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WHERE THERE'S SMOKING, THERE'S FIRE:
THE EFFECTS OF SMOKING POLICIES ON THE INCIDENCE OF FIRES IN THE UNITED STATES.

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ABSTRACT

Fires and burns are among the top ten leading causes of unintentional death in the United States, with thousands of deaths occurring annually. The majority of these deaths and injuries occur in residential fires, and cigarettes have been identified as one of the leading causes of these fire-related deaths. In this paper, I explore the relationship between cigarette smoking and fires caused by cigarettes in the United States. As fewer people smoke, there is less opportunity for fires to start as a result of cigarettes. However, the magnitude of any reduction is in question as it is not obvious that the people who quit smoking are the ones who start fires. I also examine the contribution of tobacco-related public policies in influencing the incidence of cigarette-related fires. I use a state-level panel of reported fires over time to estimate both the structural and reduced form equations for cigarette fires. Results indicate that reductions in smoking and increases in cigarette prices are associated with fewer fires. However, laws regulating indoor smoking are associated with increases in some types of fires. Specifically, workplace restrictions and bans are associated with increases in fires in all locations and in residential units. Restaurant and bar bans are associated with increases in fires in restaurants and all eating/drinking establishments.

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Introduction

Fires and burns are among the top ten leading causes of unintentional death in the United States, with thousands of deaths occurring annually (over 3,200 in 2007). The young and the elderly are particularly vulnerable, with fires and burns being the third leading cause for children ages 1-14 and the fifth leading cause for those ages 65 and older (CDC 2009). Non-fatal injuries from fires are much more common with an estimated 400,000 occurring nationwide in 2007. The majority of these deaths and injuries result from residential fires. Residential and commercial building fires are fairly common in the United States, with over 500,000 such fires occurring annually (Karter 2010). Cigarette smoking is one of the more common causes of these fires, and while the proportion of all fires caused by cigarettes is relatively small, about 2.8 percent, these fires are among the most deadly. In fact, the U.S. Fire Administration (USFA) reports that smoking is the first or second leading cause of fire deaths every year, occasionally alternating places with arson. (USFA 2004).

Fires place tremendous burdens on society through the direct costs of damage to life and property, and through the indirect costs that include funding for public fire departments, providing fire protection within buildings, insurance costs and medical costs. Karter (2010) estimates the costs of damage to property alone from fires occurring in 2008 was over $15.4 billion.[1] Fortunately, the number of fires in the US has been trending down over time (see Figure 1). Part of this trend includes a decline in residential fires caused by cigarettes and declines in deaths and injuries over time. There are likely many different factors that are responsible for these trends including the growth in the use of smoke detectors, sprinkler systems, fires safety education programs, and stricter flammability standards for mattresses, upholstery and fabrics.

[1] Direct plus indirect costs are estimated at $165 billion a year (USFA 2007).

Concurrent with the decline in fires caused by cigarettes is a downward trend in cigarette smoking over time. Along with broad scale public health and educational campaigns, increases in cigarette taxes and restrictions on smoking have contributed to the decline in smoking in the United States (Dube et al. 2009; Debrot et al. 2010).

This paper explores the relationship between cigarette smoking and fires caused by cigarettes. Co-movement in the two trends is logical; as fewer people take up smoking and more people quit, there is less opportunity for fires to start as a result of cigarettes. However, it is not clear that the people who avoid smoking are also the careless ones who start fires. The magnitude of the reduction in fires resulting from decreased smoking rates is therefore an empirical question. In this paper, I quantify the effects of reductions in smoking on rates of fires, deaths and injuries. I also examine how much of a contribution tobacco related control policies have in altering the incidence of cigarette-related fires. Specifically, I estimate the effects of increases in cigarette prices, taxes and the implementation of restrictions on smoking in public places on counts of cigarette fires in various locations and resulting deaths and injuries.

The negative externalities resulting from smoking are well known and include the harmful health effects to the smoker, the harmful health effects to those involuntarily exposed to environmental tobacco smoke, and harm to developing fetuses. Previous research has examined the public health benefits of reduced smoking rates in terms of reductions in disease prevalence, increased length of life and improved birth outcomes (USDHHS 2004). Economists focus their research questions on whether increased cigarette prices and taxes contribute to improved health outcomes. This paper extends this literature by examining the question of whether reduced smoking rates and higher cigarette prices and restrictions on smoking have reduced fires, deaths and injuries. The results show that reductions in smoking and increases in cigarette prices are associated with fewer fires. However, restrictions on indoor smoking are associated with increases in some types of fires, including those in bars and restaurants.

Mechanisms

Karter et al. (1994) discuss the three elements that must be present for a cigarette fire to start. First, there must be contact between the cigarette and the fuel source. Second is the likelihood of the cigarette to ignite the fuel source. Last is the susceptibility of the fuel source to ignite upon exposure. Efforts in fire prevention have typically focused on reducing the ability of cigarettes to ignite a fuel source, and on reducing the propensity of the fuel source to burn. For example, fire safe cigarette laws have been passed in all fifty states (with the effective date in a few states still yet to come). These cigarettes are made with banded paper that allows the cigarette to self-extinguish. From the fuel source side, a variety of mandatory and voluntary standards have been in place for decades. These include flammability standards for mattresses, upholstery, and apparel, portable heating units, and lamps. (See Frazier et al. 2000 for more details.)

The main element in starting a fire, contact between the cigarette and the fuel source, comes from human carelessness (Karter et al. 1994). The degree of carelessness or vulnerability may vary among smokers and along observable and unobservable characteristics. For example, The USFA estimates that the risk of dying in a smoking-related fire rises with age, with 38 percent of victims ages 65 or older (Hall 2006). This is much larger than the elderly's share in the population of around 12 percent. Alcohol consumption has also been cites as a major contributing factor to cigarette fires (Patetta and Cole 1990).

There are a number of scenarios by which a cigarette can start a fire. A common story starts with an improperly discarded cigarette, where burning cigarettes, ashes, embers, or butts cause ignition of a fuel source. The most deadly smoking-related fires occur when cigarettes ignite mattresses, bedding, or upholstered furniture. Falling asleep and alcohol or drug impairment are leading human factors associated with these fires. Approximately 40 percent of residential smoking fires originate in the bedroom or living/family rooms (USFA 2005).

The primary question of this paper is whether the number of fire incidents can be reduced through public policies that alter the demand for cigarettes. To answer this question, I take advantage of a large number of policy changes that have been occurred in recent years. Following the Master Settlement Agreement of 1998, numerous states and the federal government raised excise taxes on cigarettes and tobacco companies raised prices. A wave of new smoke-free air laws have been enacted in states, with tremendous variation on the degree of the restrictions and the public places to which the laws pertain. Recent studies find negative price and tax effects on different measures of smoking (Adda and Cornaglia, 2010; DeCicca and McLeod 2008; Stehr 2005). Several econometric studies have also examined the effects of smoke-free air laws on adult smoking behavior. A majority of these studies find an inverse relationship between the implementation of these laws and smoking (Wasserman et al. 1991; Chaloupka 1992; Evans et al. 1999; Ohsfeldt et al. 1999; Czart, et al. 2001; Gallet 2004; Tauras 2006; Yurkeli and Zhang 2000).

Results by Adda and Cornaglia (2010) are particularly relevant. As part of their study on the influence of cigarette policies on second hand smoke exposure, they find that bans in bars and restaurants are associated with a reduction in the prevalence of smoking and per capita consumption of cigarettes, while bans in workplaces are not statistically related to these measures of smoking. Using time use surveys, they look at how smokers change their time spent at home and in restaurants and bars in response to smoking bans. They find that bans in bars and restaurants are associated with a reduction in time spent in these locations and an increase in time spent at home by smokers. This result has implications for changes in the likelihood of starting a residential fire if smoking moves from public places to private residences as a result of a smoking ban.

The effects of stricter cigarette policies on smoking and fires

While studies on the consumption effects of tobacco control policies are informative, they provide only part of the story for cigarette-related fires. Consider the following: Let F represent the number of fires started by improperly discarded cigarettes. The number of fires is determined by the total number of smokers (S), which is the sum of careful (S_C) and not careful smokers (S_N). Each type of smoker has a different propensity to start a fire with probabilities $\alpha_0 < \alpha_1$. Note that both probabilities are also affected by conditions unrelated to cigarettes such as the susceptibility of the fuel source to ignite upon exposure to cigarettes:

1) $F=\alpha_0 S_C + \alpha_1 S_N$.

An increase in the price of cigarettes will decrease the total number of smokers, but it is not clear how the reduction is allocated over the two types of smokers:

2) $\frac{\partial F}{\partial P} = \alpha_0 \frac{\partial S_C}{\partial P} + \alpha_1 \frac{\partial S_N}{\partial P}$.

If the price increase reduces smoking only among careful smokers then the decrease in fires will be proportional to α_0 and in the extreme, could be zero if α_0 is zero. If the price increase reduces smoking solely among the careless smokers then the decrease in fires will depend on α_1 and will be relatively larger. In general, the total reduction in fires will depend on the price elasticities of demand by the different types of smokers, and the values of α_0 and α_1.

By contrast, the enactment of smoke-free air laws may have very different effects. Consider a law restricting or banning smoking in indoors public places (L). Such a law may not only influence the demand for cigarettes, but may alter the probabilities of starting a fire as well:

3) $\frac{\partial F}{\partial L} = \frac{\partial \alpha_0}{\partial L} S_C + \alpha_0 \frac{\partial S_C}{\partial L} + \frac{\partial \alpha_1}{\partial L} S_N + \alpha_1 \frac{\partial S_N}{\partial L}$.

The partial derivatives of the alphas with respect to a change in the law will be positive if the law changes smoking behaviors towards less safe disposal methods. For example, a ban on smoking in bars or restaurants may cause people to smoke outside where smokers may discard cigarettes in plants or mulch rather than in a safer ash tray. Another example follows from Adda and Corneliga (2010). If smokers move their smoking from public places to private residents, this may change the probability of a fire occurring, and perhaps increase the probability of a death or injury. Note that any such effect will vary depending on the type of law enacted and any compensative fire-safety measures taken. The total effect on fires also depends on the change in the number of smokers arising from the change in the law. As discussed above, previous research has show that some of the indoor smoking bans encourage people to quit smoking, leading to reductions in S_C and S_N as a result. Therefore, the net effect of the laws are indeterminate, depending on the magnitudes of the offsetting positive and negative effects of the laws.

Data and Empirical Methods

Data on fires in the United States come from the National Fire Incident Reporting System (NFIRS) developed by the U.S. Fire Administration. This system was implemented to monitor and assess the fire problem in the United States. NFIRS began with six states in 1976 and has grown over time. The reporting format changed in 1999, and this is the year in which I begin the analysis. I have obtained NFIRS data through 2007. Reporting in 1999 is limited to 40 states, but by 2007, fire departments in all 50 states plus the District of Columbia report. In addition to new states, the number of reporting fire departments also increased between 1999-2007, growing from approximately 9000 fire departments in 1999 to over 16,000 in 2007. The USFA estimates that 44 percent of all fire departments in the U.S. report to the NFIRS, providing information on all fires to which those department respond (USFA 2008).

The fire departments that participate in the NFIRS record information on each individual fire. This information includes the time and place of the fire, the cause and heat source, any resulting injuries and deaths, and rather infrequently, an estimate of the dollar amount of property and content loss.[2] From this information, I generate three different dependent variables to measure the damage from fires caused by cigarette smoking. The first is a simple count of the number of fires caused by cigarettes. The second is a count of the number of deaths resulting from cigarette fires. The third is a count of the number of deaths plus injuries from cigarette fires. I group deaths and injuries together because factors such as emergency medical response time or available medical technology may determine the difference between an injury and a death. Deaths and injuries are recorded for both firefighters and the victims.

I explore four variations on the types of fires examined. The first is a count of all types of fires caused by cigarettes. This includes fires in residential and non-residential structures, fires in outside properties, fields and wild lands, and automobile fires. Second, I limit the fires to only those occurring in residential units since the majority of cigarette fires and deaths occur in homes. Third, I limit the fires to those occurring in bars, restaurants and other eating and

[2] These losses are missing for 89% of the fires reported.

drinking establishments. This restriction is particularly pertinent when examining some of the more common smoke-free air laws that ban smoking in public places. I examine restaurant fires separately from bar fires, and then I use a sum of restaurants, bars, and an additional category for "eating, drinking places, other". Lastly, in order to check for spurious results, I generate counts of fires caused by cooking. These fires follow a similar trend to cigarette fires over time, yet logically should not be related to smoking or cigarette policies. Any result here showing that cigarette policies are related to cooking fires could indicate that omitted variables are problematic for the other models.

The NFIRS data are reported at the fire incident level. To generate the dependent variables, I aggregate the incidents reported by each fire department to the state level on a quarterly basis. I treat New York and Illinois as special cases. Across the United States, a few localities impose local cigarette taxes in addition to the state taxes. New York City and Chicago both have local cigarette taxes that are much higher than the state tax, and these municipalities also passed smoke free air laws at different times from the rest of the state.[3,4] For these reasons, and because both cities represent a large proportion of the fires in the their states, I treat New York city and Chicago as separate observations. The data therefore include as observations New York state exclusive of New York City, Illinois exclusive of Chicago, New York City and Chicago all as different observations. For simplicity, I will refer to the unit of observation as a state, with the understanding that these two cities are separate observations treated as a state.

[3] New York City's ban on indoor smoking became effective March 30, 2003, four months before the state ban. Chicago imposed a ban on smoking in private workplaces in January 2006. The state's restrictions did not begin until 2008.

[4] According to Orzechowski and Walker (2009), some cities in Alabama, Alaska, Missouri, Ohio, and Virginia also impose local cigarette taxes. These taxes tend to be low, for example, ranging from 1 cent to 7 cents per pack in cities in Alabama and Missouri. I ignore these taxes because the population affected by the taxes is small, and because these local taxes may be easily evaded.

Next, I generate the population covered by the reporting fire departments in each state in each quarter. To do so, I identify the unique zip codes associated with all fire incidents (including non-fire related calls) reported by each fire department in each state during a quarter. Using year 2000 population information from the U.S. Bureau of the Census, I merge populations based on zip codes and sum the populations to the state level. One issue here is that the covered population can be overstated if a zip code appears in the data that is not part of the reporting fire department's district. This can arise when a fire department assists another and reports the fire to the NFIRS. When both departments report, there is no problem as the zip code will only get counted once. However, when the assisting department reports, but the primary does not, attributing the zip code to the assisting department will understate the fire rate by overreporting the covered population. To help minimize this problem, I restrict the zip codes included to those that have an incident at least three times in each quarter. I also tested models that include 1) the population from all zip codes regardless of the number of times a code appears in the data and 2) the population from the zip codes that include only fire-related calls. The results are generally insensitive to the construction of the covered population, with only the levels changing. These results are available upon request.

One concern with the NFIRS data, particularly with small fire departments, is whether a zero count of fires is a true zero or a missing value. If a fire department reports any fire related call to the NFIRS during the quarter, I consider this as a reporting fire department and zero counts are assumed to be true zeros. If a fire department reports no fire-related calls during a particular quarter, and although they may report in other quarters during the same year, I consider them a non-reporter in that quarter and exclude them from the analysis.

Each fire in the NFIRS is assigned a heat source. From this variable, I identify all the fires caused by cigarettes which is code ‘61’ in NFIRS version 5.0. To generate the total cigarette fire counts, I include all structural and outdoor fires with this code, as well as any wildland fires that were determined to be started by cigarettes or other smoking material.[5] The counts of fires exclude exposure fires, that is, fires that spread from another fire. The counts also exclude arson, suspected arson, and fires started by children playing.

Cigarettes are identified as the cause of 2.6 to 4 percent of the fires in this data, however, a large portion of fires, 43 to 60 percent depending on the year in question, are of unknown causes. Of the cases with cause identified, a range of 6.4 to 8.0 percent are caused by cigarettes. It is impossible to know whether the fires that are indentified are a random sample, or if they represent either very small fires with a source that is easy to determine, or very large fires that undergo intense investigation. Tests of means reveal statistically significant but very small differences in deaths and injuries and dollar losses based on whether or not the cause of the fire is reported. Statistical significance is to be expected because the number of fires over the nine year period exceeds 5 million. Across this time period, the average reported dollar losses of property and content is $10,372.30 for cause-known sample and $12,164.10 for cause-unknown fires. Deaths and injuries occur with mean count of 0.03 for cause-known sample and 0.02 for cause-unknown. Thus, it is difficult to draw conclusions about the magnitudes and destructiveness of the fires based on the reported causes.

The determinants of cigarette fires follows the general relationship:

4) $F_{jy} = f(C_{jy}, X_{jy}, Y, S),$

[5] Wildland fires are defined as “Any fire involving vegetative fuels, other than prescribed fire, that occurs in the wildland. A wildland fire may expose and possibly consume structures.” (USFA 2008 p C-8).

Where *F* represents one of the three dependent variables (count of cigarette fires, deaths from cigarette fires, death plus injuries from cigarette fires) in state (*j)* in a given year (*y)*. The variable *C* represents per capita cigarette sales in a state for a given year, and the vector *X* represents some other characteristics of the states that may determine fire rates (described below). Lastly, *Y* and *S* are fixed effects for each unique year and state, respectively.

The estimation of equation 1 must be treated with some caution and skepticism because of the potential problem of endogeneity of cigarette consumption. This will occur if there are unobserved, time varying characteristics of the states that are correlated with both cigarette consumption and the probability of fires. As Karter et al. (1994) explain, the main element in cigarette fires are human carelessness. It is possible that people with this characteristic also are less likely to engage in other risk-reducing behaviors and may exhibit an increased propensity to smoke. The state fixed effects will address any unobserved characteristics of the population that are time invariant, however, common time varying factors may still remain in the error term and bias the estimates. Another potential problem with the estimation of equation 1 is measurement error resulting from a mismatch of the cigarette sales to the locations of the fire. The available sales data are aggregates for the entire state, whereas the fire counts are aggregated from reporting localities. If for example, the bulk of sales are in a non-reporting fire district, then the match quality will be poor. Instrumental variable models are used to address these potential biases. The cigarette tax and smoking restriction variables described below serve as instruments.

The equation more relevant from a policy perspective is the reduced form equation, where cigarette consumption is replaced by the exogenous determinants of consumption:

5) $F_{jyq} = f(P_{jy}, X_{jyq}, YQ, S)$.

Here, the variables are defined as above, and *P* is a vector of variables representing the full price of cigarettes. This includes price or tax, and regulations regarding indoor smoking. Details on these variables are discussed below. Note that the reduced form analysis is conducted on a quarterly basis since all variables are available quarterly. In this model, YQ represents a set of unique indicator variables for each year and quarter.

The distribution of the count of fires and related deaths and injuries suggest that a count model is the appropriate estimation technique. Table 1 contains summary statistics, and it is clear from this table that cigarette fire counts, deaths, and injuries are all relatively rare events. For cigarette fires of all types, the mean quarterly fatality count for states during the period 1999-2007 is 0.64 deaths, with a minimum of zero (65 percent of the observations) and a maximum of 9. The sum of deaths and injuries have a similar distribution with a mean injury count of 4.0, a minimum of zero that occurs 33 percent of the time and a maximum count of 59. Simple counts of cigarette fires are larger, with values ranging up to 1,085, and only 1.5 percent of the observations are zero. However, residential fires, restaurant fires and bar fires are much rarer, with maximums of 295, 35 and 5 respectively. While some of these numbers may seem too small to be believable, recall that they represent the counts in the quarter by reporting fire departments, and in the regressions, are adjusted by the population covered by the reporting fire departments.

I estimate all models with a Poisson maximum likelihood estimation, but to permit for overdispersion, standard errors are adjusted for heteroskedasticity of unknown form that includes a within-state cluster correlation (Cameron and Trivedi 2009; Bertrand et al. 2004). The advantage of the Poisson estimation is that the estimates are consistent regardless of whether the counts actually have a Poisson distribution (Wooldridge 2002).[6] Each model includes the log of the covered population as a right hand side variable to normalize for exposure. The coefficient on this log population is constrained to equal one.

Cigarette consumption is measured with the per capita number of packs of cigarettes sold annually in each state. These data come from the *Tax Burden on Tobacco* (Orzechowski and Walker 2009).[7] Cigarette prices and taxes are used as alternative measures of the monetary price of cigarettes. Cigarette price and tax data also come from the annual Tax Burden on Tobacco. The prices are weighted averages for a pack of 20 cigarettes and are inclusive of state excise taxes. Because the price published is as of November 1 of each year, the prices are adjusted to create a state-level average quarterly price. Quarterly taxes are determined using the effective date of legislated tax changes. Cigarette prices and taxes are deflated by the national Consumer Price Index published by the Bureau of Labor Statistics (1982-1984=100).

Variables representing smoking restrictions in private workplaces, restaurants and bars are included as additional measure of the full price of cigarettes. These variables come from project ImpacTeen (http://www.impacteen.org/tobaccodata.htm) and the American Nonsmokers' Rights Foundation (http://no-smoke.org/). The laws are appended to the fire data by state, year, and quarter, based on the effective dates of the laws. Even though states have smoke-free area (SFA) laws regarding many different establishments, these are the focus of this paper because private workplace and restaurant restrictions are very common and research has shown there to be an influence of these individual laws on smoking behaviors (Evans et al. 1999; Tauras 2004). While research on bar bans has shown much less effectiveness, restrictions on smoking in bars is

[6] The Poisson model is preferred to the negative binomial since the negative binomial estimates are not consistent if the variance specification is incorrect (Cameron and Trivedi 2009). Nevertheless, negative binomial models were tested and give similar results.

[7] In the Tax Burden, consumption is reported as of June 30 of each year. From this, I generate a calendar year consumption measure by using an average of the relevant fiscal years.

relevant for studying fires, especially there is some evidence that alcohol consumption is a contributing factor to residential fires started by cigarettes (Hall 2006).

The SFA laws for private workplaces are grouped in three categories: 1) no provisions; 2) laws that restrict smoking to designated areas (some laws specify with separate ventilation) with some exemptions; and 3) smoking bans that are present at all times. A similar grouping is used for laws pertaining to restaurants. For bars, only the categories of ban versus no ban are used. Only three states have some intermediate form of restrictions and two of these states do not change this value over time. Therefore, these three states are grouped with the no ban states. I then create dichotomous indicators for each category and site (workplaces, restaurants and bars) to include in the regressions. The category of no provisions serves as the omitted reference group. Because of the high degree of collinearity between the regulations, each group of SFA laws is included separately in the regressions according to the site. The collinearity arises because many states pass SFA laws applicable to different facilities at the same time. If these laws are considered as simple indexes (i.e. one variable with values 1 through 3), the simple correlations between restrictions in private workplaces and restaurants is 0.69, between private workplaces and bars is 0.47, and between bars and restaurants is 0.6.

As an alternative measure of the restrictiveness of indoor smoking in a state, I use the percent of the state population covered by 100% smoke-free air laws for each of the three sites provided by the American Nonsmokers' Rights Foundation. These measures are advantageous since they include the local area laws that are frequently passed prior to state-level laws. Within each state, the percentages increase over time, and reach a maximum of 100% when the state enacts a ban on smoking in the relevant indoor area.

Each model includes some other state-level time varying variables to account for additional factors which may be associated with the number of fires over time.[8] All models include the quarterly unemployment rates from the Bureau of Labor Statistics and per capita income from the Bureau of Economic Analysis. From the US Census Bureau, the percent of each state's population with at least a bachelor's degree and the number of housing units per square mile are also included. Next, I include a dichotomous indicator for the states which have a fire safe cigarette law in effect. Most states have just recently passed this law. In the time span of my data, New York is the first state (effective 6/28/2004), followed by Vermont (effective 5/1/2006), California (effective 1/1/2007), Oregon (effective 7/1/2007) and New Hampshire (effective 10/1/2007). Lastly all models include state fixed effects and year/quarter fixed effects.

Results

Figure 1 shows the trends in fires over time. There is a distinct seasonality to fires, with more occurring in the spring and summer months. There is also a downward trend to the fires over time, with a slight increase occurring after 2003. Figure 2 repeats Figure 1, but shows the annual trends in fires and adds the trends in cigarette consumption per capita. Here, the general downward trend in both series is clearly seen. The reason for the change in the trend for all fires after 2003 is not clear. Some of this may reflect reporting changes, for example, there is an increased reporting of wildland fires over time, but these fires constitute only about 10 percent of total cigarette fires. The change may also have arisen from the increases in smoke-free air laws over time. As I show below, these laws tend to be positively associated with the incidence of fires.

Turning to the multivariable analysis, Table 2 shows the basic relationship between annual per capita cigarette sales and annual counts of cigarette fires, adjusted for the covered

[8] New York City and Chicago are assigned the state value for these variables.

population. Table 3 contains similar results for counts of deaths and injuries. In all these models I aggregate the fire counts to the annual level to more closely match the annual sales data. Annual Poisson models treating cigarette sales as exogenous are presented first, followed by models that treat sales as endogenous. The latter models are estimated using a two-step procedure described by Wooldridge (2002) for count models with endogenous right hand side variables. The first step is an OLS regression of sales on the cigarette price, the dichotomous indicators of the smoke-free air laws in private workplaces, and all other exogenous variables in the model.[9] The residuals from the first stage regression are then predicted and included as an additional covariate in the second stage structural model, which is estimated by Poisson regression. Standard errors are adjusted to be panel-robust (correlated among states). The resulting estimates are consistent. An F-test of the instruments is presented, and the endogeneity of the consumption measures are tested by examining the t-statistic on the first stage residuals in the second equation.

In Table 2, the coefficients on the cigarette sales in the exogenous models are statistically insignificant for all of the types of fires. However, when sales is treated as endogenous, a few of the coefficients become positive and statistically significant at the 10 percent level or better. The F-stat on the instruments in the first stage is statistically significant, with a value of 8.95. T-tests on the first stage residuals reject the null that the cigarette sales coefficient is zero in three of the five models. The exceptions are residential fires and bar fires. Thus, these results provide some evidence that cigarette sales are positively related to the incidence of fires and not a result of spurious concurrent trends.

Table 3 shows the results of the structural model for fire deaths and injuries. Models are shown for all fires and for residential fires only since there are almost no deaths or injuries

[9] Models using the other SFA laws give similar results.

recorded in the NFIRS data for bars and restaurants. The results shown here indicate a positive, but statistically insignificant relationship between cigarette sales and deaths and injuries.

The reduced form estimation is more relevant for policy purposes, and given the exact dates of tax and SFA policy changes, I am better able to match the policies to the incidents of fires. Tables 4-6 show the reduced form estimates for all fires, residential fires, and bar and restaurant fires. The main models use the cigarette price or tax and the indicator variables for the different SFA laws. Alternative models are shown in Tables 7 and 8 that use the percent of the population covered by 100 percent smoke free laws. Deaths and injuries are analyzed in Table 9.

Table 4 considers counts of cigarette fires in all locations. The first thing to notice is that both higher cigarette prices and excise taxes are associated with decreases in the counts of these fires, although the tax results are not statistically significant at conventional levels. For continuous variables, the coefficients from the Poisson regression can be directly interpreted as semi-elasticities, that is, the percentage change in the number of fires resulting from a one unit change in the independent variable. To get a semi-elasticity for the dichotomous indicators, a transformation of the coefficients (exp(B)-1) is necessary (not shown). Given the means of the price and tax, a one unit change represents a rather large effect. The elasticities presented at the bottom of the table give a more reasonable interpretation to the estimates. For ease of interpretation, the bottom of the table also list select marginal effects that show the absolute change in the counts of fires from one unit change in the relevant independent variable.

The results in Table 4 show that a ten percent increase in price is associated with a decrease in fires of 6.3 to 7.5 percent, while a ten percent increase in tax is associated with a decrease in fires of 13.5 to 14.3 percent. Off the sample mean of 92 fires per quarter, these translate to a reduction in 6 to 7 fires quarterly for price and 12 to 13 fires quarterly for tax.

Also of interest in Table 4 are the results of the SFA laws. Smoking restrictions in bars and restaurants have no statistical relationship with the total counts of cigarette fires. However, relative to areas with no bans, restrictions and bans on smoking in private workplaces are associated with increases in fires. Restrictions are associated with an increase of about 14 fires per quarter, and bans are associated with an increase of about 11 fires per quarter. Such results may occur if the restrictions do not decrease smoking (or the decrease occurs only among the careful smokers), and the restrictions induce a switch in the location of careless smokers. Recall that Adda and Corneglia (2010) find no effect of workplace restrictions in reducing smoking.

Table 5 contains the results for residential fires caused by cigarettes. The results are rather similar to that for all fires, with the results showing negative price and tax effects with limited statistical significance. The magnitudes here are also very similar to that of all fires with elasticities in the range of -0.6 to -0.7 for price and -0.15 to -0.16 for tax. The SFA results are also very similar, in that workplace smoking restrictions are positively associated with residential fires while restrictions and bans in restaurants and bars have no effects.

The reduced form models for restaurants, bars, and the sum of restaurants, bars and other eating/drinking establishments are shown in Table 6. Results with taxes are not shown, but are very similar to the price results, which are all statistically insignificant. However, the results of the SFA laws on restaurant and bar fires are provocative. As shown for all locations, the ban on smoking in private workplaces is positively associated with counts of fires in these locations. Additionally, the coefficients on bans in smoking in restaurants and bars are positive in all models and are statistically significant in the four of the six models. Recall that Equation 3 above shows the total effect from bans on the incidence of fires can come about from both the change in the number of smokers and from the change in smoking behavior towards unsafe practices. Even when bans are effective in reducing smoking, if the reduction is mostly among the safe smokers and the remaining smokers act more carelessly, then we could easily see an increase in fires. In bars and restaurants in particular, smokers who are banned from inside smoking might simply move outside where careless cigarette disposal can start fires.

In order to further examine the effects of the SFA laws, I re-estimate some models using the percent of the states' populations covered by 100 percent smoke free air laws, that is, full bans on indoor smoking. Table 7 shows no effect of these laws on cigarette fires of all types and residential fires, although for residential fires, a larger percentage of the state population with complete bans on smoking in bars is associated with a slight reduction in fires, but the magnitude is extremely small. For restaurants and bars (Table 8), however, these bans are positively associated with fires, confirming the results using the dichotomous indicator variables for the bans.

From a public health perspective, deaths and injuries from fires are the more serious concern. I show results from all cigarette fires, but most of these deaths and injuries occur in residential structures; in the sample used here, 95 percent of all deaths and 90 percent of injuries are in residential locations. Table 9 shows the results of the cigarette prices and SFA policies on the total counts of deaths and injuries. Results are shown with the average price and with the SFA laws as categories. The coefficient on cigarette price is negative in all models, but only for deaths is it statistically significant at the 10 percent level, and only in one of the three models.[10]

As for the SFA laws, workplace bans are not statistically associated with deaths and injuries, while bans and restrictions in restaurants are positively related to deaths. This contradicts the coefficient on the bar bans, which is negatively associated with total deaths and injuries, but not deaths alone. In sum, these results are puzzling and inconclusive. Recall that

[10] Results with tax are similar in sign, but are not statistically significant.

workplace restrictions are associated with increases in the counts of residential fires, while restaurant and bar restrictions have no effects. It should follow that deaths and injuries, which are primarily residential, are positively associated with workplace bans. The coefficients are positive, but not significant at conventional levels. As for the other SFA laws, note that Adda and Corneglia (2010) find that bans in bars and restaurants are associated with a reduction in time spent in these locations and an increase in time spent at home by smokers. The increase in deaths associated with restaurant restrictions and bans corroborates their finding, but the negative sign on the bar bans refutes it. Clearly, further research is necessary on this question.

While the results presented thus far provide a lot of evidence that changes in cigarette policies over time are associated with changes in the incidence of fires, spurious correlation between these trends is still a worry. I therefore re-estimate some of the models presented above with the counts of fires caused by cooking as the dependent variable. As can be seen in Figure 2, the trends in cooking fires are similar to those of the other types of fires, yet logically, they should not be related to cigarette smoking. Any effects of the cigarette policies on the incidence of cooking fires would cast doubt on the main results. However, as shown in Table 10, none of the policy variables are statistically significant in regressions explaining the variation in the incidence of cooking fires. The same statement holds when examining deaths and injuries from cooking fires. These results are not shown but are available upon request.

The results of the other control variables are also of some interest. These include the quarterly unemployment rate, per capita income, the percent of each state's population with at least a bachelor's degree, the number of housing units per square mile and the dichotomous indicator for the states which have a fire safe cigarette law in effect. The results of these variables are fairly consistent across all specifications and can be generalized as follows:

Education, income and unemployment are generally not associated with fires, although states with higher income levels have fewer residential fires. The number of residential units per square mile are negatively associated with counts of fires of all types and with residential fires, but are not related to deaths and injuries. This result for the incidence of fires might reflect better fire awareness or prevention in urban areas. There might also simply be more people around to notice a fire and put it out before it gets out of control.

The results from the fire safe cigarette laws show no association of these laws with counts of all fires or of residential fires, but a positive effect with restaurant and bar fires (see Tables 4, 5, and 6), and a negative effect on deaths and injuries (see Table 9). Recall that during the time period under analysis, only 5 states have this law in effect, and three passed the law in the last year of the data, so these results should be treated as suggestive. It appears that the fire safe cigarettes are effective in reducing deaths and injuries as the law intends, however, there may also be some unanticipated effects that increase fires in restaurants and bars. One reason this effect could arise is if there is a substitution toward less safe hand rolled cigarettes away from the fire safe cigarettes. But, the substitution would need to only occur among restaurant and bar patrons in order to reconcile this with the reduction found for residential deaths. If the demographics of the groups of smokers are different then this explanation could hold. However, this is clearly an area for further research.

Conclusions

This paper examines the determinants of cigarette fires over time and questions whether public policies towards smoking have contributed to increases or decreases in these fires. When smoking rates in the population decrease, one might expect to see fewer cigarette fires as a result.

However, this conclusion is not guaranteed, as the decline in smoking may occur among the safest smokers, that is, those who are least likely to cause fires with their smoking behaviors. The empirical results do point to a small positive relationship between annual per capita sales of cigarettes and the number of cigarette fires. Using an instrumental variables approach, I estimate that each additional pack per capita sold is associated with a 2.2 percent increase in all cigarette fires and a 2.7 percent increase in fires in eating and drinking establishments.

Of more interest are the results of the reduced form models. The conclusions can be summarized as follows: Higher cigarette prices are associated with reductions in all fires and residential fires but not with restaurant and bar fires. Higher prices are also negatively related to counts of deaths and injuries in fires, with the caveat that the coefficients are of limited statistical significance. Certain restrictions and bans on indoor smoking also influence fire rates, but the effect is to increase, rather than decrease, fires. Specifically, workplace restrictions and bans are associated with increases in fires in all locations and in residential units. Restaurant and bar bans are associated with increases in fires in restaurants and all eating/drinking establishments.

The magnitude of the effects of the bans and restrictions on indoor smoking are not trivial. For example, the results indicate that a workplace ban is associated with 11 additional fires on average per quarter. The represents an increase over the mean of about 12 percent. Bans in smoking in restaurants result in an increase of 0.22 fires per quarter in eating and drinking establishments, or an increase of 15 percent over the mean of 1.46 fires per quarter.

Further research needs to establish why these indoor smoking bans are causing more fires. One likely explanation is that smokers change locations or behaviors as a result of the bans. In the case of restaurants and bars, it is easy to imagine a person going outside to smoke and then improperly disposing of the cigarette in flammable material such as mulch or shrubbery. The Star Tribune of Minneapolis-St. Paul, MN reported an extreme case where a patron, facing an indoor smoking ban on a cold night, stayed inside and dropped his secretly smoked cigarette butt down an air duct, causing a fire and nearly $1 million worth of damages (Humphrey, 2009).

In the case of goods like cigarettes with negative externalities, there is a strong argument for governments to intercede and to enact policies designed to reduce the consumption of such goods. The results of this paper exemplify that some policies, such as higher cigarette taxes and fire safe cigarettes, can be effective in reducing some of the externalities. However, the laws regulating the permissible location of smoking present a unique situation where the public policy intervention may create new and potentially deadly harms.

References

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

Bertrand, Marianne; Duflo, Esther and Mullainathan, Sendhil. "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics,* February 2004, 119(1), pp. 249-75.

Cameron, A. Colin and Pravin K. Trivedi *Microeconometrics Using Stata.* Stata Press, 2009.

CDC. WISQARS Web-based Injury Statistics Query and Reporting System. [http://www.cdc.gov/injury/wisqars/index.html] accessed August 10, 2009.

Chaloupka, F.J. "Clean Indoor Air Laws, Addiction, and Cigarette Smoking." Applied Economics, 24(2), 1992, 193-205.

Czart, C., R.L. Pacula, F.J. Chaloupka, and H. Wechsler. "The Impact of Prices and Control Policies on Cigarette Smoking Among College Students." *Contemporary Economic Policy*, 19(2), 2001, 135-149.

DeCicca, Philip and Logan McLeod. "Cigarette taxes and older adult smoking: Evidence from recent large tax increases." *Journal of Health Economics,* 27 (2008) 918–929

Dube, SR, K Asman, A Malarcher, R Carabollo. "Cigarette Smoking Among Adults and Trends in Smoking Cessation --- United States 2008." MMWR Weekly November 13, 2009 / 58(44);1227-1232

Debrot, K, M Tynan, J Francis, A MacNeil. "State Cigarette Excise Taxes --- United States, 2009" MMWR WeeklyApril 9, 2010 / 59(13);385-388.

Evans, W.N., M.C. Farrelly, and E. Montgomery. "Do Workplace Smoking Bans Reduce Smoking." *American Economic Review*, 89(4), 1999, 728-747.

Frazier, Patricia, James Williams, Howard Mell, and Hollis Stambaugh. *Product Safety Issues, Juvenile Fire-setter Intervention Project*. TriData Corporation, Arlington, Virginia, March 2000. [http://www.firemarshals.org/data/File/docs/Product%20Safety%20%20Issues%20Addenda%20%20Area%206.pdf]

Gallet, CA. "The Efficacy of State-Level Antismoking Laws: Demand and Supply Considerations." *Journal of Economics and Finance*, 28:(3), 2004, 404-412.

Hall, John R. Jr. *The Smoking-Material Fire Problem.* National Fire Protection Association: Quincy, MA. August 2006.

Humphrey, Katie. "Secret cigarette blamed for $1 million Farmington fire." Star Tribune, Minneapolis-St. Paul, MN January 8, 2009.

Karter, Michael J. *Fire Loss in the United States 2008.* National Fire Protection Association Fire Analysis and Research Division, Quincy, MA. January 2010.

Karter, Jr., Michael J., Terry L. Kissinger, Alison L. Miller, Beatrice Harwood, Rita E Fahy, and John R. Hall, Jr. "Cigarette Characteristics, Smoker, Characteristics, and the Relationship to Cigarette Fires." *Fire Technology*, Fourth Quarter 1994, pp. 400-431.

Ohsfeldt, R.L., R.G. Boyle, and E.L. Capilouto. "Tobacco Taxes, Smoking Restrictions, and Tobacco Use." in *The Economic Analysis of Substance Use and Abuse: An Integration of Econometric and Behavioral Economic Research*, edited by Frank Chaloupka, Michael Grossman, Warren Bickel, and Henry Saffer. Chicago: The University of Chicago Press, 1999, 15-30.

Orzechowski and Walker. *Tax Burden on Tobacco: Historical Compilation, 2009.*

Patetta, Michael J. and Thomas B. Cole. "A Population-Based Descriptive Study of Housefire Deaths in North Carolina." *American Journal of Public Health.* 1990; 80; 1116-1117.

Stehr, Mark. "Cigarette tax avoidance and evasion." *Journal of Health Economics,* 24 (2005) 277–297.

Tauras, J.A., "Public Policy And Some-Day Smoking Among Adults" *Journal of Applied Economics*, 7(1), 2004, 137-162.

Tauras, J.A., "Smoke Free Air Laws, Cigarette Prices, and Adult Cigarette Demand," *Economic Inquiry*, 44(2): 333-342, 2006.

U.S. Department of Health and Human Services. *The Health Consequences of Smoking: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2004.

U.S. Fire Administration, *Residential Smoking Fires and Casualties*. Topical Fire Research Series, Vol. 5, Issue 5. June 2005.

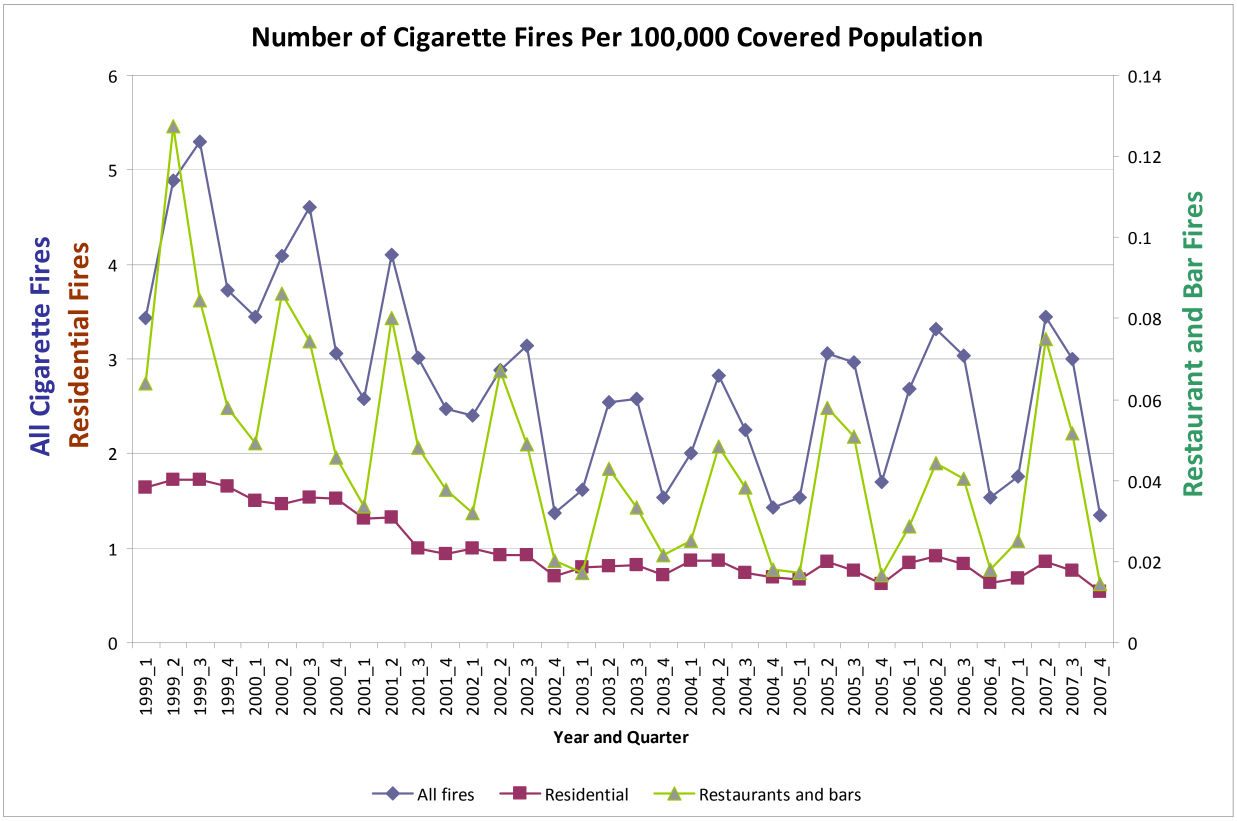
U.S. Fire Administration, *Fire in the United States 1992-2001.* USFA/FEMA. October 2004.

U.S. Fire Administration, *National Fire Incident Reporting System 5.0 Complete Reference Guide.* USFA/FEMA January 2008

Wasserman, J., W.G. Manning, J.P. Newhouse, and J.D. Winkler. "The Effects of Excise Taxes and Regulations on Cigarette Smoking." *Journal of Health Economics*, 10(1), 1991, 43-64.

Wooldridge, Jeffrey M., *Econometric Analysis of Cross Section and Panel Data,* Cambridge, MA: MIT Press, 2002.

Yurkeli A, Zhang P. 2000. The impact of clean indoor-air laws and cigarette smuggling on demand for cigarettes: an empirical model. Health Economics 9: 159–170.


Number of Cigarette Fires Per 100,000 Covered Population
All Cigarette Fires
Residential Fires
Restaurant and Bar Fires
Year and Quarter
All fires
Residential
Restaurants and bars

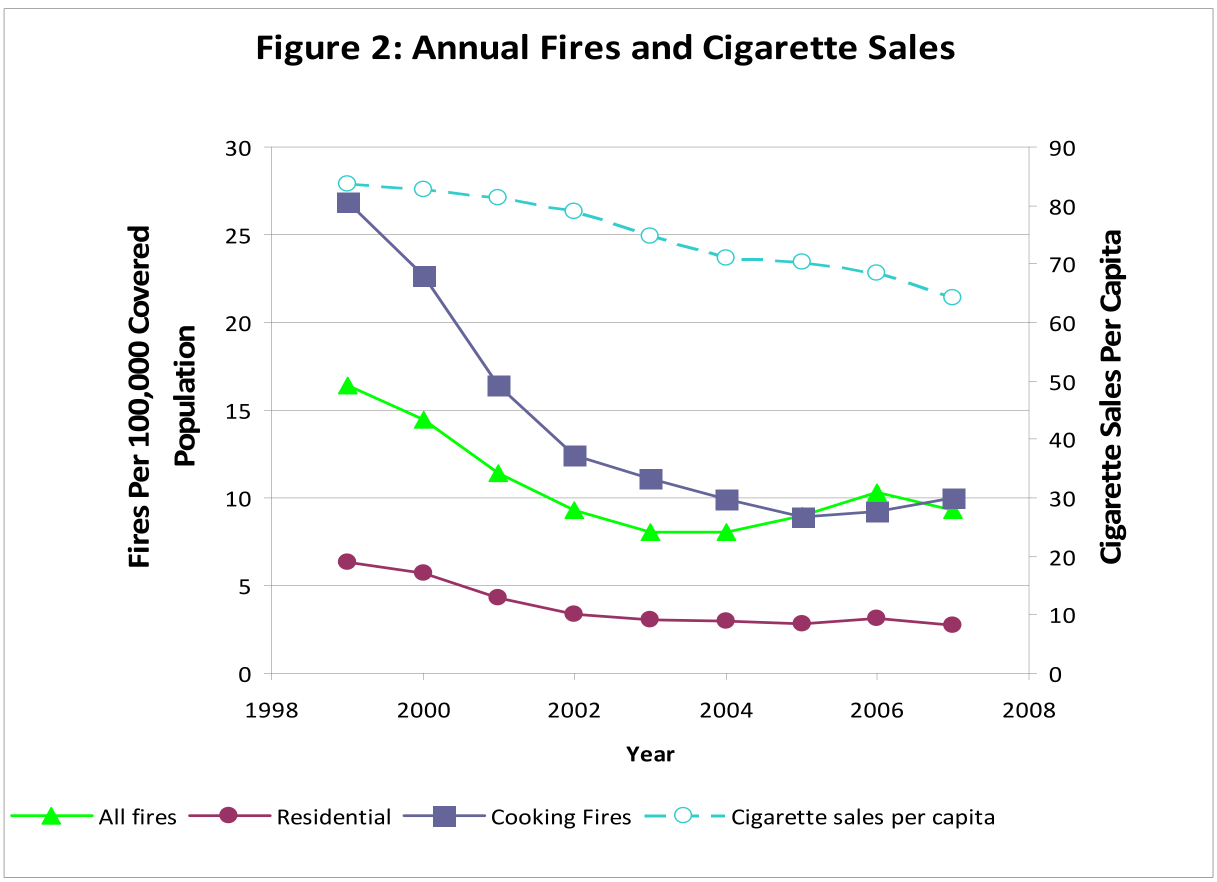


Figure 2: Annual Fires and Cigarette Sales
Fires Per 100,000 Covered Population
Cigarette Sales Per Capita
Year
All fires
Residential
Cooking Fires
Cigarette sales per capita

Table 1
Summary Statistics—Quarterly data, 1999-2007 (N=1750)

Variable	Mean	Std. Dev.	Min	Max
Count of cigarette fires, all locations	91.55	127.34	0	1085
Count of residential cigarette fires	32.10	40.74	0	295
Count of cigarette fires in restaurants	1.11	2.15	0	35
Count of cigarette fires in bars	0.19	0.52	0	5
Count of cigarette fires in restaurants, bars and other eating establishments	1.46	2.60	0	39
Count of fires caused by cooking	116.04	169.51	0	1255
Deaths from cigarette fires, all locations	0.64	1.16	0	9
Deaths and injuries from cigarette fires, all locations	4.04	6.21	0	59
Deaths from residential cigarette fires	0.61	1.12	0	9
Deaths and injuries from residential cigarette fires	3.64	5.58	0	57
Deaths from fires caused by cooking	0.25	0.77	0	11
Deaths and injuries from fires caused by cooking	1.33	2.80	0	27
Cigarette sales per capita in number of packs	74.80	28.50	31.05	184.4
Real average price of cigarettes	1.99	0.38	1.20	3.92
Real state excise tax on cigarettes	0.37	0.30	0.01	1.80
Restriction on smoking in private workplaces	0.39	0.49	0	1
Ban on smoking in private workplaces	0.13	0.34	0	1
Restriction on smoking in restaurants	0.49	0.50	0	1
Ban on smoking in restaurants	0.15	0.35	0	1
Ban on smoking in bars	0.10	0.30	0	1
% of state pop. covered by 100% SFA law, private workplaces	14.89	31.81	0	100
% of state pop. covered by 100% SFA law, restaurants	18.46	36.19	0	100
% of state pop. covered by 100% SFA law, bars	11.97	30.34	0	100
Fire safe cigarette law	0.02	0.14	0	1
Housing units per square mile	271.86	1060.22	2.49	10597.82
% of state pop. with a bachelor's degree	26.40	5.00	15.10	47.50
Real income per capita	17.03	2.68	5.23	30.06
Quarterly unemployment rate	4.71	1.16	2.13	9.67
Covered population	3,445,898	3,606,004	2,136	25,100,000

Table 2: Effects of Annual Cigarette Sales on Annual Counts of Cigarette Fires

	All Fires		Residential		Restaurants		Bars		All Eating/Drink Estab.	
Cigarette Sales:	Exogenous	Endogenous	Exogenous	Endogenous	Exogenous	Endogenous	Exogenous	Endogenous	Exogenous	Endogenous
Annual cigarette sales per capita	-0.0002 (-0.04)	0.022 (1.86)	0.006 (0.97)	0.021 (1.54)	-0.003 (-0.46)	0.023 (1.79)	-0.001 (-0.10)	0.014 (0.50)	-0.001 (-0.15)	0.027 (2.49)
Fire safe cigarette law	-0.024 (-0.26)	0.079 (0.80)	0.028 (0.17)	0.080 (0.47)	0.648 (1.18)	0.779 (1.46)	1.275 (3.16)	1.318 (3.39)	0.050 (0.29)	0.151 (1.01)
Houses per sq mile	-0.001 (-7.43)	-0.001 (-7.95)	-0.001 (-9.37)	-0.001 (-9.45)	-0.001 (-7.36)	-0.001 (-7.81)	-0.001 (-9.64)	-0.001 (-9.67)	-0.001 (-16.43)	-0.001 (-17.81)
% bachelors	-0.006 (-0.31)	0.014 (0.78)	-0.015 (-0.70)	-0.001 (-0.05)	-0.022 (-1.00)	-0.003 (-0.10)	0.006 (0.12)	0.021 (0.34)	-0.025 (-1.21)	-0.003 (-0.12)
Per capita income	-0.076 (-1.46)	-0.103 (-1.87)	-0.101 (-1.97)	-0.119 (-2.24)	-0.153 (-1.65)	-0.179 (-1.90)	0.320 (1.59)	0.302 (1.51)	-0.084 (-0.90)	-0.117 (-1.27)
Unemployment rate	-0.016 (-0.40)	0.041 (0.88)	-0.038 (-0.88)	-0.0003 (-0.01)	0.041 (0.51)	0.110 (1.31)	0.006 (0.03)	0.039 (0.19)	0.020 (0.25)	0.087 (1.12)
First stage residuals		-0.030 (-2.54)		-0.021 (-1.56)		-0.034 (-2.13)		-0.022 (-0.76)		-0.037 (-2.66)

Notes: N=443. T statistics in parentheses, intercept not shown. Models also include indicator variables for states and years. Instruments include the real cigarette price and SFA workplace laws. First stage F-statistic is 8.95.

Table 3: Effects of Annual Cigarette Sales on Annual Deaths and Injuries in Cigarettes Fires

	All Fire Deaths		All Fires Deaths + injury		Residential Deaths		Residential Deaths+ Injury	
Cigarette Sales:	Exogenous	Endogenous	Exogenous	Endogenous	Exogenous	Endogenous	Exogenous	Endogenous
Annual cigarette sales per capita	0.008 (0.68)	0.029 (1.47)	0.006 (1.02)	0.007 (0.87)	0.009 (0.74)	0.032 (1.61)	0.006 (1.20)	0.007 (0.86)
Fire safe cigarette law	-0.639 (-3.27)	-0.571 (-2.57)	-0.283 (-2.58)	-0.280 (-2.48)	-0.587 (-2.86)	-0.511 (-2.17)	-0.246 (-2.45)	-0.243 (-2.33)
Houses per sq mile	-0.001 (-1.10)	-0.001 (-1.14)	-0.001 (-1.22)	-0.001 (-1.22)	-0.001 (-1.10)	-0.001 (-1.15)	-0.001 (-1.14)	-0.001 (-1.15)
% bachelors	0.008 (0.27)	0.026 (0.86)	-0.0004 (-0.02)	0.001 (0.04)	0.002 (0.05)	0.021 (0.67)	0.002 (0.09)	0.003 (0.14)
Per capita income	0.067 (0.52)	0.035 (0.27)	-0.175 (-2.53)	-0.177 (-2.46)	0.085 (0.63)	0.052 (0.37)	-0.188 (-2.69)	-0.190 (-2.64)
Unemployment rate	0.034 (0.41)	0.087 (0.99)	-0.134 (-1.96)	-0.131 (-1.99)	0.045 (0.53)	0.101 (1.14)	-0.119 (-1.79)	-0.115 (-1.72)
First stage residuals		-0.030 (-1.59)		-0.002 (-0.19)		-0.032 (-1.81)		-0.002 (-0.19)

Notes: N=443. T statistics in parentheses, intercept not shown. Models also include indicator variables for states and years. Instruments include the real cigarette price and SFA workplace laws. First stage F-statistics is 8.95.

Table 4
Dependent Variable=Quarterly Counts of Cigarette Fires, All Locations

	(1)	(2)	(3)	(4)	(5)	(6)
Cigarette price	-0.319	-0.378	-0.368			
	(-1.94)	(-2.04)	(-1.93)			
Cigarette tax				-0.363	-0.384	-0.369
				(-1.52)	(-1.48)	(-1.38)
SFA restriction: workplaces	0.305			0.325		
	(2.89)			(2.90)		
SFA ban: workplaces	0.218			0.221		
	(2.23)			(2.19)		
SFA restriction: restaurants		0.054			0.056	
		(0.51)			(0.53)	
SFA ban: restaurants		0.091			0.081	
		(0.71)			(0.63)	
SFA ban: bars			0.045			0.032
			(0.52)			(0.36)
Fire safe cigarette law	0.046	0.012	-0.0004	0.031	-0.006	-0.016
	(0.51)	(0.12)	(-0.004)	(0.33)	(-0.05)	(-0.16)
Houses per sq mile	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-7.56)	(-7.87)	(-7.96)	(-7.49)	(-7.87)	(-7.97)
% bachelors	-0.005	-0.002	-0.003	-0.006	-0.005	-0.005
	(-0.35)	(-0.16)	(-0.21)	(-0.46)	(-0.31)	(-0.35)
Per capita income	-0.039	-0.058	-0.058	-0.038	-0.057	-0.057
	(-1.04)	(-1.48)	(-1.48)	(-0.99)	(-1.43)	(-1.43)
Unemployment rate	-0.009	-0.002	-0.004	-0.007	-0.0001	-0.002
	(-0.28)	(-0.05)	(-0.12)	(-0.21)	(-0.001)	(-0.06)
Price/tax elasticity	-0.63	-0.75	-0.73	-0.14	-0.14	-0.14
Change in count from $1 change in price/tax	-14.12	-16.73	-16.30	-16.06	-17.04	-16.36
Change in count from SFA restriction change from 0 to 1	13.99	2.40		14.94	2.49	
Change in count from SFA ban change from 0 to 1	10.48	4.14	2.04	10.64	3.71	1.43

Notes: N=1750. T statistics in parentheses, intercept not shown. Models also include indicator variables for states and year/quarters.

Table 5
Dependent Variable=Quarterly Counts of Residential Cigarette Fires

	(1)	(2)	(3)	(4)	(5)	(6)
Cigarette price	-0.318	-0.358	-0.344			
	(-1.56)	(-1.73)	(-1.61)			
Cigarette tax				-0.420	-0.426	-0.410
				(-1.49)	(-1.50)	(-1.39)
SFA restriction: workplaces	0.293			0.312		
	(2.46)			(2.47)		
SFA ban: workplaces	0.140			0.147		
	(1.55)			(1.57)		
SFA restriction: restaurants		-0.026			-0.017	
		(-0.24)			(-0.16)	
SFA ban: restaurants		-0.062			-0.061	
		(-0.57)			(-0.56)	
SFA ban: bars			-0.092			-0.096
			(-1.37)			(-1.38)
Fire safe cigarette law	0.043	-0.014	0.005	0.022	-0.036	-0.018
	(0.46)	(-0.14)	(0.05)	(0.22)	(-0.32)	(-0.17)
Houses per sq mile	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-9.31)	(-9.92)	(-9.97)	(-9.14)	(-9.81)	(-9.88)
% bachelors	-0.012	-0.010	-0.008	-0.013	-0.012	-0.010
	(-0.74)	(-0.58)	(-0.51)	(-0.85)	(-0.70)	(-0.62)
Per capita income	-0.060	-0.072	-0.070	-0.058	-0.070	-0.068
	(-1.81)	(-2.02)	(-1.98)	(-1.76)	(-1.95)	(-1.93)
Unemployment rate	-0.048	-0.036	-0.031	-0.042	-0.030	-0.026
	(-1.46)	(-1.03)	(-0.88)	(-1.28)	(-0.84)	(-0.70)
Price/tax elasticity	-0.631	-0.710	-0.683	-0.157	-0.159	-0.153
Change in count from $1 change in price/tax	-5.05	-5.69	-5.47	-6.68	-6.79	-6.52
Change in count from SFA restriction change from 0 to 1	4.81	-0.41		5.14	-0.26	
Change in count from SFA ban change from 0 to 1	2.34	-0.97	-1.40	2.47	-0.94	-1.47

Notes: N=1750. T statistics in parentheses, intercept not shown. Models also include indicator variables for states and year/quarters.

Table 6

Dependent Variables=Quarterly Counts of Cigarette Fires in Restaurants, Bars, and Other Eating/Drinking Establishments

	Restaurants			Bars			Restaurants + Bars + Other		
Cigarette price	-0.172	-0.248	-0.294	0.243	0.169	0.153	-0.244	-0.335	-0.341
	(-0.71)	(-0.92)	(-1.11)	(0.56)	(0.35)	(0.31)	(-1.19)	(-1.49)	(-1.54)
SFA restriction: workplaces	0.217			0.427			0.270		
	(1.11)			(1.97)			(1.46)		
SFA ban: workplaces	0.465			0.844			0.466		
	(2.76)			(2.29)			(3.29)		
SFA restriction: restaurants		0.020			0.058			0.069	
		(0.12)			(0.13)			(0.46)	
SFA ban: restaurants		0.437			0.514			0.422	
		(2.33)			(1.25)			(2.67)	
SFA ban: bars			0.441			0.487			0.354
			(2.82)			(1.26)			(2.88)
Fire safe cigarette law	0.720	0.706	0.664	0.767	0.725	0.670	0.171	0.119	0.076
	(2.30)	(2.41)	(2.36)	(2.18)	(1.93)	(1.81)	(1.29)	(0.84)	(0.53)
Houses per sq mile	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-10.33)	(-10.04)	(-10.17)	(-9.43)	(-9.96)	(-9.75)	(-19.78)	(-18.84)	(-18.79)
% bachelors	-0.037	-0.038	-0.040	-0.018	-0.010	-0.014	-0.038	-0.037	-0.039
	(-1.41)	(-1.59)	(-1.56)	(-0.42)	(-0.20)	(-0.28)	(-1.63)	(-1.73)	(-1.66)
Per capita income	-0.079	-0.097	-0.088	0.327	0.273	0.284	-0.034	-0.056	-0.046
	(-1.10)	(-1.35)	(-1.23)	(1.84)	(1.61)	(1.58)	(-0.51)	(-0.85)	(-0.70)
Unemployment rate	0.045	0.044	0.017	-0.038	-0.041	-0.070	0.017	0.021	-0.0001
	(0.61)	(0.59)	(0.22)	(-0.27)	(-0.27)	(-0.43)	(0.25)	(0.32)	(-0.001)
Price elasticity	-0.342	-0.493	-0.583	0.483	0.336	0.304	-0.485	-0.665	-0.677
Change in count from $1 change in price	-0.04	-0.05	-0.06	0.002	0.002	0.001	-0.11	-0.15	-0.15
Change in count from SFA restriction change from 0 to 1	0.05	0.004		0.004	0.0005		0.13	0.03	
Change in count from SFA ban change from 0 to 1	0.12	0.11	0.11	0.01	0.01	0.005	0.25	0.22	0.19

Notes: N=1750. T statistics in parentheses, intercept not shown. Models also include indicator variables for states and year/quarters.

Table 7
Dependent Variables=Quarterly Counts of Cigarette Fires

	All fires			Residential Fires		
Cigarette price	-0.360 (-1.88)	-0.358 (-1.86)	-0.355 (-1.84)	-0.360 (-1.68)	-0.350 (-1.61)	-0.326 (-1.53)
% of state pop. covered by 100% SFA law, private workplaces	0.0004 (0.52)			-0.001 (-0.90)		
% of state pop. covered by 100% SFA law, restaurants		0.0003 (0.30)			-0.001 (-1.17)	
% of state pop. covered by 100% SFA law, bars			0.0001 (0.13)			-0.001 (-1.92)
Price elasticity	-0.71	-0.71	-0.70	-0.72	-0.69	-0.65
Change in count from $1 change in price	-15.94	-15.86	-15.71	-5.73	-5.57	-5.19
Change in count from 1 percentage point change in SFA	0.02	0.01	0.005	-0.01	-0.01	-0.02

Notes: N=1750. T statistics in parentheses, intercept not shown. Models include the fire safe cigarette law, housing per square mile, education, income, unemployment, and the indicator variables for states and year/quarters.

Table 8
Dependent Variables=Counts of Cigarette Fires, in Restaurants, Bars, and Other Eating/Drinking Establishments

	Restaurants			Bars			Restaurants + Bars + Other		
Cigarette price	-0.195 (-0.73)	-0.244 (-0.90)	-0.311 (-1.15)	0.149 (0.31)	0.139 (0.29)	0.134 (0.27)	-0.286 (-1.26)	-0.323 (-1.42)	-0.354 (-1.56)
% of state pop. covered by 100% SFA law, private workplaces	0.004 (2.90)			0.009 (2.92)			0.004 (3.15)		
% of state pop. covered by 100% SFA law, restaurants		0.004 (3.09)			0.006 (2.03)			0.004 (3.04)	
% of state pop. covered by 100% SFA law, bars			0.005 (2.85)			0.005 (1.44)			0.004 (2.63)
Price elasticity	-0.39	-0.48	-0.62	0.30	0.27	0.27	-0.57	-0.64	-0.70
Change in count from $1 change in price	-0.04	-0.05	-0.07	0.002	0.001	0.001	-0.13	-0.14	-0.16
Change in count from 1 percentage point change in SFA	0.001	0.001	0.001	0.0001	0.0001	0.00005	0.002	0.002	0.002

Notes: N=1750. T statistics in parentheses, intercept not shown. Models include the fire safe cigarette law, housing per square mile, education, income, unemployment, and the indicator variables for states and year/quarters.

Table 9
Dependent Variables=Counts of Deaths and Injuries, All Locations

	Deaths			Deaths + Injuries		
Cigarette price	-0.458	-0.528	-0.488	-0.135	-0.158	-0.111
	(-1.40)	(-1.71)	(-1.56)	(-0.98)	(-1.27)	(-0.87)
SFA restriction: workplaces	0.237			0.062		
	(1.03)			(0.44)		
SFA ban: workplaces	0.266			-0.047		
	(1.30)			(-0.35)		
SFA restriction: restaurants		0.538			0.346	
		(2.37)			(2.07)	
SFA ban: restaurants		0.423			0.044	
		(1.69)			(0.27)	
SFA ban: bars			0.101			-0.201
			(0.66)			(-2.01)
Fire safe cigarette law	-0.586	-0.515	-0.665	-0.332	-0.241	-0.298
	(-2.74)	(-2.86)	(-3.82)	(-3.53)	(-2.81)	(-3.34)
Houses per sq mile	-0.0005	-0.0005	-0.0005	-0.0004	-0.0005	-0.0005
	(-0.93)	(-0.92)	(-0.96)	(-1.10)	(-1.13)	(-1.16)
% bachelors	0.009	0.025	0.012	0.001	0.013	0.006
	(0.29)	(0.78)	(0.40)	(0.05)	(0.75)	(0.36)
Per capita income	0.092	0.104	0.089	-0.107	-0.089	-0.100
	(0.73)	(0.81)	(0.72)	(-2.21)	(-1.78)	(-2.07)
Unemployment rate	0.105	0.109	0.105	-0.101	-0.093	-0.081
	(1.43)	(1.52)	(1.33)	(-1.81)	(-1.95)	(-1.51)
Price elasticity	-0.91	-1.05	-0.97	-0.27	-0.31	-0.22
Change in count from $1 change in price	-0.09	-0.10	-0.10	-0.23	-0.27	-0.19
Change in count from SFA restriction change from 0 to 1	0.05	0.10		0.10	0.59	
Change in count from SFA ban change from 0 to 1	0.06	0.09	0.02	-0.08	0.08	-0.31

Notes: N=1750. T statistics in parentheses, intercept not shown. Models also include indicator variables for states and year/quarters.

Table 10
Dependent variable=counts of cooking fires

	(1)	(2)	(3)	(4)	(5)	(6)
Cigarette price	-0.138	-0.154	-0.097			
	(-0.95)	(-1.18)	(-0.82)			
Cigarette tax				-0.028	-0.026	0.039
				(-0.17)	(-0.19)	(0.29)
SFA restriction: workplaces	0.172			0.179		
	(1.13)			(1.16)		
SFA ban: workplaces	0.106			0.097		
	(0.74)			(0.67)		
SFA restriction: restaurants		-0.059			-0.071	
		(-0.46)			(-0.55)	
SFA ban: restaurants		-0.017			-0.044	
		(-0.10)			(-0.27)	
SFA ban: bars			-0.126			-0.153
			(-0.93)			(-1.09)
Fire safe cigarette law	0.188	0.123	0.192	0.185	0.116	0.200
	(0.62)	(0.40)	(0.66)	(0.60)	(0.37)	(0.69)
Houses per sq mile	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-3.42)	(-3.50)	(-3.55)	(-3.41)	(-3.50)	(-3.57)
% bachelors	-0.017	-0.016	-0.013	-0.020	-0.018	-0.015
	(-1.10)	(-1.13)	(-0.88)	(-1.26)	(-1.33)	(-1.02)
Per capita income	-0.083	-0.100	-0.089	-0.076	-0.093	-0.081
	(-1.75)	(-2.06)	(-1.83)	(-1.59)	(-1.91)	(-1.71)
Unemployment rate	-0.020	-0.009	-0.003	-0.022	-0.010	-0.003
	(-0.36)	(-0.16)	(-0.04)	(-0.41)	(-0.18)	(-0.05)

Notes: N=1750. T statistics in parentheses, intercept not shown. Models also include indicator variables for states and year/quarters.