work SFA Laws Model



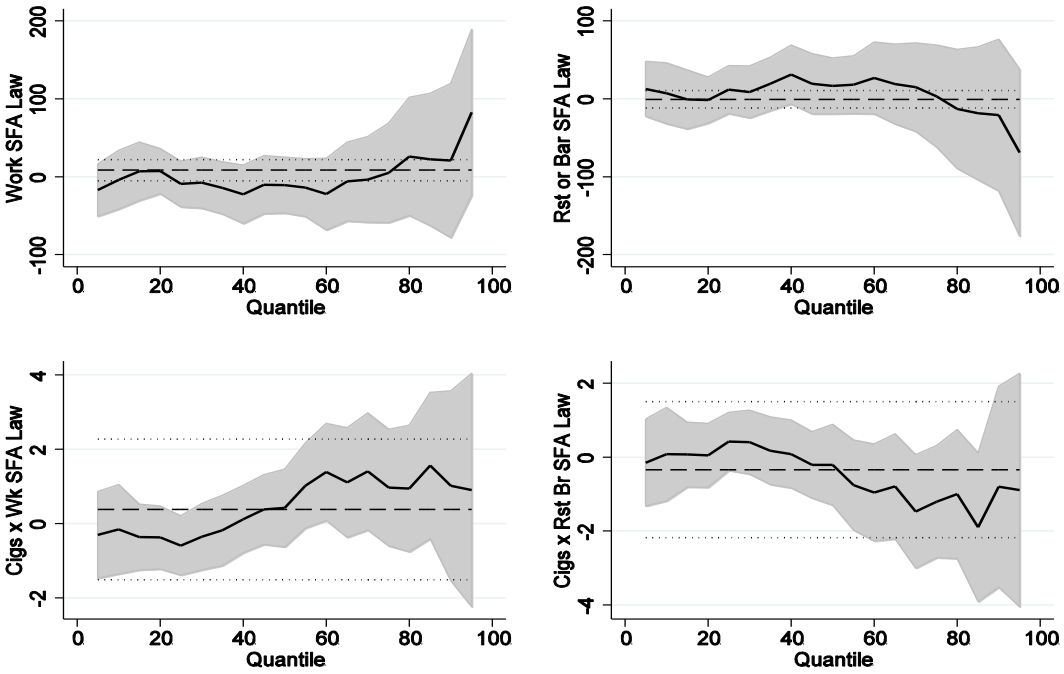
Panel B. Cigarette Prices in Rest/Bar SFA Laws Model



Notes:

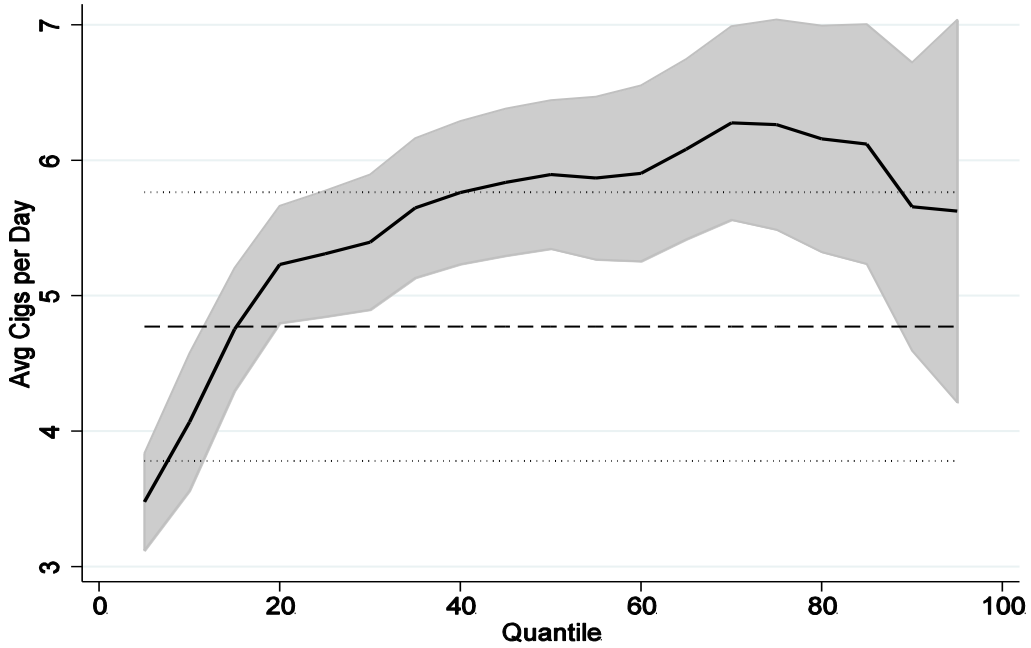
The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable in all plots is the serum cotinine concentration, measured in ng/ml, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent conficence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for the average number of cigarettes smoked per day, smoke-free air laws, gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects.

Figure 12
Quantile Regression Results of the Impact of Smoke-Free Air Laws on Changes in Smoking Behavior



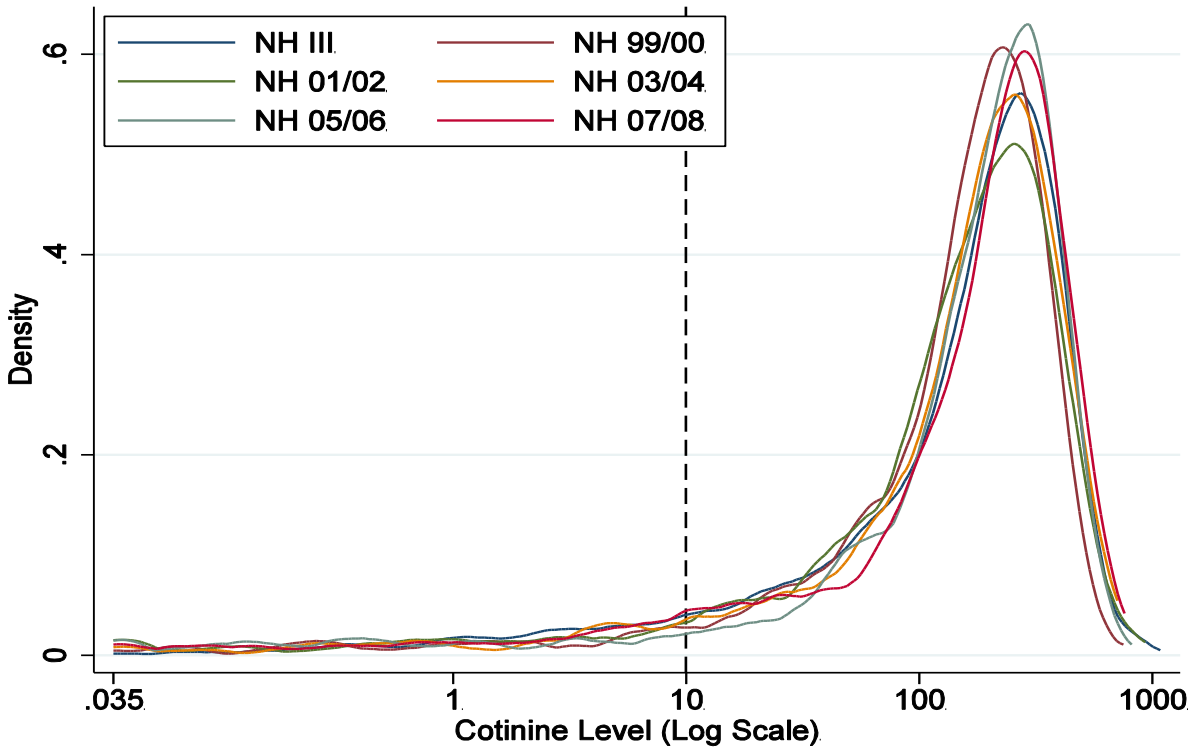
Notes:
The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable in all plots is the serum cotinine concentration, measured in ng/ml, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent conficence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for the average number of cigarettes smoked per day, cigarette prices, gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects.

Figure 13
Quantile Regression Results of the Impact of
The Average Number of Cigarettes Smoked per Day on Serum Cotinine Levels



Notes:
The plots display quantile regression coefficients for every 5th quantile between the 5th through 95th quantiles and corresponding OLS coefficients. The dependent variable is the serum cotinine concentration, measured in ng/ml, conditional on smoking participation. The solid line represents the quantile regression coefficients and the shaded area represents the 95 percent confidence interval for the quantile regression coefficients, calculated from bootstrapped standard errors using 299 replications. The dashed lines represent the corresponding OLS coefficients and 95 percent confidence interval, calculated from standard errors clustered at the state level. All regressions also control for cigarette prices, the presence of smoke-free air laws in private workplaces, interactions between the tobacco control policies and the average number of cigarettes smoked per day, gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the cigarette price and the nearest lower price in another state, and state, year and quarter fixed effects.

Figure 14
Cotinine Levels for Smokers by NHANES Survey Wave



Notes:
Data from NHANES. The black dashed line indicates a serum cotinine concentration of 10 mg/nl, the common cutoff for distinguishing smokers from non-smokers.

Table 1
Summary Statistics

Variable	Total Sample (N=33,201) Mean	Total Sample (N=33,201) Std. Dev.	Smokers (N=7874) Mean	Smokers (N=7874) Std. Dev.	Non-Smokers (N=25,327) Mean	Non-Smokers (N=25,327) Std. Dev.	Diff in Means P-Value
Currently Smoke	0.2506	0.4334	1.0000	n/a	0.0000	n/a	n/a
Avg Cigs per Day	3.9795	9.1093	15.8773	11.9237	0.0000	n/a	n/a
Cotinine Concentration	54.5905	116.4990	217.0177	137.6285	0.2631	0.7668	0.000
Average Cigarette Price	4.0162	0.9006	3.9563	0.9217	4.0363	0.8926	0.000
Cigarette Excise Tax	1.5070	0.7011	1.4640	0.7118	1.5214	0.6969	0.000
Any Work SFA Law	0.4654	0.4988	0.4500	0.4975	0.4706	0.4992	0.025
Any Rst or Bar SFA Law	0.5769	0.4941	0.5517	0.4974	0.5853	0.4927	0.000
Female	0.5454	0.4979	0.4738	0.4993	0.5694	0.4952	0.000
Age	46.2349	16.5508	41.2238	13.9077	47.9110	17.0193	0.000
Height	66.2900	3.9312	66.9130	3.7341	66.0817	3.9733	0.000
Black	0.1067	0.3088	0.1222	0.3276	0.1015	0.3020	0.000
Hispanic	0.1231	0.3286	0.1088	0.3114	0.1279	0.3340	0.000
Married	0.6396	0.4801	0.5582	0.4966	0.6668	0.4714	0.000
Missing Married Info	0.0200	0.1401	0.0181	0.1331	0.0207	0.1424	0.351
Income to Poverty Ratio	2.8175	1.7150	2.3798	1.6459	2.9639	1.7127	0.000
B.A. Degree	0.2503	0.4332	0.1137	0.3175	0.2960	0.4565	0.000
Some College	0.2828	0.4504	0.2655	0.4416	0.2886	0.4531	0.006
H.S. Degree	0.2634	0.4405	0.3370	0.4727	0.2388	0.4263	0.000
State Unemployment Rate	5.3216	1.2424	5.3013	1.2247	5.3284	1.2483	0.207

Notes:
Data from NHANES III and NHANES 1999/2000 through NHANES 2007/2008, the Tax Burden on Tobacco, Project ImpacTeen, Lillard and Sfekas (2010), U.S. Census, and the Bureau for Labor Statistics. Summary statistics are weighted by NHANES sample weights.

Table 2
The Impact of Tobacco Control Policies on Smoking Outcomes

	Both SFA Laws			Work SFA Law Only			Restaurant/Bar SFA Law Only		
	Prevalence	Avg. Cigarettes per Day	Serum Cotinine Level	Prevalence	Avg. Cigarettes per Day	Serum Cotinine Level	Prevalence	Avg. Cigarettes per Day	Serum Cotinine Level
Cigarette Prices									
Average Cigarette Price	-0.0069	-1.7184***	-8.1381	-0.0071	-1.6907***	-7.9701	-0.0078	-1.7099***	-7.7604
	(-0.628)	(-2.823)	(-1.393)	(-0.649)	(-2.804)	(-1.367)	(-0.703)	(-2.854)	(-1.349)
Any Work SFA Law	-0.0324	0.2108	9.391	-0.0255**	-0.4947	5.1106			
	(-1.572)	-0.179	-0.926	(-2.196)	(-1.149)	(0.836)			
Any Rest/Bar SFA Law	0.0073	-0.7587	-4.6033				-0.0223*	-0.5714	3.7387
	(0.281)	(-0.694)	(-0.555)				(-1.778)	(-1.503)	(0.658)
Adjusted R^2	0.118	0.22	0.176	0.118	0.220	0.176	0.118	0.220	0.176
Num. Obs	33201	7874	7874	33201	7874	7874	33201	7874	7874
Cigarette Excise Taxes									
Cigarette Excise Tax	-0.0243**	-1.1172*	-8.4390	-0.0242**	-1.0492	-7.4794	-0.0254**	-1.0908*	-7.3413
	(-2.693)	(-1.708)	(-1.457)	(-2.670)	(-1.610)	(-1.280)	(-2.627)	(-1.705)	(-1.266)
Any Work SFA Law	-0.0222	0.4309	17.9201*	-0.0247**	-0.6108	3.2220			
	(-1.176)	(0.397)	(1.848)	(-2.213)	(-1.124)	(0.519)			
Any Rest/Bar SFA Law	-0.0027	-1.1151	-15.7348*				-0.0229*	-0.7349	0.0759
	(-0.109)	(-1.149)	(-1.704)				(-1.837)	(-1.520)	(0.012)
Adjusted R^2	0.118	0.219	0.176	0.118	0.219	0.176	0.118	0.219	0.176
Num. Obs	33201	7874	7874	33201	7874	7874	33201	7874	7874

Notes:

The dependent variable in the 1st, 4th, and 7th columns is an indicator variable for whether an individual is a current smoker, the dependent variables in the 2nd, 5th, and 8th columns is the number of cigarettes smoked per day, conditional on smoking participation, and the dependent variable in the 3rd, 6th, and 9th columns is an individual's serum cotinine level, conditional on smoking participation. T-statistics calculated from standard errors clustered at the state level are shown in parentheses. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3
Quantile Regression Results of the Impact of Tobacco Control Policies on The Average Number of Cigarettes Smoked Per Day

		Quantile Regressions						
	OLS Results	**5th Quantile**	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**	**95th Quantile**
Cigarette Prices								
Average Cigarette Price	-1.6907***	-0.0028	-0.2134	-0.8017*	-0.6352	-1.6704*	-3.8173***	-4.3146***
	(-2.804)	(-0.011)	(-0.564)	(-1.690)	(-1.061)	(-1.822)	(-2.979)	(-2.587)
Any Work SFA Law	-0.4947	-0.0298	-0.3209	-0.4458	-0.7257	-0.3580	0.8219	2.7677
	(-1.149)	(-0.105)	(-0.841)	(-0.787)	(-1.004)	(-0.475)	(0.552)	(1.442)
Adjusted/Pseudo R^2	0.220	0.035	0.066	0.121	0.167	0.098	0.168	0.159
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Cigarette Excise Taxes								
Cigarette Excise Tax	-1.0492	-0.0228	-0.0962	-0.3940	-0.5889	-1.7233**	-2.1930	-1.9646
	(-1.610)	(-0.104)	(-0.300)	(-0.867)	(-0.967)	(-2.109)	(-1.506)	(-1.152)
Any Work SFA Law	-0.6108	-0.0301	-0.1918	-0.4750	-0.7425	-0.6295	0.5476	1.7728
	(-1.124)	(-0.108)	(-0.505)	(-0.853)	(-1.054)	(-0.735)	(0.400)	(0.912)
Adjusted/Pseudo R^2	0.219	0.035	0.065	0.121	0.167	0.098	0.167	0.158
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Mean/Quantiles of Cigs per Day	14.37	1.00	1.33	5.00	10.00	20.00	30.00	40.00

Notes:

The dependent variable in all columns is the average number of cigarettes smoked per day, conditional on smoking participation. T-statistics are shown in parentheses, and are calculated from standard errors clustered at the state level for column 1 and from bootstrapped standard errors using 299 replications in columns 2-8. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4
Quantile Regression Results of the Impact of Tobacco Control Policies on The Average Number of Cigarettes Smoked Per Day

		Quantile Regressions						
	OLS Results	**5th Quantile**	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**	**95th Quantile**
Cigarette Prices								
Average Cigarette Price	-1.7099***	-0.0179	-0.2300	-0.7626	-0.5764	-1.6630*	-3.6551***	-3.8728**
	(-2.854)	(-0.073)	(-0.629)	(-1.494)	(-0.947)	(-1.727)	(-2.786)	(-2.550)
Any Rest/Bar SFA Law	-0.5714	0.0151	-0.2907	-0.4606	-0.8067	-0.8919	0.1523	2.1172
	(-1.503)	(0.053)	(-0.716)	(-0.874)	(-1.275)	(-1.063)	(0.113)	(1.213)
Adjusted/Pseudo R^2	0.220	0.035	0.066	0.121	0.167	0.098	0.168	0.159
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Cigarette Excise Taxes								
Cigarette Excise Tax	-1.0908*	-0.0187	-0.1236	-0.4104	-0.6556	-1.7052**	-2.3382*	-2.1784
	(-1.705)	(-0.094)	(-0.405)	(-0.953)	(-1.217)	(-2.033)	(-1.824)	(-1.322)
Any Rest/Bar SFA Law	-0.7349	-0.0415	-0.2284	-0.4829	-0.7989	-1.0924	-0.0750	1.1534
	(-1.520)	(-0.148)	(-0.568)	(-0.837)	(-1.163)	(-1.298)	(-0.050)	(0.626)
Adjusted/Pseudo R^2	0.219	0.035	0.065	0.121	0.167	0.098	0.167	0.158
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Mean/Quantiles of Cigs per Day	14.37	1.00	1.33	5.00	10.00	20.00	30.00	40.00

Notes:

The dependent variable in all columns is the average number of cigarettes smoked per day, conditional on smoking participation. T-statistics are shown in parentheses, and are calculated from standard errors clustered at the state level for column 1 and from bootstrapped standard errors using 299 replications in columns 2-8. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5
Quantile Regression Results of the Impact of Tobacco Control Policies on Serum Cotinine Concentrations

		Quantile Regressions						
	OLS Results	**5th Quantile**	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**	**95th Quantile**
Cigarette Prices								
Average Cigarette Price	-7.9701	-9.7633*	-14.8563	-7.3128	-8.5147	-8.4810	3.7974	2.4483
	(-1.367)	(-1.764)	(-1.611)	(-0.863)	(-0.887)	(-0.656)	(0.234)	(0.115)
Any Work SFA Law	5.1106	-3.9506	-2.2354	-5.3132	-3.3749	10.0985	22.5358	15.3473
	(0.836)	(-0.620)	(-0.276)	(-0.558)	(-0.330)	(0.765)	(1.282)	(0.712)
Adjusted/Pseudo R^2	0.176	0.047	0.082	0.125	0.118	0.104	0.105	0.107
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Cigarette Excise Taxes								
Cigarette Excise Tax	-7.4794	-6.4738	-8.5028	-6.9629	-7.9552	-10.4808	-0.9993	-18.8400
	(-1.280)	(-1.267)	(-1.044)	(-0.825)	(-0.900)	(-0.923)	(-0.070)	(-0.904)
Any Work SFA Law	3.2220	-0.0141	-4.0522	-7.1231	-6.3132	16.4749	24.8731	17.1810
	(0.519)	(-0.002)	(-0.466)	(-0.716)	(-0.590)	(1.174)	(1.351)	(0.749)
Adjusted/Pseudo R^2	0.176	0.045	0.081	0.125	0.118	0.104	0.104	0.107
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Mean/Quantiles of Serum Cotinine Concentration	215.09	6.11	25.90	104.50	204.00	307.00	406.00	467.00

Notes:

The dependent variable in all columns is the serum cotinine level, measured in ng/ml, conditional on smoking participation. T-statistics are shown in parentheses, and are calculated from standard errors clustered at the state level for column 1 and from bootstrapped standard errors using 299 replications in columns 2-8. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6
Quantile Regression Results of the Impact of Tobacco Control Policies on Serum Cotinine Concentrations

		Quantile Regressions						
	OLS Results	**5th Quantile**	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**	**95th Quantile**
Cigarette Prices								
Average Cigarette Price	-7.7604	-9.2483	-15.4672*	-7.6071	-7.9803	-8.8952	1.4999	-0.3593
	(-1.349)	(-0.561)	(-1.777)	(-0.926)	(-0.812)	(-0.659)	(0.094)	(-0.016)
Any Rest/Bar SFA Law	3.7387	-3.9843	-2.7597	-2.4588	-0.7796	5.2591	5.1399	-5.6476
	(0.658)	(-0.125)	(-0.311)	(-0.263)	(-0.073)	(0.421)	(0.300)	(-0.272)
Adjusted/Pseudo R^2	0.176	0.047	0.082	0.125	0.118	0.104	0.104	0.107
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Cigarette Excise Taxes								
Cigarette Excise Tax	-7.3413	-5.8996	-9.0635	-6.0834	-8.4968	-8.8762	-2.9740	-18.3129
	(-1.266)	(-1.168)	(-1.218)	(-0.739)	(-0.969)	(-0.720)	(-0.214)	(-0.924)
Any Rest/Bar SFA Law	0.0759	-1.9539	-5.6287	-2.7612	-2.3484	9.3149	5.4943	-11.3313
	(0.012)	(-0.322)	(-0.692)	(-0.314)	(-0.233)	(0.653)	(0.342)	(-0.544)
Adjusted/Pseudo R^2	0.176	0.045	0.081	0.125	0.118	0.103	0.104	0.107
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Mean/Quantiles of Serum Cotinine Concentration	215.09	6.11	25.90	104.50	204.00	307.00	406.00	467.00

Notes:

The dependent variable in all columns is the serum cotinine level, measured in ng/ml, conditional on smoking participation. T-statistics are shown in parentheses, and are calculated from standard errors clustered at the state level for column 1 and from bootstrapped standard errors using 299 replications in columns 2-8. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7
Semi-Elasticities for OLS and Quantile Regression Coefficients Estimating the Effects of Tobacco Control Policies on Serum Cotinine Levels and the Average Number of Cigarettes Smoked per Day

			Quantile Regressions						
	Prevalence	OLS Results	5th Quantile	10th Quantile	25th Quantile	50th Quantile	75th Quantile	90th Quantile	95th Quantile
Cigarettes Smoked per Day									
Table 2/Table 3									
Cigarette Price	-0.028	-0.118***	-0.003	-0.160	-0.160*	-0.064	-0.084*	-0.127***	-0.108***
Any Work SFA Law	-0.102**	-0.034	-0.030	-0.241	-0.089	-0.073	-0.018	0.027	0.069
Cigarette Tax	-0.097**	-0.073	-0.023	-0.072	-0.079	-0.059	-0.086**	-0.073	-0.049
Any Work SFA Law	-0.099**	-0.043	-0.030	-0.144	-0.095	-0.074	-0.031	0.018	0.044
Table 2/Table 4									
Cigarette Price	-0.031	-0.119***	-0.018	-0.173	-0.153	-0.058	-0.083*	-0.122***	-0.097**
Any Rest/Bar SFA Law	-0.089*	-0.040	0.015	-0.218	-0.092	-0.081	-0.045	0.005	0.053
Cigarette Tax	-0.101**	-0.076*	-0.019	-0.093	-0.082	-0.066	-0.085**	-0.078*	-0.054
Any Rest/Bar SFA Law	-0.091*	-0.051	-0.042	-0.171	-0.097	-0.080	-0.055	-0.003	0.029
Means/Quantiles of Participation/Cigs per Day	0.25	14.37	1.00	1.33	5.00	10.00	20.00	30.00	40.00
Serum Cotinine Levels									
Table 2/Table 5									
Cigarette Price	-0.028	-0.037	-1.598*	-0.574	-0.070	-0.042	-0.028	0.009	0.005
Any Work SFA Law	-0.102**	0.024	-0.647	-0.086	-0.051	-0.017	0.033	0.056	0.033
Cigarette Tax	-0.097**	-0.035	-1.060	-0.328	-0.067	-0.039	-0.034	-0.002	-0.040
Any Work SFA Law	-0.099**	0.015	-0.002	-0.156	-0.068	-0.031	0.054	0.061	0.037
Table 2/Table 6									
Cigarette Price	-0.031	-0.036	-1.514	-0.597*	-0.073	-0.039	-0.029	0.004	-0.001
Any Rest/Bar SFA Law	-0.089*	0.017	-0.652	-0.107	-0.024	-0.004	0.017	0.013	-0.012
Cigarette Tax	-0.101**	-0.034	-0.966	-0.350	-0.058	-0.042	-0.029	-0.007	-0.039
Any Rest/Bar SFA Law	-0.091*	0.000	-0.320	-0.217	-0.026	-0.012	0.030	0.014	-0.024
Means/Quantiles of Participation/Cotinine	0.25	215.09	6.11	25.90	104.50	204.00	307.00	406.00	467.00

Notes:

The table shows semi-elasticities for the coefficients in Tables 2-6. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8
Quantile Regression Results of the Impact of Tobacco Control Policies on Changes in Smoking Behavior

		Quantile Regressions						
	OLS Results	**5th Quantile**	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**	**95th Quantile**
Cigarette Prices								
Average Cigarette Price	0.2234	-5.9738	-6.4132	-8.6572	1.8411	11.1088	18.8612	31.7555
	(0.041)	(-1.092)	(-1.106)	(-1.232)	(0.191)	(0.982)	(1.245)	(1.359)
Cigs x Price	0.1064	-0.2144	-0.0249	0.1018	0.4483*	0.4156	0.9334**	1.2385*
	(0.366)	(-1.024)	(-0.125)	(0.543)	(1.859)	(1.197)	(2.018)	(1.691)
Any Work SFA Law	7.8717	-3.6897	3.0143	0.1047	3.4045	8.8599	1.0800	26.1281
	(1.603)	(-0.657)	(0.516)	(0.013)	(0.389)	(0.775)	(0.063)	(0.993)
Cigs x Any Work SFA Law	0.1611	-0.3875	-0.1005	-0.4190	0.2630	0.1690	0.2065	0.1478
	(0.273)	(-1.122)	(-0.316)	(-1.297)	(0.654)	(0.298)	(0.274)	(0.139)
Avg Cigs per Day	4.6913***	3.4047***	4.1045***	5.4061***	5.8463***	5.9555***	5.6419***	5.5210***
	(10.013)	(20.282)	(16.652)	(24.600)	(20.566)	(16.068)	(11.918)	(8.642)
Adjusted/Pseudo R^2	0.286	0.140	0.190	0.224	0.202	0.169	0.154	0.144
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Cigarette Excise Taxes								
Cigarette Excise Tax	-1.7149	-2.7349	-4.5391	-8.5207	-2.3534	9.6551	-0.0859	19.7055
	(-0.324)	(-0.507)	(-0.778)	(-0.098)	(-0.231)	(0.899)	(-0.006)	(0.855)
Cigs x Tax	0.1268	-0.1870	-0.0435	0.2296	0.8199*	0.6393	1.1799	1.0975
	(0.289)	(-0.567)	(-0.158)	(0.112)	(1.684)	(0.942)	(1.121)	(0.841)
Any Work SFA Law	6.4582	-4.2152	2.5268	-0.5815	3.3769	8.0835	3.5623	19.9048
	(1.310)	(-0.679)	(0.402)	(-0.008)	(0.389)	(0.743)	(0.217)	(0.804)
Cigs x Any Work SFA Law	0.1058	-0.3534	-0.1021	-0.5001	-0.0032	0.2135	0.2008	-0.2669
	(0.176)	(-1.061)	(-0.339)	(-0.001)	(-0.008)	(0.376)	(0.252)	(-0.256)
Avg Cigs per Day	4.7156***	3.3874***	4.1088***	5.5050	5.9320***	6.0113***	5.5678***	5.7114***
	(10.275)	(17.686)	(16.389)	(0.146)	(18.880)	(16.857)	(11.645)	(8.551)
Adjusted/Pseudo R^2	0.286	0.139	0.189	0.224	0.202	0.169	0.153	0.142
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Mean/Quantiles of Serum Cotinine Concentration	215.090	6.110	25.900	104.500	204.000	307.000	406.000	467.000

Notes:
The dependent variable in all columns is the serum cotinine level, measured in ng/ml, conditional on smoking participation. T-statistics are shown in parentheses, and are calculated from standard errors clustered at the state level for column 1 and from bootstrapped standard errors using 299 replications in columns 2-8. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9
Quantile Regression Results of the Impact of Tobacco Control Policies on Changes in Smoking Behavior

		Quantile Regressions						
	OLS Results	**5th Quantile**	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**	**95th Quantile**
Cigarette Prices								
Average Cigarette Price	0.5914	-5.6944	-6.8671	-11.2194	1.2231	9.1282	17.7305	23.7135
	(0.113)	(-1.100)	(-1.217)	(-1.509)	(0.136)	(0.779)	(1.049)	(0.997)
Cigs x Price	0.1428	-0.1823	-0.0171	0.0188	0.4892*	0.6168*	0.9121*	1.1786
	(0.481)	(-0.952)	(-0.083)	(0.087)	(1.919)	(1.750)	(1.805)	(1.612)
Any Rest/Bar SFA Law	6.5198	-2.4159	4.5749	3.4187	6.1868	4.6657	-2.6056	4.0527
	(1.360)	(-0.402)	(0.735)	(0.468)	(0.731)	(0.407)	(-0.159)	(0.165)
Cigs x Any Rest/Bar SFA	-0.0885	-0.3584	-0.0406	0.0133	0.0028	-0.7211	0.0584	-0.3935
Law	(-0.156)	(-1.052)	(-0.102)	(0.038)	(0.007)	(-1.343)	(0.071)	(-0.391)
Avg Cigs per Day	4.7959***	3.4771***	4.0898***	5.2538***	5.9588***	6.3534***	5.7083***	5.6964***
	(9.906)	(17.700)	(14.591)	(21.304)	(18.505)	(16.743)	(11.487)	(8.106)
Adjusted/Pseudo R^2	0.286	0.140	0.190	0.224	0.202	0.169	0.154	0.144
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Cigarette Excise Taxes								
Cigarette Excise Tax	-1.3263	-3.2593	-4.9293	-10.1584	-2.9598	9.3874	3.6610	20.0059
	(-0.262)	(-0.572)	(-0.906)	(-1.413)	(-0.281)	(0.131)	(0.241)	(0.778)
Cigs x Tax	0.2373	-0.1754	-0.0603	0.0034	0.8856*	1.0964	1.5572	1.4548
	(0.502)	(-0.518)	(-0.197)	(0.009)	(1.784)	(0.008)	(1.583)	(1.149)
Any Rest/Bar SFA Law	3.6565	-1.3218	2.6805	3.8004	3.9904	1.5514	-3.2589	-11.2062
	(0.743)	(-0.215)	(0.447)	(0.544)	(0.449)	(0.010)	(-0.198)	(-0.479)
Cigs x Any Rest/Bar SFA	-0.1967	-0.2864	-0.0713	-0.0287	-0.1653	-0.6971	-0.5394	-1.0657
Law	(-0.340)	(-0.960)	(-0.220)	(-0.090)	(-0.394)	(-0.086)	(-0.595)	(-0.910)
Avg Cigs per Day	4.8523***	3.3976***	4.0855***	5.3108***	6.0408***	6.3961	5.7919***	6.2458***
	(9.999)	(17.751)	(15.209)	(23.325)	(18.702)	(0.141)	(11.224)	(8.828)
Adjusted/Pseudo R^2	0.286	0.139	0.189	0.224	0.202	0.169	0.153	0.142
Num. Obs	7874	7874	7874	7874	7874	7874	7874	7874
Mean/Quantiles of Serum Cotinine Concentration	215.090	6.110	25.900	104.500	204.000	307.000	406.000	467.000

Notes:

The dependent variable in all columns is the serum cotinine level, measured in ng/ml, conditional on smoking participation. T-statistics are shown in parentheses, and are calculated from standard errors clustered at the state level for column 1 and from bootstrapped standard errors using 299 replications in columns 2-8. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 1
Complete Results for Linear Probability, OLS, and Quantile Regression Results of the Impact of Tobacco Control Policies on the Average Number of Cigarettes Smoked Per Day

			Quantile Regressions						
	Prevalence	OLS Results	5th Quantile	10th Quantile	25th Quantile	50th Quantile	75th Quantile	90th Quantile	95th Quantile
Average Cigarette Price	-0.0071	-1.6907***	-0.0028	-0.2134	-0.8017*	-0.6352	-1.6704*	-3.8173***	-4.3146***
	(-0.649)	(-2.804)	(-0.011)	(-0.564)	(-1.690)	(-1.061)	(-1.822)	(-2.979)	(-2.587)
Any Work SFA Law	-0.0255**	-0.4947	-0.0298	-0.3209	-0.4458	-0.7257	-0.3580	0.8219	2.7677
	(-2.196)	(-1.149)	(-0.105)	(-0.841)	(-0.787)	(-1.004)	(-0.475)	(0.552)	(1.442)
Anti-Smoking Sentiment	0.0263	1.0370	1.1850	1.3773	1.6060	-1.2591	-0.3118	-3.5027	-8.9642
	(0.516)	(0.540)	(1.073)	(0.893)	(0.749)	(-0.501)	(-0.095)	(-0.723)	(-1.296)
Price Difference	0.0164	1.7716*	0.3485	0.8747*	0.8215	0.8666	0.8764	1.6754	3.5416
	(1.227)	(1.819)	(0.873)	(1.691)	(1.286)	(1.146)	(0.741)	(0.935)	(1.444)
Female	-0.0820***	-0.5464**	0.1959	0.3467*	0.0951	-0.0595	-0.3738	-1.1317	-1.3785
	(-8.836)	(-2.074)	(1.308)	(1.674)	(0.338)	(-0.173)	(-0.722)	(-1.464)	(-1.398)
Age	0.0173***	0.6427***	0.0635***	0.1679***	0.3995***	0.5753***	0.7723***	0.8233***	0.8016***
	(18.554)	(11.236)	(2.722)	(4.976)	(9.108)	(12.076)	(11.114)	(8.127)	(6.280)
Age Squared	-0.0216***	-0.5881***	-0.0570**	-0.1549***	-0.3710***	-0.5184***	-0.6842***	-0.7320***	-0.6971***
	(-19.486)	(-9.305)	(-2.339)	(-4.265)	(-7.956)	(-10.069)	(-9.448)	(-6.921)	(-5.150)
Height	0.0061***	0.2469***	0.0180	0.0789**	0.1465***	0.2333***	0.3190***	0.2889***	0.3293**
	(6.253)	(5.939)	(0.786)	(2.534)	(3.649)	(4.776)	(4.733)	(3.010)	(2.338)
Black	-0.0285**	-7.6935***	-0.6277***	-2.0091***	-4.9195***	-8.2309***	-8.9506***	-12.2001***	-11.7642***
	(-2.218)	(-19.099)	(-2.724)	(-6.286)	(-14.363)	(-26.131)	(-19.051)	(-18.485)	(-13.450)
Hispanic	-0.1212***	-9.4159***	-1.4707***	-3.1851***	-7.1621***	-10.6375***	-10.5828***	-13.2483***	-14.0012***
	(-10.449)	(-16.621)	(-6.185)	(-10.568)	(-20.606)	(-26.939)	(-19.618)	(-15.240)	(-13.052)
Married	-0.0846***	0.1575	-0.0225	-0.0035	0.2731	0.2000	0.5216	-0.3328	-1.5434**
	(-14.010)	(0.762)	(-0.214)	(-0.022)	(1.353)	(0.821)	(1.345)	(-0.589)	(-2.107)
Missing Married Info	-0.0501***	-0.1086	-0.2040	-0.3357	-0.5894	-0.1716	0.7414	0.4985	-3.0221
	(-2.883)	(-0.107)	(-0.381)	(-0.366)	(-0.407)	(-0.114)	(0.466)	(0.202)	(-0.890)
Income to Poverty Ratio	-0.0240***	-0.1102	-0.0411	-0.0449	-0.1542*	-0.0878	0.0630	-0.0316	-0.0999
	(-10.925)	(-1.065)	(-0.997)	(-0.709)	(-1.811)	(-1.004)	(0.470)	(-0.171)	(-0.409)
B.A. Degree	-0.2057***	-4.5111***	-1.1158***	-2.7384***	-3.9402***	-3.7753***	-4.3060***	-4.2128***	-4.8658***
	(-13.119)	(-8.468)	(-4.013)	(-6.740)	(-6.926)	(-6.665)	(-5.223)	(-3.277)	(-3.475)
Some College	-0.1112***	-1.9037***	-0.5428***	-0.7257***	-1.1574***	-1.2719***	-1.2778**	-2.4963***	-2.7620***
	(-10.482)	(-5.605)	(-3.138)	(-3.107)	(-3.876)	(-3.668)	(-2.439)	(-3.422)	(-2.861)
H.S. Degree	-0.0459***	-0.9271***	-0.1324	-0.1766	0.2568	-0.5311**	-0.4380	-1.2860**	-1.6516**
	(-4.496)	(-3.062)	(-0.999)	(-0.955)	(0.971)	(-2.072)	(-1.056)	(-2.066)	(-1.982)
State Unemployment Rate	-0.0038	0.2074	-0.0336	-0.0324	0.0202	-0.0640	0.0378	0.4585	0.2149
	(-0.773)	(1.152)	(-0.282)	(-0.219)	(0.093)	(-0.301)	(0.112)	(0.889)	(0.324)
Exam Q2	-0.0005	1.1257**	0.1383	0.3080	0.3555	1.1077***	1.5802**	1.8577**	1.6597
	(-0.057)	(2.088)	(0.874)	(1.234)	(0.939)	(2.578)	(2.105)	(1.975)	(1.340)
Exam Q3	0.0056	0.6606	-0.2828	0.0457	-0.0322	0.9922*	1.6993*	1.8070	1.3982
	(0.639)	(1.016)	(-1.211)	(0.137)	(-0.065)	(1.846)	(1.903)	(1.562)	(0.968)
Exam Q4	-0.0095	1.0499**	0.1429	0.5214***	0.5264*	0.8837***	1.0875*	1.4998*	1.3994
	(-1.414)	(2.106)	(0.940)	(2.617)	(1.736)	(2.620)	(1.773)	(1.758)	(1.443)
Exam Afternoon	0.0043	-0.3680	-0.0655	-0.1719	-0.4565**	-0.5089**	-0.1204	0.1675	0.2792
	(0.903)	(-1.562)	(-0.576)	(-1.025)	(-2.042)	(-2.023)	(-0.287)	(0.308)	(0.382)
Exam Evening	-0.0110	-0.4403	-0.0414	-0.1967	-0.8435***	-0.2539	-0.3072	-0.7853	0.3609
	(-1.058)	(-1.304)	(-0.276)	(-0.787)	(-2.635)	(-0.729)	(-0.580)	(-1.049)	(0.349)
Exam on Weekend	-0.0110*	-0.3748	0.1621	0.2293	0.0942	-0.0618	-0.6640	-1.0275*	-1.0946
	(-1.941)	(-1.297)	(1.344)	(1.326)	(0.390)	(-0.246)	(-1.625)	(-1.773)	(-1.417)
Adjusted/Pseudo R^2	0.118	0.220	0.035	0.066	0.121	0.167	0.098	0.168	0.159
Num. Obs	33201	7874	7874	7874	7874	7874	7874	7874	7874
Mean/Quantiles of Cigs per Day	0.25	14.37	1.00	1.33	5.00	10.00	20.00	30.00	40.00

Notes:
The dependent variable in the first column is an indicator variable for whether an individual is a current smoker. The dependent variable in all other columns is the cigarettes smoked per day, conditional on smoking participation. T-statistics are shown in parentheses, and are calculated from standard errors clustered at the state level for column 1 and from bootstrapped standard errors using 299 replications in columns 2-8. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 2
Complete Results for Linear Probability, OLS, and Quantile Regression Results of the Impact of Tobacco Control Policies on Serum Cotinine Concentrations

			Quantile Regressions						
	Prevalence	**OLS Results**	**5th Quantile**	**10th Quantile**	**25th Quantile**	**50th Quantile**	**75th Quantile**	**90th Quantile**	**95th Quantile**
Average Cigarette Price	-0.0071	-7.9701	-9.7633*	-14.8563	-7.3128	-8.5147	-8.4810	3.7974	2.4483
	(-0.649)	(-1.367)	(-1.764)	(-1.611)	(-0.863)	(-0.887)	(-0.656)	(0.234)	(0.115)
Any Work SFA Law	-0.0255**	5.1106	-3.9506	-2.2354	-5.3132	-3.3749	10.0985	22.5358	15.3473
	(-2.196)	(0.836)	(-0.620)	(-0.276)	(-0.558)	(-0.330)	(0.765)	(1.282)	(0.712)
Anti-Smoking Sentiment	0.0263	-12.9012	5.2138	13.8734	6.9253	4.0016	-56.9144	-72.0192	-14.9606
	(0.516)	(-0.467)	(0.217)	(0.486)	(0.211)	(0.102)	(-1.279)	(-1.116)	(-0.184)
Price Difference	0.0164	21.8330**	23.6762***	28.2688**	24.5025**	20.8487	24.9600	13.0658	8.3314
	(1.227)	(2.094)	(3.219)	(2.364)	(2.051)	(1.553)	(1.488)	(0.605)	(0.303)
Female	-0.0820***	-13.9301**	-1.4978	-4.4622	-10.2646**	-10.3206*	-18.6224***	-23.8890***	-30.1913**
	(-8.836)	(-2.551)	(-0.483)	(-1.076)	(-2.131)	(-1.932)	(-2.768)	(-2.598)	(-2.152)
Age	0.0173***	9.0777***	1.5006***	3.4506***	7.3410***	9.4248***	11.2052***	9.9856***	12.5134***
	(18.554)	(13.482)	(3.147)	(5.422)	(11.270)	(13.585)	(12.070)	(7.945)	(7.399)
Age Squared	-0.0216***	-8.8853***	-1.3118***	-3.2954***	-6.9959***	-8.9906***	-11.1569***	-9.8212***	-12.6243***
	(-19.486)	(-11.891)	(-2.628)	(-4.940)	(-10.067)	(-12.206)	(-11.310)	(-7.733)	(-7.162)
Height	0.0061***	0.2537	0.2526	0.0324	0.9304	1.2408*	-0.5418	-0.2906	0.5656
	(6.253)	(0.348)	(0.551)	(0.054)	(1.327)	(1.655)	(-0.587)	(-0.222)	(0.297)
Black	-0.0285**	28.8332***	3.3846	4.1865	5.4370	25.9459***	45.7377***	56.6504***	69.8075***
	(-2.218)	(8.588)	(0.791)	(0.722)	(1.045)	(4.605)	(7.187)	(6.990)	(5.421)
Hispanic	-0.1212***	-94.0208***	-30.0563***	-56.2344***	-96.5830***	-104.7527***	-107.8073***	-87.2273***	-87.9721***
	(-10.449)	(-15.904)	(-7.706)	(-10.930)	(-19.473)	(-16.465)	(-13.541)	(-9.918)	(-7.298)
Married	-0.0846***	0.1420	-3.3935	-0.3205	-1.4047	1.1673	-4.5180	-0.0682	-0.2942
	(-14.010)	(0.039)	(-1.503)	(-0.092)	(-0.427)	(0.293)	(-0.912)	(-0.010)	(-0.030)
Missing Married Info	-0.0501***	5.0273	2.6159	8.6552	-8.9068	10.4168	10.1744	-20.4525	-37.3562
	(-2.883)	(0.247)	(0.209)	(0.579)	(-0.507)	(0.446)	(0.384)	(-0.793)	(-0.826)
Income to Poverty Ratio	-0.0240***	-1.8973	-0.6784	-1.1246	-0.5692	-1.0146	-2.8444*	-4.9001**	-4.3559
	(-10.925)	(-1.546)	(-0.782)	(-0.864)	(-0.467)	(-0.675)	(-1.669)	(-2.147)	(-1.586)
B.A. Degree	-0.2057***	-40.7287***	-30.2457***	-47.8275***	-58.2698***	-41.0598***	-34.9917***	-18.0563	-23.4501
	(-13.119)	(-5.202)	(-6.013)	(-7.578)	(-6.914)	(-4.857)	(-3.404)	(-1.335)	(-1.543)
Some College	-0.1112***	-17.3508***	-11.0798***	-15.8123***	-17.0584***	-16.4388***	-17.0203**	-8.8291	-18.6391*
	(-10.482)	(-4.416)	(-3.052)	(-3.240)	(-3.613)	(-2.842)	(-2.512)	(-1.009)	(-1.699)
H.S. Degree	-0.0459***	-3.1929	-5.1983	-1.0894	3.6214	-4.5034	-3.5391	1.3962	-0.5053
	(-4.496)	(-1.155)	(-1.626)	(-0.278)	(0.960)	(-1.041)	(-0.638)	(0.167)	(-0.049)
State Unemployment Rate	-0.0038	-2.2140	4.0047*	3.7612	-0.6031	-7.0329*	-3.6895	-10.4579*	-7.7603
	(-0.773)	(-0.683)	(1.944)	(1.264)	(-0.177)	(-1.938)	(-0.821)	(-1.737)	(-0.990)
Exam Q2	-0.0005	14.1834*	6.1362*	6.0914	5.9018	13.1403*	23.5656**	30.0593**	6.9862
	(-0.057)	(1.972)	(1.781)	(1.093)	(0.885)	(1.764)	(2.466)	(2.279)	(0.467)
Exam Q3	0.0056	1.4116	-0.1551	1.4326	0.1977	-2.6187	2.0195	21.0737	-5.0502
	(0.639)	(0.200)	(-0.030)	(0.183)	(0.026)	(-0.282)	(0.186)	(1.467)	(-0.279)
Exam Q4	-0.0095	2.0285	-0.1281	0.4246	0.0692	0.0007	6.3482	13.3105	-6.8187
	(-1.414)	(0.364)	(-0.042)	(0.089)	(0.014)	(0.000)	(0.671)	(1.218)	(-0.500)
Exam Afternoon	0.0043	2.7296	0.2459	-0.4991	1.6818	-0.2115	4.6581	10.4775	18.3730**
	(0.903)	(0.968)	(0.097)	(-0.145)	(0.481)	(-0.048)	(0.850)	(1.432)	(1.990)
Exam Evening	-0.0110	10.4924**	-0.5374	-4.5022	4.5261	17.9102***	14.9815**	8.7661	17.1281
	(-1.058)	(2.089)	(-0.167)	(-0.940)	(0.841)	(2.883)	(2.239)	(0.923)	(1.424)
Exam on Weekend	-0.0110*	3.8128	2.7178	2.3403	2.2820	4.8276	0.8731	1.4259	-3.4886
	(-1.941)	(0.903)	(0.984)	(0.658)	(0.619)	(1.044)	(0.158)	(0.202)	(-0.406)
Adjusted/Pseudo R^2	0.118	0.176	0.047	0.082	0.125	0.118	0.104	0.105	0.107
Num. Obs	33201	7874	7874	7874	7874	7874	7874	7874	7874
Mean/Quantiles of Serum Cotinine Concentration	0.251	215.090	6.110	25.900	104.500	204.000	307.000	406.000	467.000

Notes:

The dependent variable in the first column is an indicator variable for whether an individual is a current smoker. The dependent variable in all other columns is the serum cotinine concentration, measured in ng/ml, conditional on smoking participation. T-statistics are shown in parentheses, and are calculated from standard errors clustered at the state level for column 1 and from bootstrapped standard errors using 299 replications in columns 2-8. All regressions also control for gender, age, age squared, race, ethnicity, height, marital status, education, income-to-poverty ratio, whether examination was on a weekday or weekend, time of day when the serum cotinine sample was drawn (morning, afternoon, or evening), state anti-smoking sentiment, state unemployment rate, the difference between the tax/price and the nearest lower tax/price in another state, and state, year and quarter fixed effects. Stars denote statistical significance: * Significant at 10%; ** significant at 5%; *** significant at 1%.