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### Public Sentiment and Tobacco Control Policy

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#### Recommended Citation

Singleton, Perry, "Public Sentiment and Tobacco Control Policy" (2008). *Center for Policy Research*. 61.  
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**Center for Policy Research  
Working Paper No. 106**

**PUBLIC SENTIMENT AND TOBACCO  
CONTROL POLICY**

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**May 2008**

**\$5.00**

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## **Abstract**

The well-documented correlation between cigarette excise taxes and cigarette demand may not be entirely causal if excise taxes reflect public sentiment towards smoking. I consider whether proxies for smoking sentiment – the prevalence of smoking by education and intention to quit statuses – are correlated with support for and implementation of tobacco control laws. I find that cigarette excise taxes are most sensitive to the prevalence of educated smokers who do not want to quit. Additionally, when proxies for public sentiment are included, the estimated elasticity of cigarette demand declines from -2.0 to -1.3.

**JEL Codes:** H23, I18

**Keywords:** Cigarette demand, excise taxes, legislative endogeneity

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Federal, state, and local governments have dramatically increased cigarette excise taxes in recent years. From 1995 to 2001, the federal excise tax on cigarettes increased from 24 cents to 34 cents per pack, and nineteen states nominally increased cigarette taxes by 31 cents per pack on average. The popularity of cigarette excise taxes stems from their dual effects: they generate tax revenue from smokers who remain smoking and encourage marginal smokers to quit. The reduction in cigarette consumption in response to increased excise taxes is well documented: a review of earlier studies suggests that the estimated price elasticity of cigarette demand ranges from  $-.14$  to  $-1.23$  (see Chaloupka and Warner, 2000, for a review), and may have increased to  $-2.1$  in recent years (Goolsbee and Slemrod, 2004). As a result, cigarette excise taxes are now an integral component of public policies to curb smoking.

The documented relationship between excise taxes and cigarette consumption may not be entirely causal, however. An important concern, and an often unaddressed issue in the literature, is the extent to which tobacco control policies reflects public sentiment towards smoking. If public sentiment towards smoking affects the prevalence of smoking and is also correlated with tobacco control policy, then the implied effect of tobacco control policies on the prevalence of smoking, without controlling for public sentiment, may be overstated (Wasserman et al. in particular, 1991; and Besley and Case, 2000, more generally). If this were the case, then policies that change public sentiment towards smoking, such as health education, may be more effective at reducing smoking rates than tobacco control policies alone.<sup>1</sup> Therefore, to design

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<sup>1</sup> Tobacco control policies may be used to correct naïve assumptions about the health risks posed by smoking, serving as a substitute for health education (Viscusi, 1990), so the implementation of tobacco taxes may ultimately impact public sentiment towards smoking. Evans and Farrelly (1998), however, find that some smokers switch from lower to higher strength cigarettes in response to excise taxes to attenuate the effect of decreased cigarette consumption on actual tar and nicotine intake. Thus, for some individuals, cigarette taxes are not a perfect substitute for education about the health risks posed by smoking.

and implement effective policies to reduce cigarette consumption, it is important to isolate the causal effect of cigarette excise taxes on smoking.

In this study, I develop several proxies for public sentiment towards smoking and examine the correlation between these proxies and changes in federal and state excise taxes on cigarettes. The most straightforward proxy for public sentiment is the prevalence of smoking: smokers are less averse to smoking than non smokers. I then disaggregate the prevalence of smoking along two dimensions: the prevalence of smokers who plan to quit and the prevalence of educated smokers. Smokers who plan to quit evidently disparage smoking more than smokers who do not want to quit. And the health behaviors of those with higher socioeconomic status, measured by education attainment, may serve as a leading indicator for public sentiment towards smoking. Therefore, the prevalence of smoking by intention to quit and education attainment arguably serve as better proxies for public sentiment towards smoking than the rate of smoking alone.

I first examine whether smoking status and, among smokers, the intention to quit is correlated with explicit support for a particular tobacco control policy: smoking bans in public places. The data come from the 1995 and 1996 Tobacco Supplements of the CPS. First, I find that non smokers favor smoking bans more than smokers, and smokers who plan to quit favor smoking bans more than smokers who do not plan to quit. If the differential support for public smoking bans reflects one's attitude towards smoking, then the prevalence of smoking by intention to quit status arguably serve as proxies for public sentiment towards smoking.

I then examine the correlation between proxies for public sentiment and changes in federal and state excise tax increases between 1995 and 2001. Over this time period, nineteen states nominally increased their state excise taxes (state excise tax rates in 1995 and 2001 are

presented in Appendix Table). The results indicate that states are less likely to increase excise taxes, and increase them by less, as the prevalence of smoking increases. Furthermore, the negative correlation between taxes and the rate of smoking is driven almost entirely by the prevalence of educated smokers who do not want to quit. If the prevalence of educated smokers who do not plan to quit serves as an adequate proxy for changing public sentiment towards smoking, then the results suggest that tobacco control policies are indeed correlated with public sentiment.

Finally, I estimate the effect of cigarette excise taxes on the demand for cigarettes with and without controlling for public sentiment. The empirical strategy consists of regressing state-level changes in cigarette consumption between 1995 and 2001 on the change in the price of cigarettes over the same time period. To isolate variation in prices due to excise tax increases, I instrument the change in the price of cigarettes with the change in price due to federal and state excise tax increases. However, if changes in excise taxes are endogenous and correlated with public sentiment towards smoking, then the causal effect of taxes on smoking may be overstated. Without controls for baseline sentiment, I find that the elasticity of cigarette demand is -2.0 and the elasticity of the smoking rate is -.48. When baseline proxies for public sentiment are included, the estimated elasticity of cigarette demand and the elasticity of the smoking rate decline to -1.27 and -.09, respectively. Thus, it appears that the causal effect of excise taxes on smoking is potentially overstated when public sentiment is not controlled.

There are numerous studies that examine the elasticity of cigarette demand to excise tax changes, but to my knowledge, only Ohsfeldt et al. (1999) explicitly address the potential endogeneity of cigarette excise taxes. In contrast to the results of this study, they find that the elasticity of cigarette demand actually increases when public sentiment is addressed. However,

their empirical strategy is fundamentally different from the strategy considered here. Instead of using proxy variables to control for public sentiment, they use instruments for cigarette excise taxes based on government characteristics in an attempt to purge the effect of public sentiment on cigarette prices altogether.<sup>2</sup> But it is not obvious – nor do the authors clarify – what type of variation in cigarette prices these instruments isolate and therefore the extent to which this variation is exogenous. Rather than using questionable instrumental variables to purge the effect of public sentiment from excise taxes, I attempt to directly control for public sentiment by using proxy variables.

## **I. Methodology and Data**

### **A. Methodology**

The empirical objective is to evaluate the extent to which tobacco control policy reflects public sentiment towards smoking. I first evaluate two proxies for public sentiment: smoking status and, among smokers, the intention to quit smoking. Naturally, smokers are less averse to smoking than non smokers, and smokers who want to quit disparage smoking more than smokers who do not want to quit. I first evaluate the correlation between smoking and intention to quit statuses with explicit support for public smoking bans. If smoking and intention to quit statuses are strongly correlated with support for smoking bans, and those who support smoking bans disparage smoking more than those who do not, then smoking prevalence and the prevalence of smokers who intend to quit may serve as proxies for smoking sentiment.

I then examine whether proxies for public sentiment towards smoking are correlated with recent increases in federal and state excise taxes on tobacco. If state excise taxes reflect public

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<sup>2</sup> The instruments include per-capita government expenditures, state political liberalism, and an index of interparty competition



attitudes towards smoking, and smoking status serves as a proxy for smoking sentiment, then increases in excise taxes should be negatively correlated with the prevalence of smoking. The empirical specification is given by,

$$(1) \quad \Delta \log(T_n) = \alpha_0 + \alpha_1 S_n + \alpha_2 X_n + \varepsilon_{1,n},$$

where  $\Delta \log(T_n)$  is some measure of the change in state excise taxes in state  $n$ , and  $S_n$  is the baseline smoking rate in state  $n$ . The vector  $X_n$  is a set of state-specific characteristics, and  $\varepsilon_{1,n}$  is an error term. The alternative hypothesis - the likelihood or magnitude of an excise tax increase is negatively associated with the prevalence smoking - is  $\alpha_1 < 0$ .

As mentioned, the correlation between excise tax changes and the smoking rate may depend differentially on the prevalence of smokers who plan to quit. The empirical specification, with the smoking rate disaggregated by intention to quit status, is given by,

$$(2) \quad \Delta \log(T) = \beta_0 + \beta_1 S_q + \beta_2 S_{\bar{q}} + \beta_3 X_n + \varepsilon_2,$$

where  $S_q$  and  $S_{\bar{q}}$  ( $S = S_q + S_{\bar{q}}$ ) are the prevalence of smokers who plan to quit and do not plan to quit, respectively (state subscripts  $n$  are suppressed). If the prevalence of smokers who do not plan to quit serves as a better proxy for public sentiment towards smoking than smoking prevalence alone, then the negative correlation between tax increases and the prevalence of smoking should be greater with respect to the prevalence of smokers who do not want to quit:

$$|\beta_1| > |\beta_2|.$$

In addition to the intention to quit, the negative correlation between excise taxes and the rate of smoking may depend differentially on the proportion of educated smokers. Previous research has shown that the historical decline in cigarette consumption in the US and in other countries is concentrated among the more educated (Pierce, 1989; Escobedo and Peddicord, 1996; Osler et al, 1998). And second, previous economic research on signaling demonstrates

that the higher end of the socioeconomic strata sets trends for certain behaviors; for example, popular fashion (Pesendorfer, 1995) and first names (Levitt and Fryer, 2004). In the context of smoking, higher educated individual may choose not to smoke - and openly disparage smoking - to signal their social status. Cigarette smoking would then be considered unfashionable, and lower ends of the social strata would eventually adopt a negative sentiment towards smoking. Thus, the health behaviors of the more educated plausibly serves as a proxy for public health sentiment towards smoking and a leading indicator for changes in smoking prevalence. The empirical specification, with the prevalence of smoking disaggregated by education attainment, is given by,

$$(3) \quad \Delta \log(T) = \gamma_0 + \gamma_1 S_e + \gamma_2 S_{\bar{e}} + \gamma_3 X_n + \varepsilon_3,$$

where  $S_e$  and  $S_{\bar{e}}$  ( $S = S_e + S_{\bar{e}}$ ) are the prevalence of smoking of more educated and less educated individuals, respectively. If the prevalence of smoking among the more educated serves as a better proxy for public health sentiment than the prevalence among the less educated, and tax increases reflect public sentiment towards smoking, then  $|\gamma_1| > |\gamma_2|$ .

If the cigarette taxes reflect public sentiment towards smoking, and the prevalence of smokers by education and the intention to quit serve as better proxies for public sentiment than smoking rates alone, then state tax increases should be most sensitive to the prevalence of educated smokers who do not plan to quit. A more general function disaggregates smoking rates by both educational attainment and intention to quit status,

$$(4) \quad \Delta \log(T) = \lambda_0 + \lambda_1 S_{qe} + \lambda_2 S_{q\bar{e}} + \lambda_3 S_{\bar{q}e} + \lambda_4 S_{\bar{q}\bar{e}} + \lambda_5 X_n + \varepsilon_4.$$

If the prevalence of educated smokers who do not plan to quit serves as the best proxy among the other prevalence measures, then much of the negative correlation between tax increases and smoking prevalence should be driven by the prevalence of educated smokers who do not want to

quit. Therefore,  $\lambda_3$  should be greater in absolute value than the coefficients associated with the other prevalence measures.

The negative correlation between cigarette demand and cigarette taxes is well documented; but if public sentiment towards smoking affects the prevalence of smoking and is correlated with excise taxes, then the negative correlation between cigarette consumption and excise taxes may not be entirely causal. Therefore, I examine whether the elasticity of cigarette demand and smoking rates to price are sensitive to the inclusion of proxies for smoking sentiment. The specification for estimating the elasticity of cigarette demand is derived by first-differencing two, presumably equilibrium, outcomes at the state level,

$$(5) \quad \Delta \log(D) = \pi_0 + \pi_1 \Delta \log(P) + \nu.$$

To isolate variation in price changes due to excise taxes, i.e. the component of cigarette prices affected by policy, the change in price is instrumented with the predicted change in price due to excise tax changes:  $\Delta \log(T) = \log(\Delta T + P_0) - \log(P_0)$ , where  $P_0$  is the baseline price of cigarettes and  $\Delta T$  is the level change in excise taxes on cigarettes.

If sentiment towards smoking affects the demand for cigarettes through  $\nu$ , and sentiment is correlated with excise tax changes  $\Delta \log(T)$ , then the instrument and the structural error term in equation (5) are positively correlated. Thus, the structural effect of price on cigarette demand,  $\pi_1$ , is biased upwards. To address this concern, I include proxies for public sentiment in equation (5),

$$(6) \quad \Delta \log(D) = \eta_0 + \eta_1 \Delta \log(P) + \eta_2 S_{qe} + \eta_3 S_{q\bar{e}} + \eta_4 S_{\bar{q}e} + \eta_5 S_{\bar{q}\bar{e}} + \theta.$$

In this equation, the structural error term in equation (5) is effectively disaggregated by public sentiment and a residual error term:  $v = \eta_2 S_{qe} + \eta_3 S_{q\bar{e}} + \eta_4 S_{\bar{q}e} + \eta_5 S_{\bar{q}\bar{e}} + \theta$ . If  $\theta$  is now uncorrelated with excise tax changes  $\Delta \log(T)$ ,  $\pi_1$  is consistently estimated.

## **B. Recent Changes in Federal and State Excise Taxes on Cigarettes**

Federal and state excise taxes have increased dramatically in recent years. From 1995 to 2001, the federal excise tax on cigarettes increased from 24 cents to 34 cents per pack, and nineteen states nominally increased cigarette taxes by 31 cents per pack on average. In 1995, only seven states had combined (federal and state) cigarette excise taxes in excess of 75 cents per pack, and no state had combined cigarette excise taxes in excess of one dollar (combined excise taxes by state are presented in the Appendix Table). By 2001, sixteen states had combined excise taxes in excess of 75 cents per pack (in 1995 values), and five states had combined excise taxes that exceeded one dollar. There was also a wave of excise tax increases between 2001 and 2003: 25 states nominally increased state excise taxes and, by 2003, 18 states had combined state and federal excise taxes (in 1995 values) in excess of one dollar.

For two related reasons, I focus on federal and state excise tax increases between 1995 and 2001 rather than the wave of state tax hikes between 2001 and 2003. First, Goolsbee and Slemrod (2004) estimate an increased price elasticity of cigarette demand during the 1990s relative to estimates from earlier periods.<sup>3</sup> And second, the state tax increases between 2001 and 2003 were largely in response to state-level budget deficits; so much of the variation in excise tax increases over this time period potentially reflects the severity of state budgetary issues rather

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<sup>3</sup>In their study, they examine the extent to which increased use of the internet affects cross-state sales of cigarettes and conclude that the estimated price elasticity of cigarette demand is sensitive to internet-usage across states.

than public sentiment towards smoking. Ostensibly, the goal of excise tax increases between 1995 and 2001 - when the US economy was expanding and government budgets were shrinking – was to reduce cigarette consumption and therefore are more likely to reflect public sentiment towards smoking. Thus, this study considers the extent to which a correlation between public sentiment and excise tax increases affects the estimated price elasticity of cigarette demand between 1995 and 2001.

### **C. Data**

The main data for the empirical analysis come from the Tobacco Supplements from the Current Population Survey. Supplements in certain years contain smoking status, intentions to quit (among smokers), former smoking status (among non smokers), and sentiment towards smoking bans in certain public places. To examine explicit support for smoking bans by smoking status, I pool CPS supplements in September 1995, January 1996, and May 1996. Because proxy respondents are more likely to misreport smoking status and intentions to quit compared to non proxy respondents, I only consider non proxy survey responses.<sup>4</sup> I also focus on civilian adults. There are 193,808 observations that satisfy these criteria.

The pooled CPS data are also used to estimate state-level smoking prevalence measures, by intention to quit status and educational attainment, and state-specific characteristics for equations (1) through (4). Survey population weights are used to calculate state-level averages. The outcome variable in estimation equations (1) through (4) is constructed using information on federal and state excise taxes, compiled from data provided by the Tax Policy Center of the Urban Institute and Brookings Institution; and cigarette prices, which are obtained from the *Tax Burden on Tobacco* (Orzechowski and Walker, 2003). These data are presented by state in the

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<sup>4</sup>Ohsfeldt et al. (1997) demonstrate systemic underreporting of smoking by proxy respondents relative to respondents.

Appendix Table. The outcome variable is defined as the change in taxes from 1995 to 2001 relative to the average price of cigarettes (generic cigarettes included) in 1995 at the state level,

$$\Delta \log(T) = \log(T_{2001} - T_{1995} + P_{1995}) - \log(P_{1995}),$$

where T represents federal and state excise taxes.<sup>5</sup>

For equations (5) and (6), I use the same smoking prevalence measures used in equations (1) through (4), and I consider two different outcome variables: cigarette demand and the smoking rate. The change in cigarette demand is measured as the change in per-capita tobacco sales, obtained from the *Tax Burden on Tobacco*, between 1995 and 2001 (data are also included in the Appendix Table). The change in smoking rate is estimated using the CPS Tobacco Supplements in 1995 and 1996 and in 2001 and 2002 (June 2001, November 2001, and February 2002).

## II. Sentiment by Smoking Status: Smoking Bans

I first examine whether smoking status and intention to quit status are correlated with explicit support for a particular tobacco control policy; smoking bans in certain public places. The proportions of individuals who favor smoking bans by smoking status and public place are presented in Table 1. Panels A and B refer to non smokers and smokers, respectively, and the columns correspond to the public space. Across all spaces, non smokers favor smoking bans more than smokers. The order from most supported to least supported among smokers and non smokers alike is as follows; hospitals, sporting venues, work, shopping malls, restaurants, and bars. The largest difference in support between smokers and non smokers is in restaurants (56.9% versus 18.6%) and hospitals (83.2% versus 59.2%). Thus, the data suggest that the

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<sup>5</sup>The estimation equations (1) through (6) are estimated at the state level, so excise taxes at the local level are not incorporated in the analysis.

sentiment towards smoking, and explicit support for tobacco control policies, depends on smoking status.

In panel B, I disaggregate smokers by intention to quit status according to their response to a particular Tobacco Supplement question: “Are you seriously considering stopping within the next sixth months?” The sample size of smokers is reduced from 44,322 to 42,885 due to missing responses to the intention to quit question. As indicated, smokers who plan to quit support smoking bans in all spaces relative to those who do not plan to quit, suggesting that smokers who intend to quit disparage smoking more than smokers who do not plan to quit. Additionally, the smallest differences in support between these two groups are smoking bans in restaurants (27.3% versus 12.9%) and bars (8.9% versus 5.1%); two places commonly associated with smoking. One interpretation is that smokers who plan to quit view smoking bans as a self-control device to aid them in their attempt to quit (Gruber, 2001), and therefore favor bans more than those who do not plan to quit.<sup>6</sup> However, they may also hedge against an unsuccessful attempt at quitting by supporting bans relatively less in restaurants and bars.

I next examine differential support for bans among non smokers by whether they are former smokers (panel A of Table 1) and by whether they quit within the past year. As indicated, those who never smoked prefer smoking bans more than former smokers in all public spaces, and the difference in support is even greater when never smokers are compared to former smokers who recently quit. Consistent with the results in Panel B, the difference in support between never smokers and former smokers who recently quit is largest in restaurants (56.9% versus 32%) and bars (31.6% and 12.0%), which in this case may reflect hedging behavior among former smokers against smoking relapse.

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<sup>6</sup>Gruber and Mullainathan (2002) find that cigarette excise taxes make predicted smokers happier, suggesting that smokers view tobacco control policies as a self-control device.

Smoking status may be correlated with other factors that may affect sentiment towards smoking and therefore support for smoking bans. Therefore, I estimate first-difference models of support while simultaneously controlling for certain observable characteristics: age (linearly), sex (male and female), marital status (married and not married), educational attainment (high school or less and some college or more), race (white and non white), and labor force participation (participating and no participating). The first-differences estimators are estimated from two different samples: non smokers, by former smoking status, and current smokers, by intention to quit status.

The estimates from the first-difference, linear probability models are presented in Table 2. Estimates among non smokers are presented in panel A (the left out group is former smokers) and estimates among smokers are presented in panel B (the left out group is smokers who do not plan to quit). Within each panel, estimates with and without controls are given in rows I and II, respectively. As indicated, the differential support for smoking bans among the two sets of groups is robust to the inclusion of observable characteristics. Furthermore, the largest difference in support for bans among non smokers by former smoking status, and smallest difference in support for bans among smokers by intention to quit status, is in restaurants and bars. All estimated differences are also robust to the inclusion of certain observable characteristics.

### **III. Sentiment and Public Policy: Cigarette Excise Taxes**

#### **A. Summary of Data**

I next consider whether proxies for smoking sentiment are correlated with increases in cigarette excise taxes. The data for the analysis are summarized in Table 3. The variables are



grouped by row, and the columns correspond to different samples of states according to the log change in federal and state excise taxes between 1995 and 2001 (relative to the average price of cigarettes by state in 1995). The first column contains all states, column II is states with relatively smaller changes in excise taxes ( $<.075$ ), and column III is states with relatively larger changes ( $>.075$ ). State observations are weighted with respect to state size, and standard errors reflect that state-level averages are calculated from micro-level data.

The first set of variables corresponds to the change in cigarette variables between 1995 and 2001. On average, excise taxes increased by approximately 5.7% between 1995 and 2001 relative to the price of cigarettes in 1995; and the average price of cigarettes increased by approximately 46.9% over the same time period. By comparing the second and third columns, increases in state excise taxes are correlated with changes in the average price of cigarettes. A regression of the change in prices on the change in taxes, controlling for state-average demographic characteristics, yields a point estimate on the change in taxes of .68 (standard error: .10) and an F-statistic of 13.4. Furthermore, states with larger increases in state excise taxes exhibited relatively larger declines in per capita cigarette sales and smoking rates. Figure 1 plots the change in log per capita cigarette sales against the change in log excise tax price and illustrates a negative correlation between state excise taxes and cigarette demand.

The second set of variables corresponds to smoking prevalence by intention to quit and education attainment. Individuals are separated into two groups according to education attainment: less educated, defined as high school or less, and more educated, defined as some college and more. Indicated in the first column, the smoking prevalence of the less educated is greater than the prevalence of the more educated: 13.1% versus 8.4%. The differential prevalence of smoking by education attainment does not result from a higher prevalence of less

educated individuals: in the final panel of Table 3, the sample is almost evenly split between less and higher educated individuals. The data also indicate that the proportion of educated smokers who want to quit is greater than the proportion of educated smokers who do not, whereas the opposite is true among less educated smokers. Because more educated individuals are less likely to smoke, and a larger proportion of educated smokers would like to quit, the prevalence of smoking among the more educated by intention to quit status may serve as a leading indicator for public sentiment towards smoking.

When states are separated by smaller versus greater excise tax increases, two relationships become apparent. First, states with smaller excise tax increases have slightly higher rates of smoking: 23.5% versus 20.0%. In Figure 2, I plot the change in log excise taxes from 1995 and 2001 against the prevalence of smoking in 1995. The figure illustrates that much of the excise tax increases occurred in states with relatively lower rates of smoking. And second, in states with relatively smaller excise tax increases, the proportion of educated smoker who do not want to quit is greater than the proportion of educated smokers who do plan to quit. However, in states with relatively larger excise tax increases, the educated smoker population is split evenly between those who want to quit and those who do not. Thus, it appears that excise tax increases are correlated with the prevalence of smoking, particularly the prevalence of smoking and intention to quit among the more educated.

The final panel of Table 3 contains demographic characteristics; average age, percent male, percent married, percent who are higher educated, percent non white, and percent of individuals who are not participation in the labor force. As indicated, only the prevalence of more educated individuals varies considerably between states with larger versus smaller increases in excise taxes: 46.0% versus 51.3%. Nonetheless, I control for state-level

demographics when estimating the correlation between changes in excise taxes and proxies for smoking sentiment.

## **B. Estimation Results**

Estimates of equations (1) through (4) are presented in Table 4. In panel I, the outcome variable is binary, equaling one if the log change in excise taxes – between 1995 and 2001 relative to the average cigarette price in 1995 - is greater than .075 and zero otherwise. In panel II, the outcome variable is the actual log change in excise taxes relative to the average cigarette price in 1995.

I first estimate the likelihood and magnitude of excise tax increases with respect to changes in the rate of smoking – equation (1) above. As indicated in columns (1), states are less likely to increase cigarette taxes, and increase them by less, as the prevalence of smoking increases: a one percent increase in the smoking rate is associated with a .09 percent decline in the probability of increasing excise taxes and a .01 percent decline in the actual change in excise taxes.

I then disaggregate smoking prevalence by intention to quit – equation (2) above. Again, if the prevalence of smokers who intend to quit is a better proxy for public sentiment towards smoking than the prevalence of smoking alone, then much of the negative correlation between excise taxes increases and the prevalence of smoking should be driven primarily by the prevalence of smokers who do not want to quit. The results, in columns (2), confirm this contention. A one percent increase in the prevalence of smokers who do not intend to quit is associated with a .1 percent decline in the likelihood of an excise tax increase – the coefficient on the prevalence of smokers is -.05 and statistically insignificant.

I then disaggregate the smoking rate by educational attainment – equation (3) above. If the smoking rate among the more educated is a better proxy for public sentiment towards smoking, then much of the negative correlation between smoking prevalence and excise taxes should be driven by the prevalence of educated smokers. The results, presented in columns (3), suggest that this is indeed the case: a one percent increase in the prevalence of educated smokers is associated with a .18 percent decline in the likelihood of an excise tax increase. In contrast, the partial correlation between state excise tax increases and the prevalence of less educated smokers is nearly zero and statistically insignificant. The heterogeneous effect of smoking prevalence by educational attainment also holds for actual changes in excise taxes, presented in panel II.

Finally, I disaggregate the smoking prevalence by both educational attainment and intention to quit status – equation (4) above. Based on previous arguments, the prevalence of educated smokers who do not want to quit is arguably the best proxy for public sentiment towards smoking among those considered, so the partial correlation between excise taxes and this prevalence measure should be greatest compared to other prevalence measures. As indicated in column (4) of both panels, much of the negative correlation between excise taxes and smoking prevalence is driven by the prevalence of educated smokers who do not want to quit. Taken together, the results suggest that public sentiment towards smoking is indeed correlated with tobacco control policies.

#### **IV. Price Elasticity of Cigarette Demand**

If public sentiment towards smoking affects changes in the rate of smoking and is also correlated with tobacco control policies, then the effect of tobacco control policies on smoking

may be overstated. Therefore, I estimate the elasticity of cigarette demand and smoking prevalence with respect to the total price of cigarettes with and without the inclusion of proxies for public sentiment. The specification equation, given in equations (5) and (6) above, consists of regressing the change in cigarette demand or the prevalence of smoking on the change in the average price of cigarettes by state. To isolate the effect of excise tax policy on cigarette prices, the actual change in the average price of cigarettes within a state is instrumented with the change in federal and state excise taxes relative to the state-average price of cigarettes in 1995.

The elasticity estimates are presented in Table 5. The panels correspond to different outcome variables: panel I is per-capita tobacco sales, panel II is the rate of smoking, and panels III and IV correspond to the unconditional rate of smoking among the more educated and less educated, respectively. In each panel, the first column gives the estimated elasticity without including baseline proxies for smoking sentiment, and the second column reflects the estimated elasticity controlling for baseline proxies for smoking sentiment.

As indicated in panel I, the price elasticity of cigarette demand is -2.0 and statistically significant. Similar to the findings of Goolsebee and Slemrod (2004), the estimated elasticity during the 1990s is high relative to previous years. However, the estimated elasticity declines to -1.27 when the proxies for public sentiment are included, which suggests that the effect of taxes on cigarette demand is overstated when public sentiment is not controlled.

The estimated elasticity of the smoking rate with respect to price also declines when proxies for public sentiment are included, indicated in panel II. Without controlling for sentiment, the elasticity of the smoking rate is -.48, but declines to -.09 when baseline proxies for smoking sentiment are included, though neither estimate is statistically significant.

The results in panels III and IV, which contains elasticity estimates of the smoking rate by education attainment status, suggests that the rate of smoking among the less educated is more responsive to price than the rate of smoking among the more educated,  $-.708$  versus  $-.405$ , which is consistent with previous studies in the literature (Townsend et al., 1994). However, the elasticity estimates for the less educated declines in magnitude, and the elasticity among the more educated reverses sign, when baseline proxies for sentiment are included.

## **V. Conclusion**

In this study, I examine whether proxies for public sentiment towards smoking are correlated with explicit support for tobacco control policies and subsequent changes in tobacco control laws. The rate of smoking naturally serves as a proxy for public sentiment towards smoking, but I also disaggregate the prevalence of smoking by education attainment and intention to quit status. The prevalence of educated smokers who do not want to quit is perhaps the best proxy for public sentiment towards smoking and consequently changes in cigarette demand. The results indicate that there is negative correlation between excise tax increases and the prevalence of smoking, which is driven primarily by the prevalence of educated smokers who do not want to quit. Thus, it appears that public sentiment towards smoking is an important factor for whether and to what extent tobacco control policies are implemented.

If tobacco control policies such as cigarette excise taxes and smoking bans are correlated with public sentiment towards smoking, and smoking sentiment affects future demand for cigarettes, then the causal effect of tobacco control policies on cigarette demand may be overstated. I find that when the proxies for public sentiment are controlled, the estimated price elasticity of cigarette demand declines by approximately 38% (from  $-2.0$  to  $-1.3$ ) and the

elasticity of the rate of smoking declines by 81% (from  $-.481$  to  $.092$ ). Thus, it appears that the decline in cigarette consumption and increase in excise taxes reflects, to a certain extent, public sentiment towards smoking.

If reducing the rate of smoking is a prescribed policy goal, the results presented here suggest that public sentiment and tobacco control policies move in tandem. Therefore, to reduce the prevalence of smoking, cigarette excise taxes may not be a perfect substitute for policies that change public sentiment, and are more realistically a complement health education.

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Appendix Table

Variable Year	Excise Tax		Cigarette Price		Per-Capita Sales		Smoking Rate	
	1995	2001	1995	2001	1995	2001	1995	2001
State								
Alabama	40.5	43.5	157	268	11.3	10.2	22.6	21.7
Alaska	53.0	115.3	209	380	11.3	7.5	23.9	22.3
Arizona	82.0	79.2	206	306	8.0	5.5	21.9	18.3
Arkansas	55.5	57.4	167	273	12.7	9.5	25.7	23.5
California	61.0	104.1	197	333	6.5	4.2	17.3	13.9
Colorado	44.0	46.5	168	260	9.3	7.4	22.0	19.0
Connecticut	74.0	55.9	206	295	8.5	7.1	20.0	16.9
Delaware	48.0	49.9	166	265	13.9	15.1	24.4	19.0
DC	89.0	85.2	229	315	5.7	3.9	20.8	16.8
Florida	57.9	58.4	178	277	9.8	7.8	21.8	18.4
Georgia	36.0	39.6	155	259	11.7	8.6	21.8	19.5
Hawaii	84.0	115.3	230	354	5.6	5.2	19.4	18.1
Idaho	52.0	53.4	172	258	8.8	7.4	20.5	20.0
Illinois	68.0	79.2	188	293	9.3	7.2	23.4	20.4
Indiana	39.5	42.6	147	251	15.1	13.3	27.7	23.5
Iowa	60.0	60.2	182	269	10.5	9.4	21.8	20.2
Kansas	48.0	49.9	167	256	9.9	8.7	24.6	21.1
Kentucky	27.0	31.8	138	242	19.3	16.1	28.2	25.8
Louisiana	44.0	49.9	162	264	12.4	9.6	23.3	19.4
Maine	61.0	98.5	186	317	10.5	9.0	25.2	20.4
Maryland	60.0	86.1	177	311	8.5	6.3	20.4	16.4
Massachusetts	75.0	94.7	207	339	8.3	5.9	19.8	14.2
Michigan	99.0	93.8	228	317	9.6	8.3	24.7	22.2
Minnesota	72.0	70.6	206	291	9.4	7.7	21.7	19.7
Mississippi	42.0	44.7	159	258	12.3	10.4	21.9	22.2
Missouri	41.0	43.9	157	255	14.0	11.6	24.8	24.6
Montana	42.0	44.7	156	255	9.8	7.9	23.5	20.1
Nebraska	58.0	58.5	174	277	10.0	8.6	20.7	20.4
Nevada	59.0	59.4	193	276	10.5	8.2	27.1	21.8
New Hampshire	49.0	74.0	167	295	17.5	14.4	23.9	21.6
New Jersey	64.0	98.1	192	322	8.8	6.0	19.6	17.6
New Mexico	45.0	47.3	168	267	7.6	5.6	23.4	19.1
New York	80.0	124.8	214	362	7.7	4.9	20.6	18.3
North Carolina	29.0	33.6	145	246	13.9	10.0	25.2	23.7
North Dakota	68.0	67.1	182	282	9.0	7.5	21.9	21.4
Ohio	48.0	49.9	158	258	12.5	10.8	25.3	23.5
Oklahoma	47.0	49.0	162	263	12.6	11.1	24.2	24.2
Oregon	62.0	87.8	190	307	10.5	7.1	21.6	18.5
Pennsylvania	55.0	55.9	167	267	10.3	9.1	23.3	20.6
Rhode Island	82.5	102.8	212	315	10.0	7.6	24.0	18.7
Carolina	31.0	35.3	146	253	12.1	10.7	24.6	20.3
South Dakota	52.0	57.7	167	275	11.0	8.3	21.2	19.9
Tennessee	37.0	40.4	155	257	13.3	11.4	26.6	25.2
Texas	65.0	64.5	187	277	8.8	6.8	22.5	18.0
Utah	50.5	73.6	173	288	6.7	4.3	14.2	11.2
Vermont	56.0	67.1	180	296	12.4	10.1	24.3	23.1
Virginia	26.5	31.4	159	248	11.4	10.1	23.7	20.9
Washington	93.0	100.2	236	336	7.2	5.4	22.7	19.8
West Virginia	41.0	43.9	157	248	12.8	11.9	26.2	25.0
Wisconsin	64.0	83.9	194	309	10.3	8.5	24.4	21.8
Wyoming	36.0	39.6	159	262	13.2	10.6	24.2	22.2

The excise tax data come from the Tax Policy Center of the Urban Institute and the Brookings Institution. Average cigarette prices and per-capita sales of cigarette packs come from the Tax Burden on Tobacco. The excise tax data reflect state and federal taxes - the federal excise tax on cigarettes increased nominally from 24 to 34 cents per pack from 1995 to 2001. Figures in 2001 are in 1995 values.

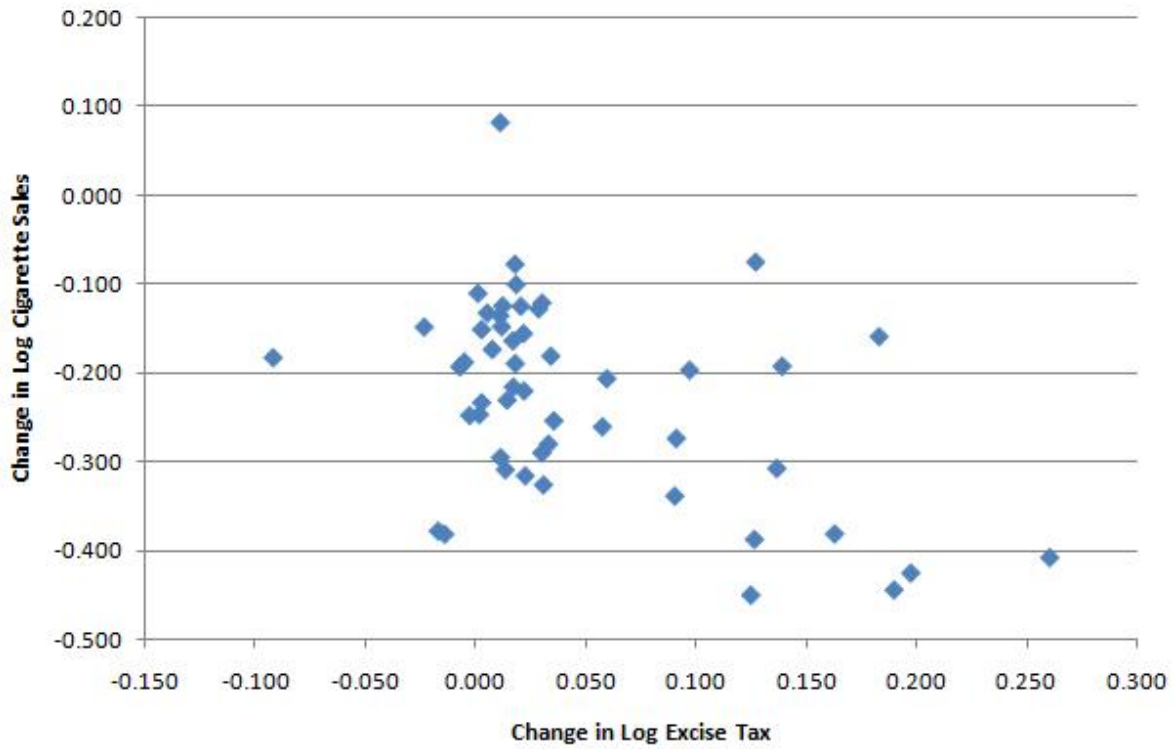


Figure 1: State-level changes in cigarette sales (packs per capital) and changes in federal and state excise taxes, relative to the state average price of cigarettes in 1995, between 1995 and 2001. Taxes and prices in 2001 are adjusted to 1995. Changes are in logs and approximate percentage point changes.

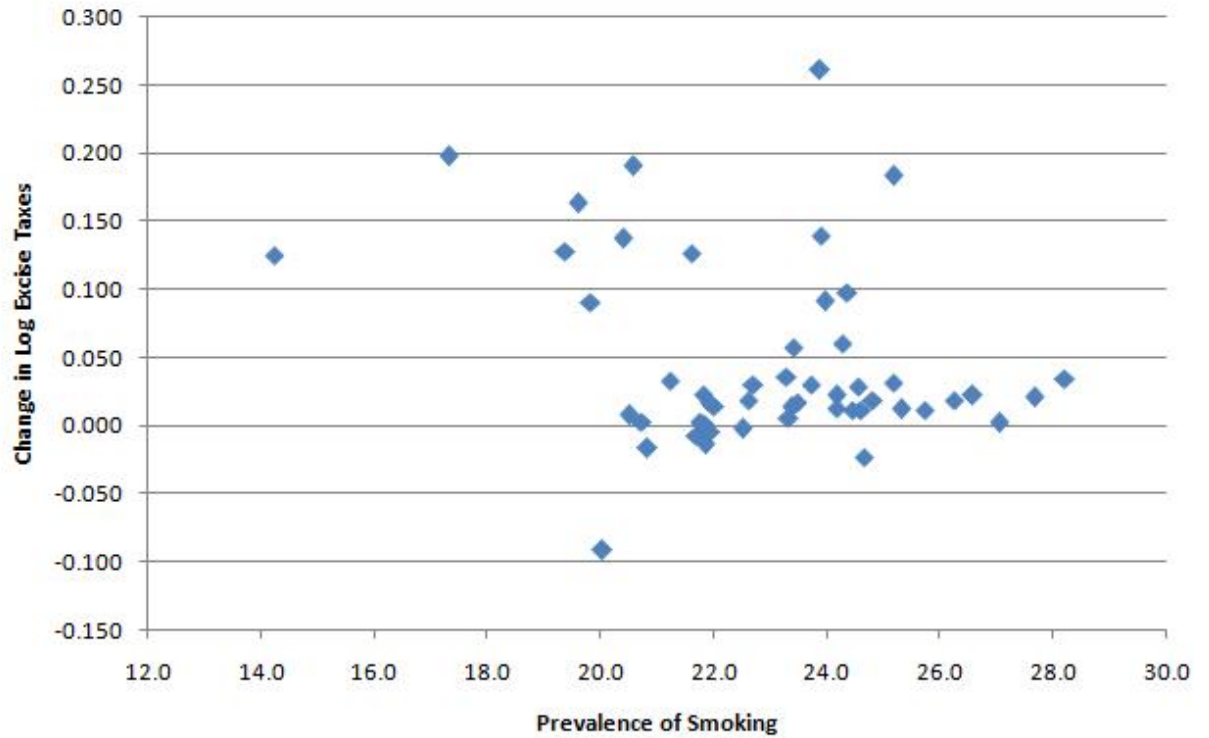


Figure 2: State-level changes in federal and state excise taxes between 1995 and 2001, relative to the state average price of cigarettes in 1995, and the prevalence of smoking in 1995. The prevalence of smoking is estimated from the Tobacco Supplements of the Current Population Survey. The change in excise taxes is in logs and approximates percentage change.

**Table 1**  
Smoking Ban Preferences by Smoking and Plan to Quit Status

	Observations	Public Space					
		Restaurants	Hospitals	Work	Bars	Sport Events	Mall
<b>Smoking Status</b>							
<b>A. Non Smokers</b>							
All	149486	56.9 (0.13)	83.2 (0.10)	69.8 (0.12)	31.6 (0.12)	73.7 (0.11)	68.4 (0.12)
Never Smoked	104857	60.3 (0.15)	85.4 (0.11)	72.9 (0.14)	34.2 (0.15)	75.2 (0.13)	71.0 (0.14)
Fmr Smoker: All	44629	48.5 (0.24)	78.0 (0.20)	62.3 (0.23)	25.1 (0.21)	70.1 (0.22)	62.2 (0.23)
Fmr Smoker: Recent	4275	32.0 (0.71)	72.3 (0.68)	51.4 (0.76)	12.0 (0.50)	60.8 (0.75)	52.7 (0.76)
<b>B. Smokers</b>							
All	44322	18.6 (0.18)	59.2 (0.23)	34.7 (0.23)	6.6 (0.12)	48.8 (0.24)	39.4 (0.23)
All (Quit-6m)	42885	18.8 (0.19)	59.6 (0.24)	35.0 (0.23)	6.6 (0.12)	49.2 (0.24)	39.7 (0.24)
Smokers: Quit-6m	17599	27.3 (0.34)	70.1 (0.35)	45.4 (0.38)	8.9 (0.21)	59.3 (0.37)	49.8 (0.38)
Smokers: No Quit-6m	25286	12.9 (0.21)	52.3 (0.31)	27.8 (0.28)	5.1 (0.14)	42.1 (0.31)	32.6 (0.29)

Data come from the 1995 and 1996 CPS Tobacco Supplements. Only non proxy observations are included. Sample weights are used. Standard errors are in parentheses.

**Table 2**  
Smoking Ban Preferences by Smoking and Plan to Quit Status: Difference Estimates

	Public Space						
	Restaurants	Hospitals	Work (1)	Work (2)	Bars	Sport Events	Mall
<b>A. Never and Former Smokers</b>							
I. No Controls							
Never	11.8 (0.31)**	7.4 (0.25)**	10.6 (0.30)**	10.6 (0.30)**	9.1 (0.28)**	5.1 (0.28)**	8.8 (0.30)**
II. Controls							
Never	12.6 (0.33)**	6.6 (0.26)**	10.3 (0.31)**	10.3 (0.31)**	11.8 (0.29)**	5.3 (0.30)**	9.1 (0.31)**
<b>B. Smokers by Plan to Quit Status</b>							
I. No Controls							
Quit	14.4 (0.45)**	17.8 (0.52)**	17.5 (0.53)**	17.5 (0.53)**	3.8 (0.29)**	17.3 (0.54)**	17.2 (0.54)**
II. Controls							
Quit	14.2 (0.45)**	16.9 (0.52)**	16.6 (0.53)**	16.6 (0.53)**	4.0 (0.29)**	16.9 (0.54)**	17.0 (0.54)**
Observations	149486	149486	149486	42885	149486	149486	149486

Linear probability, first difference estimates of support for smoking bans in public places. The sample in panel A is non smokers, differentiated never smokers and former smokers; and the sample in panel B is smokers, differentiated by those who seriously plan to quit in the next six months and those who do not. The control variables include age (linearly), sex (male and female), marital status (married and not married), educational attainment (high school or less and some college or more), race (white and non white), and labor force participation (participating and no participating). Data come from the 1995 and 1996 CPS Tobacco Supplements. Only non proxy observations are included. Sample weights are used. Robust standard errors are in parentheses. \* and \*\* signify statistical significance at the 5 and 1 percent level.

**Table 3**  
Data Summary

Variable	All		Excise Tax<.075		Excise Tax>.075	
	Mean	SE	Mean	SE	Mean	SE
<b>Cigarette (Change in Log)</b>						
Excise Tax	0.057	(0.011)	0.012	(0.0037)	0.163	(0.012)
Average Price	0.469	(0.0087)	0.451	(0.010)	0.514	(0.011)
Per Capita Sales	-0.250	(0.016)	-0.202	(0.013)	-0.366	(0.028)
Smoking Rate	-4.74	(0.010)	-4.72	(0.011)	-4.78	(0.021)
<b>Smoking Prevalence, 1995 (%)</b>						
Smoke	22.5	(0.37)	23.5	(0.30)	20.0	(0.77)
Less Educated, Quit	5.3	(0.12)	5.5	(0.13)	4.9	(0.26)
Less Educated, No Quit	8.8	(0.30)	9.6	(0.30)	7.0	(0.43)
More Educated, Quit	3.9	(0.10)	3.9	(0.12)	4.0	(0.19)
More Educated, No Quit	4.5	(0.085)	4.6	(0.10)	4.2	(0.12)
<b>Demographics (% , Except Age)</b>						
Age	44.6	(0.21)	44.6	(0.24)	44.4	(0.44)
Male	43.4	(0.21)	43.3	(0.25)	43.8	(0.39)
Married	57.7	(0.60)	58.1	(0.75)	56.8	(0.97)
More Educated	47.6	(0.77)	46.0	(0.85)	51.3	(1.1)
Non White	13.7	(1.48)	13.3	(1.7)	14.7	(3.2)
NLFP	34.0	(0.58)	34.1	(0.69)	34.0	(1.1)
States	51		38		13	
Observations	192,371		135,794		56,577	

Cigarette excise tax data come from the Tax Policy Center of the Brookings Institution and the Urban Institute. Cigarette prices and per capita cigarette sales come from the Tax Burden on Tobacco. Smoking prevalence and demographic data come from the 1995 and 1996 CPS Tobacco Supplements. Only non proxy of the CPS are included. Sample weights were first used to calculate state averages, and then averages across states were calculated by weight states by the number of observations used to calculate state averages. Standard errors are in parentheses.

**Table 4**  
State Excise Tax Increases by Smoking Prevalence, Education, and Plan to Quit Status

Variable	I. Excise Tax Increase: 1995-2001				II. Percent Increase: 1995-2001			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
<b>All</b>								
% Smoke	-0.089 (0.027)**				-0.012 (0.006)*			
% Quit		-0.052 (0.063)				-0.013 (0.012)		
% No Quit		-0.103 (0.030)**				-0.011 (0.006)*		
<b>More Educated</b>								
% Smoke			-0.175 (0.055)**				-0.023 (0.012)+	
% Quit				-0.108 (0.141)				-0.01 (0.024)
% No Quit				-0.231 (0.097)*				-0.035 (0.016)*
<b>Less Educated</b>								
% Smoke			-0.039 (0.039)				-0.005 (0.007)	
% Quit				-0.002 (0.125)				-0.015 (0.022)
% No Quit				-0.045 (0.049)				-0.002 (0.009)
Observations	51	51	51	51	51	51	51	51
R-Square	0.27	0.35	0.36	0.36	0.38	0.29	0.37	0.38

The outcome variable in the first panel is an indicator of whether federal and state excise tax increases between 1995 and 2001 were considerable, which is defined as the change in log cigarette taxes relative to state-average price of cigarettes in 1995 in excess of .075. The outcome variable in the second panel is the actual change in log cigarette taxes relative to cigarette prices in 1995. The control variables include age (linearly), sex (male and female), marital status (married and not married), educational attainment (high school or less and some college or more), race (white and non white), and labor force participation (participating and non participating). Cigarette excise tax data, used to construct the dependent variable, come from the Tax Policy Center of the Brookings Institution and the Urban Institute. Smoking prevalence and demographic data come from the 1995 and 1996 CPS Tobacco Supplements. Only non proxy responses of the CPS are included. Sample weights were first used to calculate state averages, and then observations in the regression are weighted by the number of observations used to construct state averages. Standard errors are in parentheses. \* and \*\* signify statistical significance at the 5 and 1 percent level.



**Table 5**  
Price Elasticity of Cigarette Sales and Consumption by Education, Instrumental Variable Estimates

Variable	I. Per Capita Sales		II. All-Rate		III. More Educated-Rate		IV. Less Educated-Rate	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Price	-2.06 (0.514)**	-1.27 (0.343)**	-0.481 (0.341)	-0.092 (0.239)	-0.405 (0.335)	0.247 (0.294)	-0.708 (0.556)	-0.288 (0.354)
Less Educated, Quit		-0.03 (0.025)		-0.011 (0.020)		0.01 (0.021)		-0.019 (0.027)
Less Educated, No Quit		0.048 (0.010)**		0.017 (0.008)*		0.022 (0.008)*		0.021 (0.013)
More Educated, Quit		0.022 (0.020)		0.004 (0.016)		-0.011 (0.018)		0.011 (0.023)
More Educated, No Quit		-0.045 (0.031)		0.01 (0.026)		0 (0.030)		0.014 (0.032)
Observations	51	51	51	51	51	51	51	51

The estimated elasticity of cigarette demand is in panel I, and the estimated elasticity of the smoking rate by education attainment are in panels II, III, and IV. The change in log cigarette price is instrumented with the change in log cigarette taxes relative to the state-average price of cigarettes in 1995. Cigarette excise tax data, used to construct the dependent variable, come from the Tax Policy Center of the Brookings Institution and the Urban Institute. Smoking prevalence and demographic data come from the 1995 and 1996 CPS Tobacco Supplements. Only non proxy responses of the CPS are included. Sample weights were first used to calculate state averages, and then observations in the regression are weighted by the number of observations used to construct state averages. Standard errors are in parentheses. \* and \*\* signify statistical significance at the 5 and 1 percent level.