Impact of Restaurant Smoking Bans on Demand for Smoking and Restaurant Food

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Abstract

Many states and localities have either recently enacted or are considering bans on smoking in restaurants, making this one of the most active areas of tobacco control policy. The bans are intended to reduce secondhand smoke exposure for both the customers and employees of restaurants. Restaurant smoking bans might also help encourage smokers to cut down or quit entirely. However, in addition to their public health benefits, the bans might change the restaurant-food consumption patterns of smokers and nonsmokers. Previous research explores the economic impact of smoking bans on the restaurant industry, such as taxable restaurant sales. Much less is known about the impact on consumer behavior. For example, some previous empirical studies find that smoking bans have approximately zero net effect on restaurant sales. This finding could mean that most consumers simply do not respond to a ban one way or the other. Alternatively, the same finding could result from strong but offsetting consumer responses by smokers and nonsmokers.

We estimate an econometric model of the impact of restaurant smoking bans on the demand for restaurant food by smokers and non-smokers. We use data from multiple waves of the Simmons National Consumer Survey (NCS) and the Consumer Expenditure Survey (CES) from 2000 – 2004. The combined waves of the NCS provide measures on the number of visits to family and fast food restaurants for a sample of over 110,000 adults. The combined waves of the CES provide a measure of expenditures on food away from home for a nationally representative sample of over 37,000 households. We use geocode information to merge the individual-level NCS and CES data with data on restaurant smoking bans in the respondents' state and locality. We improve upon most previous studies of smoking bans because we take into account local bans and we take into account the bans' strictness. With these improvements, our measures of restaurant smoking bans show substantial variation across states and over time in our sample period. For example, the fraction of the NCS sample subject to any state-level smoking ban, regardless of strictness, stays roughly constant at about 64% from 2000 – 2004. In contrast, the fraction of the NCS sample subject to strict ban at either the state- or municipal-level increases from about 16% in 2000 to 35% in 2004.

A complete policy analysis of restaurant smoking bans requires a better understanding of the bans' consequences for the consumers of restaurant food and the businesses that serve them. A few highly publicized studies find that restaurant smoking bans have a positive impact on restaurant sales. This is surprising because in this situation profit-maximizing restaurant owners should voluntarily accommodate customers' preferences for a ban. However, restaurant owners may be in a prisoner's dilemma type game where each owner loses if she individually enacts a ban, but the industry as a whole gains through the coordinated action of a uniform smoking ban. Because our results quantify the impact of the bans on smokers' and non-smokers' demand for restaurant food, we shed new light on the plausibility of this scenario. Furthermore, our results shed new light on the public health benefits of the bans for the smokers themselves: the bans' consequences for smokers depend on whether the bans prompt them to change their smoking behavior or their restaurant-going behavior.

Introduction

Many states and localities have either recently enacted or are considering bans on smoking in restaurants, making this one of the most active areas of tobacco control policy. The number of states with a restaurant smoking ban increased from 3 in 2002 to 24 by early January 2008 (Table 1). The number of localities with restaurant smoking bans has increased more rapidly, from only 1 in 1990, to 73 in 2000, to 409 by early January 2008. 63 localities also ban smoking in outdoor dining areas. By January 2008 over half of the US population was covered by state and/or local restaurant bans, exceeding the Healthy People 2010 Objective (27-13c) for 51% coverage of smoking bans in restaurants (USDHHS 2000).

The restaurant smoking bans are intended to reduce secondhand smoke exposure for both the nonsmoking customers and employees of restaurants. On the other hand, they might affect people's smoking and restaurant-going behaviors. For smokers the bans might encourage them to cut down or quit entirely. In addition to their public health benefits, the bans might change the restaurant-food consumption patterns of both smokers and nonsmokers. Opponents of the bans argue that the restaurants bans are bad for business because smokers might visit restaurants less often. Perceptions that the bans hurt the restaurant industry can prevent their adoption or even encourage their repeal.

The majority of previous research explores the economic impact of restaurant smoking bans on the restaurant industry. However, these studies can not shed much light on the underlying consumer behavior. For example, a finding that a restaurant smoking ban has no effect on restaurant sales could mean that most consumers do not respond to a ban. Alternatively, the same finding could reflect strong but offsetting consumer responses by nonsmokers and smokers. In effect, by making behavioral adjustments on other margins, smokers may be able to insulate themselves from the bans. Whether and to what extent the bans prompt smokers to change their smoking behavior or their restaurant-going behavior may determine the ultimate impact on public health.

A complete policy analysis of restaurant smoking bans requires a better understanding of the bans' consequences for the consumers of restaurant food and the businesses that serve them. This paper is the first to investigate the impact of restaurant smoking bans using national data on individual and household behaviors. It examines many margins of restaurant-going and smoking behavior including number of visits to family versus fast food restaurants, time spent eating at restaurants, household expenditures on restaurant meals, smoking cessation attempt, successful cessation, daily smoking amount, and household expenditures on smoking items.

Thus, the paper is also the first to conduct an integrated study of the impact of restaurant smoking bans on both restaurant-going behavior and smoking behaviors. The integrated analysis will provide valuable insights beyond what can be learned from studies that focus on bans' impacts on restaurant-going and smoking separately. For example, to the extent smokers strongly react to bans by cutting back on their restaurant-going, they may have less incentive to cut back on their smoking. Recent work by Adda and Cornaglia (2006) and Adams and Cotti (forthcoming) underline the importance of exploring a range of behavioral adjustments.

Background and review of existing literature

Banning smoking in restaurants is one of the most active areas of tobacco control policy in the US. The number of states with laws to restrict smoking in various public places has increased rapidly in recent years. The increase in restaurant smoking bans has been particularly rapid. Part of the trend is towards comprehensive bans which do not allow separately ventilated smoking rooms, do not have size exemptions, and include any attached bar in the restaurant. Nevertheless, a recent Institute of Medicine report, issued in response to concern about the "waning momentum in tobacco control efforts," recommends that states and localities should enact complete bans in all nonresidential indoor locations, including restaurants (Bonnie, Stratton, and Wallace 2007). Interest in smoking bans is worldwide. The WHO Director-General Chan urged "all countries that have not yet done so to take this immediate and important step to protect the health of all by passing laws requiring all indoor workplaces and public places to be 100% smoke-free." (WHO 2007).

Restaurant smoking bans protect restaurant customers and employees from exposure to secondhand smoke, which causes diseases and premature death in nonsmokers. According to the Surgeon General's Report: "…exposure to secondhand smoke kills more than 3,000 adult nonsmokers from lung cancer, approximately 46,000 from coronary heart disease, and an estimated 430 newborns from sudden infant death syndrome" and is linked to coughing, phlegm, and reduced lung function (USDHHS 2006). Siegel (1993) estimates that food service workers face a 50% higher risk of dying from lung cancer, partly due to their workplace exposure to secondhand smoke. Two recent studies find evidence that hospital admissions for myocardial infarctions fell after smoking was banned in workplaces and public places (including restaurants) in Helena, Montana (Sargent, Shepard, and Glantz 2004) and Pueblo, Colorado (Bartecchi et al. 2006).

More US states and localities are considering restaurant smoking bans, but they are often opposed by the restaurant industry. Although the trend is towards adoption, opponents of the bans sometimes successfully use the argument that the bans are bad for business. Glantz and Smith (1994) point out that this argument has been used from the beginning of the ban movement: "…in 1987, when the tobacco industry convinced the Beverly Hills City Council to repeal the first 100% smokefree restaurant ordinance in California on the basis of undocumented claims that business dropped 30% because of the ordinance." Given the size of the restaurant industry, the potential negative impact of restaurant smoking bans is a serious concern. After the government, the restaurant industry is the largest employer in the US with an estimated 12.8 million employees with a claimed economic impact over $1.3 trillion in 2007 (National Restaurant Association 2007).

Previous research explores the economic impact of restaurant smoking bans on the restaurant industry, but much less is known about the impact on consumer behavior. A comprehensive literature review of the economic impact studies located more than 150 studies conducted up to July 2005 (Scollo and Lal 2005). Several more studies on this topic have emerged since. More than half of the previous studies use measures of restaurant business, most commonly taxable restaurant sales. The most commonly examined localities are New York City and communities in California and Massachusetts. The majority of previous studies either fail to detect a statistically significant impact of restaurant smoking bans on restaurant business, or find a positive impact. The estimated effect sizes are generally modest, in the range of 5% to 10%. The positive impacts seem surprising: in this situation profit-maximizing restaurant owners should voluntarily accommodate customers' preferences for a ban (Dunham and Marlow 2000). However, restaurant owners may be in a prisoner's dilemma game where each loses if she individually enacts a ban, but the industry as a whole gains through the coordinated action of a uniform smoking ban (Fleck and Hanssen 2007; Hammar 2004). In addition to studies of taxable sales, a few studies each conducted a small survey of restaurant owners in a single locale. In the surveys that were not sponsored by the tobacco industry, the majority of restaurant owners felt their business was not or would not be hurt by a smoking ban (Scollo and Lal 2005).

Small-scale surveys of consumers in a few localities provide limited evidence that bans prompt nonsmokers to visit restaurants more often, while smokers cut back on their restaurant visits. Corsun, Young and Enz (1996) surveyed a sample of 389 consumers in Manhattan. While most of the sample did not change their eating out frequency after a ban took effect, 38% of smokers said they dined out less often while 17% of nonsmokers reported dining out more often. Two surveys asked somewhat larger samples in Massachusetts (Biener and Siegel 1997) and South Australia (Wakefield and Roberts 1999). 8% of smokers in the Massachusetts sample and 15% of smokers in the Australian sample predicted that their use of restaurants would decrease if restaurant smoking were banned. We have not been able to locate any previous study that uses large-scale nation-wide consumer data to study the impact of restaurant smoking bans.

Some econometric studies examine the impact of worksite smoking bans (Wasserman et al 1991 and Evans et al 1999). From a meta-analysis of 26 studies, Fichtenberg and Glantz (2002) estimate that worksite bans are associated with a 3.8% reduction in the prevalence of smoking and 3.1 fewer cigarettes smoked per day per continuing smoker. Levy and Friend's (2003) conclude that worksite smoking bans have the potential to reduce smoking by somewhat larger amounts. Goel and Nelson (2006) review additional international evidence on the impact of worksite bans. Tauras (2006) studies a broader set of smoking bans. In his models that include separate measures of the various bans, restaurant smoking bans are not statistically significant, but he finds a statistically significant effect on average smoking by adult smokers for a combined index of the clean indoor air laws. Adda and Cornaglia (2006) use data on cotinine concentration -- a metabolite of nicotine – to estimate econometric models of the impact of smoking bans on nonsmokers' exposure to secondhand smoke. Their preliminary results provide evidence that "smokers replace smoking at banned locations with smoking in places where nonsmokers are in turn more likely exposed." Adams and Cotti (forthcoming) find that bans on smoking in bars are followed by increases in alcohol-related traffic fatalities, which they suggest may reflect increases in miles driven by drinkers wishing to smoke.

Another line of research in agricultural and applied economics investigates consumer demand for restaurant food, but does not examine the role of smoking bans. Several studies, using data ranging from the 1970s to 1990s, have identified a relatively consistent set of socio-economic and demographic households characteristics that influence demand for food away from home by market segment, mostly fast food versus full-service restaurants (McCracken and Brandt 1987; Nayga and Capps 1994; Byrne, Capps et al. 1998; Stewart, Blisard et al. 2004). The main factors identified include household income, household size and composition, region of residence, and age, race, and education. We have not found any previous studies in this line of research that include smoking bans in the analysis of demand for food away from home.

Data

This paper uses two sources of data on individual and household behavior: the Simmons National Consumer Survey (NCS) and the Consumer Expenditure Survey (CES).

Simmons National Consumer Survey

Our individual-level behavior data come from the NCS for the years 2000–2004. The NCS is a repeated cross-sectional survey with two waves each year. The sample for each wave is independently drawn. The NCS employs a multi-stage stratified probability sample. The final sample represents a representative probability sample of all adults living in households in the U.S. (excluding Hawaii and Alaska). Because it is a marketing survey, high income consumers are intentionally over-sampled. The sample size with geocode information varies somewhat across waves. In order to minimize respondent fatigue the data are collected in a four-stage modular approach: an initial personal interview (Phase 1); a self-administered questionnaire; a second personal interview (Phase II); and a telephone interview. We use data on demographic characteristics of the individual and his/her household that were collected in the Phase I personal interviews. We use data on consumer behavior reported in the self-administered questionnaires. The questionnaires were left with the respondents at the time of the Phase I interviews and usually recovered at the time of the Phase II interviews. It was the interviewer's responsibility to explain the procedures to the respondent and to check over the questionnaire when it was picked up to make sure that it was answered properly. (This paper does not use data from the Phase II personal interviews and the telephone interviews on magazine/ newspaper reading habits and radio listening habits.) Survey response rates in the NCS are generally high (approximately 70%) and compare well with other widely-used surveys. For example: in the 2002 Behavioral Risk Factor Surveillance Survey the median response rate across states was 58% (range: 42% to 83%); for the 2002 National Health Interview Survey the total household response rate was approximately 90% and the final response rate for the Adult Sample Person was 74% (CDC 2003, 2004).

The NCS provides detailed information on consumer behavior related to restaurant-going. In the self-administered questionnaire respondents indicated the number of times during the past 30 days that they visited specific family restaurants and specific fast food restaurants. The questionnaire included lists of the names of about 30 family restaurants and about 50 fast food restaurants. Both lists included the category "other." The number of visits to each specific family restaurant visits was coded categorically: none; one; two; three; four – five; six to nine; and ten or more. The total number of visits to specific fast food restaurants was again coded categorically, but with somewhat different categories: none; one to five; six to thirteen; and fourteen or more. We sum the mid-point of the categorical measures of visits to specific restaurants to create measures of the total number of visits to family restaurants and the total number of visits to fast food restaurants.

In another set of questions, the NCS addresses daily activities for each hour of a specified day. The survey provides information on whether the day is a weekday or Saturday or Sunday. The three questions are: 1. Where were you (in a home, at a restaurant, bar, pub, or cafe, etc)? 2.

With whom (alone, with family, etc.)? 3. What were you doing (working, eating, etc)? From responses to the questions 1 and 3, we create 24 binary variables, each indicating whether a respondent was eating out at a restaurant, bar, pub, or café for one hour of the day. Sum of the 24 binary variables is the measure of time spent eating out at a restaurant, bar, pub, or café during one specified day.

The data on daily activities are available for years 2001-2003. In our analysis sample most respondents visit fast food restaurants (83%) and family restaurants (74%) during a 30-day period. On average they visit fast food restaurants 14 times and family restaurants only about 4 times (Table 2A, 2B). Within one day about 14% respondents spend some time eating at a restaurant/bar/pub/café/. The average time they spent is 1.5 hours.

The NCS also provides information on smoking behaviors. For current smokers, we measure the number of cigarettes smoked per day. We also create a series of measures of smoking cessation behavior using the same approach we have used in previous work (Avery et al. 2007). We use responses to the NCS question, "Did you attempt to quit smoking in the past 12 months?" to code our measure of a quit attempt. In our previous work, by that measure 45% of smokers attempted to quit in the past 12 months. NHIS estimates of the one-year quit attempt rate range from 39% to 49% over the time period in our NCS data (CDC 1997, 2003). We combine the response to the question about quit attempts with answers to the question, "Do you currently smoke?" to identify respondents who "successfully" quit. These individuals are smokers who tried to quit smoking the past year and do not currently smoke. Measured this way in our previous work, 10% percent of smokers quit. This number corresponds closely to the past-year cessation rate of 9% reported by Liu (forthcoming) based on data from over 895,000 smokers from pooled Tobacco Use Supplements to the Current Population Survey. The NCS estimate of the one-year quit rate is higher than the permanent cessation rate of 2.5% reported by the CDC (1993) because the NCS does not provide a measure of permanent or long-term cessation.

Consumer Expenditure Survey

Our household expenditure data come from the 2002 Consumer Expenditure Survey (CES). The CES is a major data collection effort administered by the US Bureau of Labor Statistics; one of its uses is for the periodic revision of the Consumer Price Index. The CES consists of two components, a quarterly Interview Survey and a weekly Diary Survey. We use data from the Diary Survey, which provides a quarterly representative sample of around 7,500 non-institutional households. In the Diary section of the CES each household records its expenditures on frequently purchased smaller items for two consecutive 1-week periods. The CES Diary Survey also collects data on household income and socioeconomic characteristics. The response rate for the 2004 Diary Survey was 68.9%.

We use CES Diary reports to construct two measures of household expenditures on food away from home: expenditures on food at limited-service (fast-food, take-out or delivery) restaurants; and expenditures on food at full-services restaurants. Stewart et al. (2004) use the same approach to use the CES data to measure consumer demand for food away from home. They note that because the CES data do not include expenditures by businesses or for people in institutions, the data do not capture all of the away-from-home market. Stewart et al estimate that the CES captures about 75% of the total food-away-from-home market. We construct a measure of household expenditures on smoking-related items (cigarettes, cigar, smoking accessories, etc.). Based on positive expenditures on smoking-related items, we create a binary indicator that measures if anyone in the household might be a smoker.

Our CES sample reveals that during a one-week period 62% and 40% households have non-zero expenditures on food at limited and full service restaurants, respectively. The average expenditure at fast food restaurants is about $1.3 per week per person and it is about $2.4 at full service restaurants. Less than 19% households spend money on smoking-related items during a week and the average expenditure is $14 per adult household member.

Measure of Restaurant Smoking Bans

This paper uses data on smoking bans in restaurants from a database constructed by American Nonsmokers' Rights Foundation (ANRF). The database lists municipalities and states in the US with 100% smokefree restaurants laws and the effective dates of the laws. We define a municipality as covered by a restaurant smoking ban since the time a local ordinance or a state law takes effect, whichever is earlier.

In order to merge the ANRF state- or municipality-level data on smoking bans to the NCS individual-level data, we create a Designated Marketing Areas (DMA)-specific restaurant smoking ban coverage variable. The NCS identifies the state of residence for all respondents but provides partial information on respondents' locality of residence by DMAs. A DMA is typically identified by its largest city, and includes any surrounding counties where that city's television broadcasts are most popular. These counties can be within one state or across state boundaries. The NCS has identifiers for each of the 12 most populous DMAs and ranking groups for the rest of the DMAs (for example, belong to the 20^{th}-30^{th} group). Mainly by information on the DMA ranking and state identifiers we can further identify respondents who live in 44 smaller DMAs.

The DMA-specific ban coverage variable is defined as the proportion of the DMA's population that is covered by a municipality- or state-level restaurant smoking ban by the end of the year: $Ban_{dst} = \frac{Population\ subject\ to\ a\ smoking\ ban_{dst}}{Total\ population_{ds}}$. For each DMA we identify the included municipalities, match them to the information on restaurant smoking bans from the ANRF database, and calculate the percentage of the population covered by a restaurant smoking ban within the DMA. We merge the ban coverage variable to the NCS data by state, DMA and year. The variable reflects an assumption about how likely it is that an individual who lives in a given DMA faces a smoking ban in the restaurants he or she visits. In most cases, where a respondent is from a state with no ban at all or with a state-wide ban in the year, construction of our measure of smoking bans is straight-forward and requires minimal assumptions. More than 91% of our sample are assigned either a 0 or a 1 for the smoking ban measure. About 12% of respondents in our sample live in unidentified DMAs where we can not assign our restaurant ban coverage measure. In our NCS analysis sample, the smoking ban coverage is nearly 22% across waves.

From the DMA specific ban coverage measure we calculate the state-level average restaurant smoking ban coverage variable for 2002 and merge it to households in the 2002 CES by state identifiers (The public use CES data identifies state of residence for all households). In the 2002 CES sample 13% households are subject to a restaurant smoking ban.

Compared to some previous approaches to measuring restaurant smoking bans, the smoking ban coverage variables to be created have several advantages. The first is that it captures the recent policy trend towards 100% bans. The second advantage of the coverage measure is that it takes into account municipal bans. Many consumers who are not subject to a state ban may be subject to a municipal ban. The third advantage of our measure is it shows much greater variation over our sample period than a simple state-level index. The econometric study of Tauras (2006) uses a state-level measure of smoking bans from ImpacTeen; the CDC STATE system provides a similar measure for more recent years. This approach measures the ban as a binary indicator of whether there is a state law that imposes any smoking restrictions in restaurants. The fraction of the NCS sample subject to any state-level smoking ban, regardless of strictness, stays roughly constant at about 64%. In contrast, the fraction of the NCS sample subject to either a state-level or municipal 100% ban increases from about 16% in 2000 to 38% in 2004.

Empirical Approach

Empirical Models

Based on the standard model of consumer demand (Deaton and Muellbaur 1980) and models of demand for cigarettes (Becker and Murphy 1988, Grossman 2000, Kenkel 2000, Gruber and Koscegi 2001, and DeCicca, Kenkel and Mathios forthcoming), we estimate standard reduced-form demand functions for restaurant visits and smoking. Equations (1) and (2) show the demand for restaurant visits R_{is} and smoking S_{is} by individual i in locality s as a function of the presence of a restaurant smoking ban in locality s, a vector of other locality-specific variables Z_s , and a vector of individual characteristics X_i.

(1) $R_{is} = \beta_0 + \beta_1 (\text{Rest. ban}_s) + \beta_2 Z_s + \beta_3 X_{is} + \beta_4(\text{Wave effects}) + \varepsilon_{is}$

(2) $S_{is} = \alpha_0 + \alpha_1 (\text{Rest. ban}_s) + \alpha_2 Z_s + \alpha_3 X_{is} + \alpha_4(\text{Wave effects}) + \eta_{is}$

The estimates of β_1 and α_1 provide the key estimates of the "treatment effects" of a restaurant smoking ban on restaurant-going and smoking behaviors. The treatment effects of a restaurant smoking ban are analogous to a cross-price effect on the demand for restaurant-going in equation (1) and an own-price effect on the demand for smoking in equation (2). We estimate equation (1) separately for nonsmokers and smokers. It allows for heterogeneity in tastes between nonsmokers and smokers, which allows us to test the straight-forward hypothesis that the impact of a restaurant smoking ban on the demand for restaurant-going will be different for nonsmokers and smokers. For nonsmokers it might be that $\beta_1 > 0$, because a smoking ban is a positive attribute that makes visiting restaurants more attractive. For smokers it might be that $\beta_1 < 0$ because not being allowed to smoke makes visiting restaurants less attractive. In equation (2), α_1 might be < 0 because prohibiting smoking in restaurants makes smoking less attractive overall.

Our econometric approach uses within-wave variation in restaurant smoking ban coverage across locality (states and DMAs within state) to identify the effect of restaurant smoking ban on the outcomes of interest. It is possible that the within-wave variation in restaurant ban coverage is endogenous. Localities that enact restaurant bans might be systematically different from those that do not. In the empirical model, unobserved differences are captured by the error terms ε and η in equations (1) and (2). If these differences are correlated with the ban coverage variable, the models will yield biased estimates of the bans' impacts. We take two approaches to deal with the possible policy endogeneity issue.

The first approach is to include a direct measure of state anti-smoking sentiment. The state anti-smoking sentiment is based on responses about attitudes towards smoking, including attitudes about restaurant smoking bans, reported in cycles of the Tobacco Use Supplements to the CPS (DeCicca et al. forthcoming). DeCicca et al. (forthcoming) and Carpenter and Cook (2007) find that the measure of state anti-smoking sentiment is a useful explanatory variable in econometric models of individual smoking behavior. We use the state anti-smoking sentiment measure as a proxy for state-level attitudes about restaurant smoking bans that is likely to be correlated with the enactment of bans. An auxiliary regression of the ban coverage measure on the sentiment measure with other controls shows that the anti-smoking sentiment variable is a strong predictor of the smoking ban ($F(1, 44) = 17.02$, Prob > F = 0.0002). We may not expect anti-smoking sentiment to influence visits to restaurants. However, it may not be true for family restaurant visits. Estimates of Equation (1) without the smoking ban coverage variable for the whole sample show that the anti-smoking sentiment variable is not associated with visits to fast-food restaurants but it is strongly associated with the family restaurant visits (coefficient = -1.47, se = .286, p<.000).

The state-level anti-smoking sentiment variable does not address systematic differences at the local level. Nearly 200 municipal restaurant smoking bans are in place by the end of our study period. In the second approach to control for locality-level differences that may cause bias in our models we focus on a subset of within-wave variation in bans coverage that is more likely to provide "cleaner" quasi-experiments (i.e. more exogenous, or more likely to be uncorrelated with the error terms ε and η in equations 1 and 2). We use the ban coverage variation among DMAs that never had a ban by the end of our study period and DMAs that did not had a ban until a state-wide restaurant smoking ban was imposed. In other words, we exclude DMAs that include municipalities which ever enacted a local restaurant smoking ban. Because the within-wave variation we rely on arises only when a state-level ban is implemented, it does not reflect local ban politics and therefore, this variation is less likely to be a source of bias.

In the states of CT, DE, FL, ID, ME, and UT there were no municipal bans prior to the state-level bans, so all of the within-wave variation across states stems from state-imposed bans in these states. During our study period, there were smoking bans in some municipalities in New York, but none of them was within the Buffalo DMA. We add the Buffalo DMA as part of our treatment group in this approach. By the end of our study period, 30 states have no local or state restaurant smoking ban across state. They constitute the majority of the control group. Also included in the control group are four DMAs from MD, TX, and WV. These three states have local smoking bans but none of them is in the four DMAs. Because most of the variation in ban coverage in this approach is actually at the state level, as in the previous approach we include state anti-smoking sentiment to control for state-level characteristics that may bias our estimation.

To shed light on possible bias in our estimates, we compare the estimated impact of a mix of locally and state enacted bans from the first approach to state-imposed bans in the second approach. In all analysis we adopt multiple methods to develop robust and reliable estimates of the key parameters of interest.

This study uses the variation in ban coverage across DMAs or states within wave but not within DMA or state across waves as in a difference-in-difference approach. We choose not to take the DD approach due to a major concern that there may not be enough variation in ban coverage required by the DD method. The DD method would rely on variation in ban coverage within locality across waves. This source of variation in our study period is mainly driven by bans passed in 7 states (CT, DE, FL, ID, MA, ME, and NY) within a period of less than 2 years. All the seven states passed state-wide bans but only MA and NY had local bans prior to the state-level bans. Some of the local bans in MA started prior to our study period but all the local bans in NY began from 2003. And all the state bans in the 7 states were implemented from November 2002 to July 2004. Thus, lack of variation in ban coverage within state or DMA over time can be a serious problem if we chose to implement the DD approach. Low identifying variation may not provide adequate statistical power to detect meaningful treatment effects. As a multicollinearity diagnostic, we run two auxiliary regressions of the ban coverage variable, one on wave dummies only and one on state dummies only. The R-squared of the regression is .53 on wave dummies but it went up to .80 with state dummies, suggesting that the state fixed effects explains 80 percent of the variation in the ban coverage variable.

Econometric Estimation

We use the NCS data to estimate multiple versions of equation (1), corresponding to two versions of the dependent variable that measures the demand for restaurant-going. In the first version of equation (1), we estimate demand functions for restaurant visits. In these functions, R_{is} is measured as the total number of visits to restaurants within the past 30 days. We use OLS for demand functions for restaurant visits as the measures of total visits are the sums of visits to specific restaurants and approximately continuous. In the second version of equation (1), we use a measure of time spent eating out at restaurants. We use Tobit models to take into account the large fraction of the sample that did not eat out on the surveyed day. In the tobit models we add a dummy variable for a weekend day versus a weekday. We use the CES data to estimate additional versions of equation (1). In the CES models R_{is} are measured as household expenditures on food away from home at full service and limited service restaurants over a 1-week period. As a nontrivial fraction of the sample has zero expenditures, we estimate a tobit model of expenditures on food away from home. In both NCS and CES data we estimate separate equations for family versus fast food restaurants, and further for each type of restaurants, we estimate separate equations for non-smokers versus smokers.

We use the NCS data to estimate several versions of equation (2), corresponding to different dependent variables related to the demand for smoking. For the same sample of current smokers, we estimate a model where the dependent variable is a binary indicator of a smoking cessation attempt in the past year. Over the sample of past-year smokers, we estimate a model where the dependent variable is a binary indicator of successful smoking cessation within the past year. The models of cessation attempt and successful cessation are estimated by maximum likelihood probit. For current smokers, we also use OLS to estimate a model of the number of cigarettes smoked per day. The large body of research on worksite smoking bans suggests that these dependent variables capture the important margins on which smokers adjust to bans -- smoking cessation and reduced consumption.

We use the CES data to estimate a two-part model of cigarette demand (equation 2). The two part model is standard in health economics studies of cigarette demand (Chaloupka and Warner 2000). The dependent variable for the first part is a binary indicator of whether the household had positive expenditures for smoking-related items. The first part of the model is estimated by maximum likelihood probit. For the second part of the model, the sample is restricted to smoking households. The dependent variable in the second part is household expenditures on smoking-related items, estimated by OLS. DeCicca, Kenkel and Mathios (forthcoming) show that the standard two-part model is mis-specified because it neglects addiction. They show that a more appropriate approach is to focus on separate models of smoking initiation and cessation. This study is able to model smoking cessation using the NCS data, but we can not take that approach with the CES data. As a result, the first part of the proposed models estimated with the CES data may not be that informative about the impact of smoking bans and other policies on smoking behavior. The second part of the model captures the bans' potential impact on reducing cigarette consumption.

Individual respondents in the NCS and CES data are clustered within states and localities, and our models include variables measured at the individual- or household-, state-, and locality levels. We use Stata's cluster command to obtain robust standard errors that account for potential clustering at the state level (Due to unknown DMAs we will lose nearly one-third of the sample if we adjust clustering at the DMA level). The clustering methods address the issues raised by Bertrand, Duflo, and Mullanaithan (2006).

Results

Overall our results show that restaurant smoking bans have insignificant effect on most outcomes of interest.

Effects of restaurant smoking bans on restaurant-going behaviors

For measures of total visits to family restaurants and fast food restaurants in the past 30 days, our results show statistically insignificant coefficients among both smokers and non-smokers (Table 3). The result of insignificant impact remains from the second analysis approach, where we restrict the sample to respondents subject to a state-wide ban only or no ban at all during the study period. The state anti-smoking sentiment variable is not or negatively but weakly ($p<.1$) associated with restaurant visits. Other person- and household-level control variables show patterns across socio-economic groups consistent with previous research on demand for food-away-from home. For example, younger age and the presence of children increase the demand for fast food restaurants, while being female, lower income, and the number of children decrease total visits to family restaurants.

The tobit estimates of time spent eating at restaurants in one day are basically consistent with the results for total restaurant visits (Table 4). Although restaurant smoking bans seem to increase time spent at restaurants among smokers (0.5 hour, $P<.05$) in the full sample, the statistical significance disappears when we estimate the impact of state imposed bans in the restricted sample. Among non-smokers the estimated effects of smoking bans are not different from zero by either approach. Consistent and highly significant results are found across all estimates for the weekend indicator. On Saturday or Sunday people spend longer time (.75-.83 hour) eating at restaurants than on a weekday.

Tobit estimates on food expenditures at restaurants indicate that a restaurant smoking ban increases nonsmokers' expenditure at fast food restaurants by $0.3 per capita per week (Table 5). It has no statistically significant effect on nonsmokers' expenditures at full service restaurants or on smokers' expenditures at fast food or full service restaurants. Results on other control variables are consistent with the literature. For example, higher income is strongly associated with higher expenditures at full service and fast food restaurants.

Effects of restaurant smoking bans on smoking behaviors

All the NCS results show insignificant effect of smoking bans on daily smoking amount, smoking cessation attempts, or successful quits (Table 6). Results from a 2-part model using CES data suggest that a restaurant smoking ban reduces smoking-related expenditures by $.3 ($p<.1$) per capita per week among household that had any smoking-related purchase (Table 7). In all the estimates on smoking behavior the state anti-smoking sentiment measure is in the expected direction and show strong negative association with smoking behaviors in most cases.

Discussions & Limitations

Each of the surveys used – the NCS and the CES – provides partially incomplete data on restaurant-going and smoking behaviors. The NCS measures consumer behaviors but not expenditures. As a result, the models estimated with the NCS data on restaurant visits may miss some margins on which consumers respond to restaurant bans. For example, in addition to going to restaurants as frequently as before, smokers may spend less at restaurants because they want to spend less time at restaurants. We will capture this margin in the NCS data on time spent eating out and in the CES data on expenditures. The CES provides measures of expenditures, but does not provide measures of the number of restaurant visits. The CES is also at the level of the household instead of the individual. While neither data is perfect, the gaps in the NCS are filled in the CES and vice versa. The analysis of these two complementary data sets will provide a fairly complete picture of the impacts of restaurant smoking bans on consumer behavior.

Because this study uses data from cross-sectional surveys of individuals, we will be limited in our ability to examine the dynamics of the impact of restaurant smoking bans on restaurant-going and smoking. The longer-run impacts of the bans may be larger than, or even qualitatively different than, the short-run impacts. For example, Falba et al. (2003) find that smokers who reduce the number of cigarettes they smoke per day are more likely to subsequently quit. One possible pattern of short- and longer-run impacts is: in the short-run, smokers change little in their smoking or restaurant-going behaviors; in the longer-run, they cut back on smoking or even quit smoking and keep their restaurant-going behavior as pre-ban levels. Due to data limitations we are not be able to examine the bans' longer-run potential impacts on smoking initiation. We are also not able to examine the hypothesis suggested by Jacobson and Wasserman (1999) that the bans change social norms about smoking. However, we believe that the current study will make important and innovative contributions by examining the short-run impacts of restaurant smoking bans.

The current study lacks data on the extent to which restaurant smoking bans are enforced. As noted above, this study improves upon earlier econometric studies because it will be able to distinguish statutory 100% bans from bans that less strict by statute. But we do not have data on how well the 100% bans are enforced. It is not clear how much enforcement varies. Pollack and Jacobson (2003, p.130) notes that "existing studies suggest widespread implementation of clean indoor air regulations despite the practical lack of enforcement resources." Jacobson and Wasserman (1999) find that although "clean indoor air laws were rarely enforced by governmental agencies….these laws were largely self-enforcing in that changed social norms regarding appropriate smoking behavior led to generally high compliance rates." Although this suggests there may be little variation in practical enforcement, the self-enforcing nature of restaurant smoking bans may be less evident in the short run than in the longer-run. A related issue is that, according to anecdotal reports, in response to bans some restaurants provide outdoor heaters to accommodate their smoking patrons (Zawel 2007). Again, we lack data on this behavior. The bottom line is that this study yields estimates of the impacts of smoking bans in the enforcement context actually observed. It does not address whether the bans' impacts would be different if they were optimally enforced, or if outdoor heaters were also banned.

The current study does not estimate a fully structural model that is tightly linked to economic theory. In the reduced-form demand functions we estimate, the effects of a restaurant smoking ban are analogous to a cross-price effect on the demand for restaurant-going and an own-price effect on the demand for smoking. Without additional structure, consumer theory provides relatively little guidance about cross-price effects. We estimate the restaurant demand functions separately for nonsmokers and smokers, using informal guidance from theory that it will be important to allow for heterogeneity in tastes when estimating the impact of a smoking ban. Our work in progress includes an empirical model of consumer demand for four goods: food consumed in restaurants that allow smoking; food consumed in smoke-free restaurants; cigarettes consumed in restaurants; and cigarettes consumed elsewhere. The model allows for common corner solutions where many consumers choose to not smoke and/or to not visit restaurants. Smoking bans are modeled as a change in constraints or consumer rationing (Neary and Roberts 1980). Before a ban is imposed, the market equilibrium that allows smoking in all restaurants constrains or rations consumers to a zero quantity of food consumed in smoke-free restaurants. Smoking bans constrain or ration consumers to a zero quantity of food consumed in restaurants that allow smoking and a zero quantity of cigarettes consumed in restaurants

Based on our current data and econometric specification we seem to lack good statistical power to detect smaller effect sizes. We calculate statistical power applying an approach used by Adams and Hotz (2000) to our preliminary results on restaurant visits. For any given effect size, power = $\Phi(\beta/\sigma - Z)$ where Φ is the standard normal cumulative distribution function, β is the effect size, σ is the estimated standard error from our preliminary regressions reported above, and Z is the critical value from the normal distribution for a two-sided test at the 5% level. From our preliminary study we use a robust standard error σ that accounts for clustering at the state level (Table 3 left panel). Figures 1-4 show the power over a plausible range of effect sizes. The effect sizes range from 0 to about 25% of the average number of restaurant visits in the sample for smokers and non-smokers. Based on previous research, the impact of a restaurant smoking ban might be as small as 10%, corresponding to about 0.4 family restaurant visits and 1.4-1.6 fast food restaurant visits. In our preliminary models, we have less than 20% power to detect ban effects of this magnitude. We have relatively higher power (60-80%) to detect ban effects as large as 25% (i.e., 0.9 family restaurant visits or 3.5-4 fast food restaurant visits). Effects of these magnitudes are practically more important for policymaking.

In order to obtain adequate statistical power, we will expand the time period and use data from NCS waves conducted from 1996 – 2007 (We are in the process of purchasing the NCS data from 2005 – 2007). This will increase our power for two reasons. First, the sample size will more than double, from about 75,000 observations to about 200,000 observations. Second, we will be able to exploit additional within-state and within-DMA variation in restaurant smoking bans. Table 4 summarizes trends in municipal restaurant smoking bans. The preliminary pilot study used data from a period when smoking bans expanded from covering about 13% of the national population to covering about 32% of the national population. (In the NCS sample, coverage expanded from about 16% to 35%). Adding data from the years after 2004 will provide substantial additional variation, as smoking bans expand from 32% to 61% coverage. Put differently, we will add data from a period over which an additional 200 municipalities enacted smoking bans. Although the NCS data do not cover all municipalities in the U.S., the relative increase in variation in our ban measure from adding the additional waves should be comparable to national trends.

Another way to improve power is to use the appropriate econometric specification. Modeling the distribution of the LHS variable correctly improve precision by as much as a substantial increase in sample size (Manning and Mullahy, JHE 2001). As an illustration, we seem to get a lot more power if we use logged visits. The restaurant visit variables have non-trivial number of zeros, and are skewed to the right. With the log transformation of the visit variables we have nearly 100% power to detect ban effects on fast food restaurant visits as small as 12.5% (i.e., 2 fast food restaurant visits). For family restaurant visits, with the log transformation we have high (90+% for smokers and nonsmokers) power when the ban effects are 35% of the sample mean (i.e., 1.3 visits). We will keep searching for the correct model that suits the distribution of our dependent variables.

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Figure 1: Power to detect effect on family restaurant visits for smokers and non-smokers

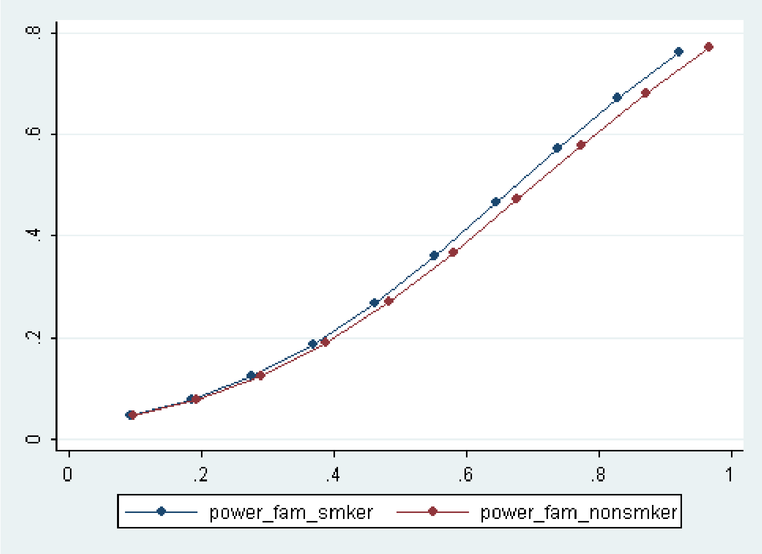

Figure 2: Power to detect effect on fast food visits for smokers and non-smokers

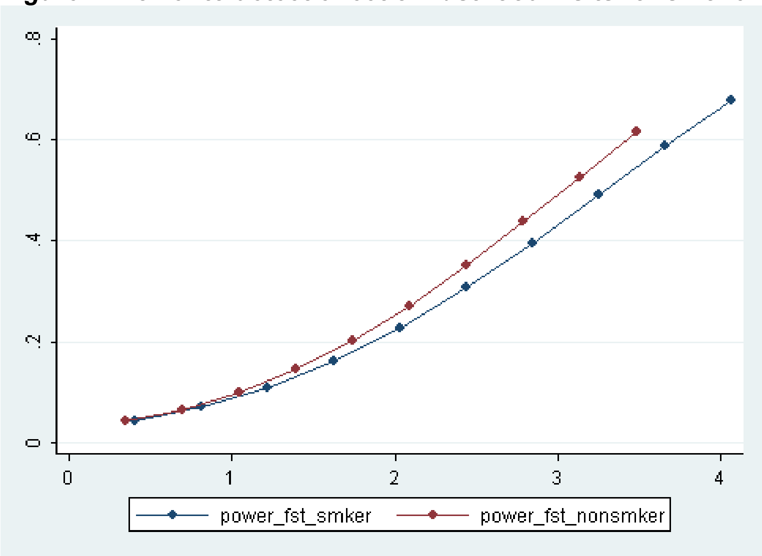

Figure 3: Power to detect effect on family restaurant visits (logged) for smokers and non-smokers

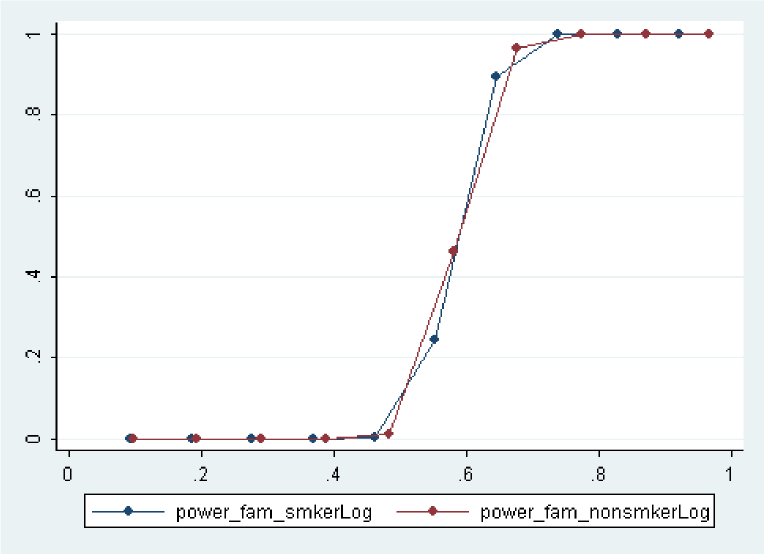

Figure 4: Power to detect effect on fast food restaurant visits (logged) for smokers and non-smokers

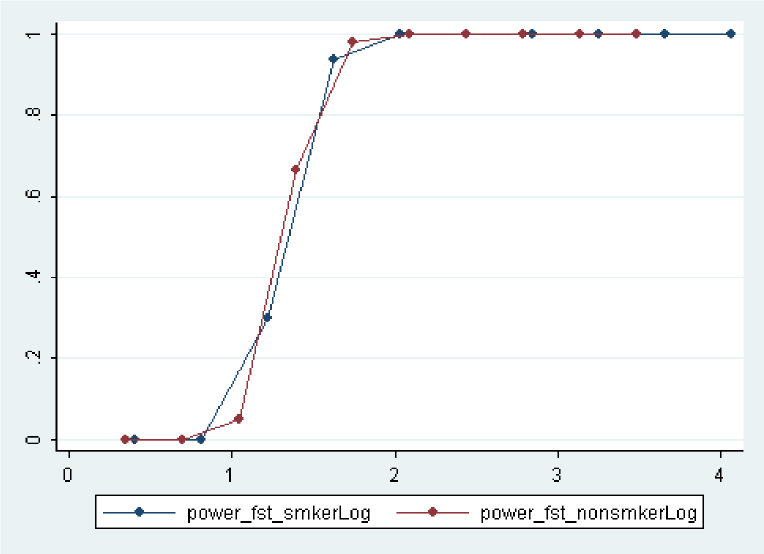

Table 1: Trend in 100% Smokefree Restaurant Laws*

Year	# of Municipal Laws**	# of Statewide Laws	% U.S. Population Protected
1990	1	0	0.02%
1991	2	0	0.17%
1992	3	0	0.19%
1993	9	0	0.63%
1994	22	0	1.00%
1995	29	2	12.93%
1997	31	2	12.94%
1998	37	2	12.97%
1999	48	2	13.03%
2000	60	2	13.16%
2001	83	2	13.29%
2002	108	3	13.99%
2003	151	6	29.26%
2004	193	9	32.20%
2005	245	13	36.60%
2006	326	18	47.54%
2007	402	23	59.18%
2008 (Jan. 2nd)	409	24	61.24%

*Includes any attached bar in the restaurant.
**Do not include municipal laws enacted after a statewide law took effect.
Source: American Nonsmokers' Rights Foundation (www.no-smoke.org)

Table 2A. Summary statistics of key variables in the NCS sample

Variables	Mean	Std.	Min	Max
Dependent variables				
Visits to fast food restaurants	14.145	13.267	0	78
Visits to family restaurants	3.832	3.910	0	21
Time spent eating out (n=6585)	1.500	0.759	1	8
Quit attempt (n=19672)	0.446	0.497	0	1
Successful quit(n=19672)	0.100	0.301	0	1
Amount smoked(n=17779)	16.742	10.306	2.5	40
Independent variables				
Ban coverage	0.219	0.408	0	1
smoking	0.197	0.397	0	1
Anti-smoking sentiment	0.252	0.198	-0.166	0.715
Weekend (n=48592)	0.218	0.413	0	1
age18_24	0.094	0.291	0	1
age25_34	0.152	0.359	0	1
age35_44	0.214	0.410	0	1
age45_54	0.212	0.408	0	1
age55_64	0.152	0.360	0	1
female	0.551	0.497	0	1
black	0.065	0.247	0	1
hisp	0.133	0.339	0	1
rlesshs	0.117	0.321	0	1
rhighsch	0.286	0.452	0	1
rsomecol	0.283	0.450	0	1
divor_seper	0.099	0.299	0	1
widow	0.058	0.234	0	1
single	0.178	0.382	0	1
nchild	0.794	1.193	0	9
nadm	1.150	0.678	0	6
nadf	1.174	0.631	0	6
inc_quin1	0.164	0.370	0	1
inc_quin2	0.178	0.383	0	1
inc_quin3	0.212	0.409	0	1
inc_quin4	0.170	0.376	0	1
gmmcare	0.065	0.246	0	1
nocare	0.246	0.431	0	1
emp_part	0.130	0.337	0	1
emp_retired	0.172	0.377	0	1
emp_unempl~d	0.038	0.192	0	1
emp_disabled	0.031	0.173	0	1
emp_student	0.015	0.123	0	1
emp_homema~r	0.082	0.274	0	1
_Wave23	0.130	0.336	0	1
_Wave25	0.079	0.270	0	1
_Wave27	0.098	0.297	0	1
_Wave29	0.077	0.266	0	1
_Wave31	0.091	0.288	0	1
_Wave33	0.084	0.277	0	1
_Wave35	0.081	0.273	0	1
_Wave37	0.111	0.314	0	1
_Wave39	0.114	0.318	0	1
Sample size = 95385				

Source: 2000-2004 NCS. Weekend and time spent eating out are available for waves 25-35.

Table 2B. Summary statistics of key variables in the CES sample

Variables	Mean	Std.	Min	Max
Dependent variables				
Expenditures at Fast food restaurants per capita/10 (n=7921)	0.126	0.157	0.0006	5.85
Expenditures at Family restaurants per capita/10 (n=5163)	0.241	0.322	0.0008	7.19
Expenditures on smoking goods>0	0.189	0.392	0	1
Expenditures on smoking goods per adult/10 (n=2417)	1.443	1.619	0.0265	25.378
Independent variables				
Ban coverage	0.128	0.329	0	1
Anti-smoking sentiment	0.254	0.173	-0.091	0.615
age_foodmanager	4.777	1.729	1.4	8.5
emp_retired	0.186	0.389	0	1
emp_home	0.107	0.309	0	1
emp_school	0.015	0.123	0	1
emp_ill	0.049	0.216	0	1
emp_unemply	0.005	0.073	0	1
emp_other	0.003	0.057	0	1
fmlesshs	0.129	0.335	0	1
fmhighsch	0.303	0.459	0	1
fmsomecol	0.285	0.451	0	1
famsize	0.259	0.150	0.1	1.4
nchild	0.702	1.116	0	9
income_capita	0.337	0.446	-1.167	6.680
black	0.118	0.323	0	1
other	0.047	0.211	0	1
single	0.264	0.441	0	1
adults_nochd	0.216	0.411	0	1
single_parent	0.061	0.239	0	1
Other family type	0.140	0.347	0	1
month2	0.078	0.268	0	1
month3	0.090	0.286	0	1
month4	0.087	0.282	0	1
month5	0.086	0.280	0	1
month6	0.080	0.272	0	1
month7	0.080	0.271	0	1
month8	0.084	0.277	0	1
month9	0.086	0.280	0	1
month10	0.085	0.279	0	1
month11	0.076	0.265	0	1
month12	0.082	0.275	0	1
Sample size = 12760				

Source: 2002 CES.

Table 3. OLS estimates of the effects of smoking bans on restaurants visits in past 30 days

	Local or state bans				Imposed state bans only		
	Smokers		Non-smokers		Smokers		Non-s
	Fast food	Family	Fast food	Family	Fast food	Family	Fast food
Ban coverage	1.072	-0.109	0.168	-0.134	-0.061	0.006	0.519
	(1.680)	(0.344)	(1.546)	(0.358)	(1.303)	(0.258)	(1.472)
Anti-smoking sentiment	-3.776	-1.261*	-4.263	-1.394*	-7.741*	-1.583*	-7.056*
	(3.163)	(0.654)	(3.002)	(0.696)	(4.064)	(0.867)	(3.935)
age18_24	10.927***	0.779***	9.144***	0.250**	11.152***	0.716***	8.915***
	(0.801)	(0.185)	(0.300)	(0.116)	(0.917)	(0.256)	(0.380)
age25_34	8.608***	0.286**	6.282***	-0.221**	9.044***	0.271	6.158***
	(0.704)	(0.119)	(0.287)	(0.106)	(0.821)	(0.161)	(0.360)
age35_44	6.683***	-0.003	5.443***	-0.397***	6.855***	0.049	5.361***
	(0.577)	(0.131)	(0.344)	(0.090)	(0.697)	(0.156)	(0.415)
age45_54	4.549***	0.058	4.007***	-0.164***	4.612***	0.162	3.922***
	(0.493)	(0.137)	(0.247)	(0.056)	(0.617)	(0.162)	(0.251)
age55_64	2.608***	0.295*	1.968***	-0.037	2.842***	0.454***	1.879***
	(0.537)	(0.172)	(0.259)	(0.048)	(0.427)	(0.146)	(0.264)
female	-0.026	0.355***	-0.658***	0.079***	0.011	0.352***	-0.699***
	(0.209)	(0.045)	(0.096)	(0.024)	(0.208)	(0.057)	(0.130)
black	3.428***	0.159*	2.383***	-0.050	3.575***	0.135	2.118***
	(0.384)	(0.083)	(0.279)	(0.087)	(0.413)	(0.100)	(0.319)
hisp	0.735	0.584***	0.191	0.127	0.647	0.562***	-0.060
	(0.621)	(0.163)	(0.433)	(0.149)	(1.023)	(0.202)	(0.714)
rlesshs	2.844***	-0.078	1.804***	-0.045	2.213***	-0.166	1.556***
	(0.417)	(0.096)	(0.262)	(0.100)	(0.485)	(0.122)	(0.256)
rhighsch	2.451***	0.184**	1.899***	0.347***	2.066***	0.178	1.696***
	(0.344)	(0.091)	(0.235)	(0.084)	(0.309)	(0.114)	(0.297)
rsomecol	2.454***	0.470***	2.083***	0.593***	2.331***	0.503***	1.873***
	(0.416)	(0.081)	(0.131)	(0.051)	(0.370)	(0.116)	(0.170)
divor_seper	1.285***	0.250***	0.907***	-0.028	1.189***	0.266**	0.859***
	(0.290)	(0.087)	(0.189)	(0.050)	(0.366)	(0.110)	(0.251)
widow	0.247	0.026	-0.212	-0.384***	0.229	0.009	-0.152
	(0.465)	(0.155)	(0.222)	(0.063)	(0.582)	(0.147)	(0.294)
single	1.535***	0.115	0.288*	-0.038	1.398***	0.188*	0.402
	(0.387)	(0.073)	(0.169)	(0.047)	(0.416)	(0.097)	(0.268)
nchild	0.587***	-0.087***	0.675***	-0.118***	0.572***	-0.093***	0.714***
	(0.176)	(0.029)	(0.067)	(0.019)	(0.185)	(0.032)	(0.077)
nadm	0.074	-0.117**	-0.122	-0.175***	0.122	-0.103	-0.002
	(0.254)	(0.055)	(0.119)	(0.033)	(0.365)	(0.072)	(0.149)
nadf	0.366*	0.009	0.181*	-0.015	0.611**	0.020	0.344**
	(0.185)	(0.046)	(0.100)	(0.030)	(0.264)	(0.074)	(0.129)
inc_quin1	-0.937**	-1.067***	-0.126	-0.759***	-0.896	-1.080***	0.007
	(0.442)	(0.115)	(0.289)	(0.086)	(0.555)	(0.154)	(0.349)
inc_quin2	-0.283	-0.712***	0.453**	-0.440***	-0.815	-0.769***	0.496
	(0.457)	(0.079)	(0.204)	(0.069)	(0.500)	(0.102)	(0.295)
inc_quin3	0.160	-0.385***	0.188	-0.191***	0.030	-0.385***	0.270
	(0.424)	(0.099)	(0.179)	(0.055)	(0.506)	(0.119)	(0.248)
inc_quin4	0.045	-0.304***	0.372**	-0.086*	-0.020	-0.235*	0.409*
	(0.226)	(0.098)	(0.166)	(0.044)	(0.291)	(0.118)	(0.233)
gmmcare	0.677	-0.002	-0.304	-0.309***	0.637	-0.102	-0.581**
	(0.429)	(0.129)	(0.320)	(0.065)	(0.428)	(0.159)	(0.272)
nocare	-0.977***	-0.472***	-1.876***	-0.681***	-0.884**	-0.504***	-1.705***
	(0.293)	(0.058)	(0.132)	(0.045)	(0.356)	(0.079)	(0.174)
emp_part	-0.543**	-0.049	-0.671***	-0.051	-0.641*	0.026	-0.532***
	(0.258)	(0.084)	(0.150)	(0.053)	(0.335)	(0.116)	(0.141)

emp_retired	-1.236***	0.137	-1.315***	0.125*	-0.987**	0.259*	-1.462***
	(0.402)	(0.138)	(0.152)	(0.062)	(0.486)	(0.150)	(0.167)
emp_unemployed	-0.566	-0.276**	-0.590*	-0.259***	-1.094*	-0.115	-0.873*
	(0.438)	(0.127)	(0.331)	(0.082)	(0.559)	(0.120)	(0.434)
emp_disabled	0.296	-0.200	0.045	-0.133	-0.106	-0.204	0.005
	(0.566)	(0.159)	(0.355)	(0.109)	(0.660)	(0.211)	(0.379)
emp_student	-0.935	-0.286	-2.173***	-0.261**	-2.491*	0.036	-3.187***
	(1.194)	(0.200)	(0.525)	(0.105)	(1.314)	(0.291)	(0.475)
emp_homemaker	-0.894**	-0.076	-1.037***	-0.254***	-1.060**	-0.096	-1.320***
	(0.351)	(0.092)	(0.199)	(0.049)	(0.425)	(0.102)	(0.180)
_Wave23	-0.126	0.223**	0.261*	0.137**	-0.183	0.298**	0.238
	(0.508)	(0.107)	(0.145)	(0.053)	(0.558)	(0.117)	(0.184)
_Wave25	-1.269**	0.991***	-0.217	0.993***	-1.524**	1.083***	-0.333
	(0.622)	(0.141)	(0.299)	(0.086)	(0.681)	(0.185)	(0.418)
_Wave27	1.401**	1.088***	1.011***	1.236***	1.247*	1.072***	0.953**
	(0.541)	(0.129)	(0.230)	(0.047)	(0.677)	(0.163)	(0.365)
_Wave29	0.382	0.575***	0.165	0.604***	0.582	0.756***	0.129
	(0.521)	(0.139)	(0.311)	(0.080)	(0.588)	(0.157)	(0.387)
_Wave31	0.418	0.445***	1.164***	0.843***	0.589	0.628***	1.144***
	(0.490)	(0.133)	(0.374)	(0.082)	(0.639)	(0.160)	(0.389)
_Wave33	0.804	0.489***	0.256	0.517***	0.923	0.646***	0.439
	(0.618)	(0.149)	(0.385)	(0.117)	(0.798)	(0.186)	(0.462)
_Wave35	0.091	0.695***	0.556*	0.921***	0.802	0.746***	0.797*
	(0.511)	(0.119)	(0.305)	(0.075)	(0.732)	(0.191)	(0.426)
_Wave37	-0.890	0.448***	-0.223	0.654***	0.157	0.564***	0.339
	(0.568)	(0.129)	(0.414)	(0.101)	(0.728)	(0.199)	(0.493)
_Wave39	-0.809	0.360***	-0.369	0.602***	0.282	0.381**	-0.047
	(0.591)	(0.110)	(0.358)	(0.084)	(0.846)	(0.162)	(0.496)
Constant	7.894***	3.678***	9.639***	4.259***	8.266***	3.546***	10.044***
	(0.777)	(0.175)	(0.538)	(0.220)	(0.907)	(0.211)	(0.540)
Observations	18673	18753	76671	76632	13333	13361	51358
R-squared	0.08	0.03	0.08	0.04	0.09	0.04	0.08

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4. Tobit estimates of the effects of smoking bans on time spent eating at restaurants in one day

	Local or state bans		Imposed state bans only	
	Smokers	Non-smokers	Smokers	Non-smokers
Ban coverage	0.472**	0.052	0.424	-0.128
	(0.198)	(0.199)	(0.580)	(0.160)
weekend	0.832***	0.769***	0.774***	0.748***
	(0.113)	(0.035)	(0.121)	(0.038)
Anti-smoking sentiment	-1.119***	-0.158	-1.343***	-0.114
	(0.324)	(0.367)	(0.471)	(0.367)
age18_24	0.442*	0.102	0.445	-0.028
	(0.231)	(0.111)	(0.284)	(0.142)
age25_34	0.295	0.037	0.263	-0.023
	(0.188)	(0.073)	(0.259)	(0.085)
age35_44	0.190	-0.080	0.014	-0.156**
	(0.179)	(0.070)	(0.196)	(0.078)
age45_54	0.197	-0.012	0.100	-0.035
	(0.157)	(0.067)	(0.181)	(0.076)
age55_64	0.427**	0.056	0.413**	0.019
	(0.194)	(0.060)	(0.206)	(0.071)
female	0.075	0.011	0.118	0.040
	(0.102)	(0.053)	(0.127)	(0.067)
black	-0.838***	-1.074***	-0.898***	-0.971***
	(0.176)	(0.080)	(0.240)	(0.093)
hisp	-0.021	-0.119	0.259	-0.234*
	(0.204)	(0.094)	(0.158)	(0.135)
rlesshs	-1.439***	-0.749***	-1.531***	-0.760***
	(0.178)	(0.092)	(0.226)	(0.113)
rhighsch	-0.740***	-0.439***	-0.732***	-0.404***
	(0.138)	(0.050)	(0.172)	(0.057)
rsomecol	-0.463***	-0.223***	-0.486***	-0.252***
	(0.117)	(0.042)	(0.143)	(0.052)
divor_seper	0.009	0.055	-0.021	0.133*
	(0.135)	(0.067)	(0.175)	(0.078)
widow	0.101	-0.134*	0.160	-0.112
	(0.199)	(0.072)	(0.233)	(0.101)
single	0.253	0.138*	0.203	0.167**
	(0.193)	(0.071)	(0.248)	(0.071)
nchild	-0.091*	-0.108***	-0.066	-0.095***
	(0.052)	(0.021)	(0.063)	(0.026)
nadm	-0.331***	-0.209***	-0.324***	-0.141**
	(0.074)	(0.054)	(0.093)	(0.065)
nadf	-0.342***	-0.178***	-0.386***	-0.162***
	(0.091)	(0.037)	(0.127)	(0.056)
inc_quin1	-0.746***	-0.688***	-0.789***	-0.689***
	(0.179)	(0.097)	(0.202)	(0.118)
inc_quin2	-0.565***	-0.385***	-0.656***	-0.345***
	(0.114)	(0.081)	(0.111)	(0.072)
inc_quin3	-0.452***	-0.234***	-0.443**	-0.214***
	(0.148)	(0.067)	(0.178)	(0.072)
inc_quin4	-0.306**	-0.185***	-0.290*	-0.227***
	(0.137)	(0.046)	(0.160)	(0.067)
gmmcare	0.468**	-0.210**	0.003	-0.190*
	(0.232)	(0.087)	(0.241)	(0.105)
nocare	-0.306**	-0.657***	-0.356**	-0.629***
	(0.155)	(0.056)	(0.173)	(0.073)

emp_part	0.183	0.148**	0.244	0.154**
	(0.141)	(0.062)	(0.163)	(0.067)
emp_retired	0.090	0.230**	0.183	0.323***
	(0.158)	(0.101)	(0.198)	(0.090)
emp_unemployed	0.022	0.127	0.022	0.100
	(0.213)	(0.091)	(0.281)	(0.120)
emp_disabled	-0.291	-0.137	-0.250	0.050
	(0.200)	(0.167)	(0.284)	(0.139)
emp_student	0.143	0.237	0.395	0.276
	(0.431)	(0.163)	(0.544)	(0.221)
emp_homemaker	0.295	0.049	0.473*	0.080
	(0.216)	(0.078)	(0.244)	(0.092)
Constant	-1.795***	-1.773***	-2.237***	-1.845***
	(0.281)	(0.213)	(0.315)	(0.159)
Observations	9583	39519	7032	27363

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 5. Tobit estimates of the effects of smoking bans on household expenditures# on food at restaurants

	Smokers		Non-smokers	
	Limited services	Full services	Limited services	Full services
Ban coverage	0.013	0.024	0.030***	-0.010
	(0.024)	(0.043)	(0.009)	(0.024)
Anti-smoking sentiment	-0.054	-0.015	-0.022	-0.053
	(0.042)	(0.074)	(0.017)	(0.047)
age_foodmanager	-0.020***	-0.009	-0.014***	0.005
	(0.004)	(0.007)	(0.002)	(0.004)
emp_retired	-0.040**	-0.014	-0.044***	-0.034*
	(0.019)	(0.033)	(0.007)	(0.018)
emp_home	-0.007	0.023	-0.034***	-0.044**
	(0.017)	(0.029)	(0.006)	(0.018)
emp_school	-0.092*	-0.171*	-0.050***	-0.047
	(0.048)	(0.088)	(0.015)	(0.043)
emp_ill	0.000	-0.042	-0.043***	-0.127***
	(0.019)	(0.035)	(0.010)	(0.029)
emp_unemply	0.050	0.033	-0.076***	-0.267***
	(0.052)	(0.088)	(0.028)	(0.088)
emp_other	-0.039	0.090	-0.025	0.095
	(0.078)	(0.132)	(0.033)	(0.085)
fmlesshs	-0.015	-0.193***	-0.037***	-0.220***
	(0.017)	(0.031)	(0.007)	(0.020)
fmhighsch	-0.027**	-0.087***	-0.021***	-0.129***
	(0.013)	(0.023)	(0.005)	(0.014)
fmsomecol	0.014	-0.048**	-0.005	-0.064***
	(0.013)	(0.023)	(0.005)	(0.013)
famsize	-0.058	-0.050	-0.004	-0.081
	(0.076)	(0.141)	(0.037)	(0.109)
nchild	-0.014*	-0.014	-0.012***	-0.037***
	(0.008)	(0.015)	(0.004)	(0.011)
income_capita	0.052***	0.163***	0.056***	0.193***
	(0.013)	(0.021)	(0.004)	(0.011)
black	-0.009	-0.114***	-0.008	-0.163***
	(0.015)	(0.028)	(0.006)	(0.018)
other	-0.019	-0.079*	-0.001	-0.016
	(0.025)	(0.044)	(0.009)	(0.024)
single	0.036*	0.023	0.000	-0.042
	(0.021)	(0.037)	(0.009)	(0.027)
adults_nochd	0.002	0.061**	-0.016**	0.026
	(0.017)	(0.030)	(0.007)	(0.020)
single_parent	-0.010	-0.038	-0.017*	-0.130***
	(0.023)	(0.041)	(0.010)	(0.029)
other_famtype	-0.003	-0.012	-0.012*	-0.063***
	(0.014)	(0.026)	(0.007)	(0.020)
month2	-0.028	-0.017	-0.018*	0.015
	(0.022)	(0.039)	(0.009)	(0.025)
month3	-0.032	0.012	-0.023**	0.005
	(0.021)	(0.037)	(0.009)	(0.024)
month4	-0.024	-0.023	-0.023***	-0.009
	(0.022)	(0.038)	(0.009)	(0.024)
month5	-0.023	-0.043	-0.021**	0.012
	(0.022)	(0.039)	(0.009)	(0.024)
month6	-0.004	0.035	-0.012	0.006

	(0.023)	(0.039)	(0.009)	(0.024)
month7	0.014	-0.021	-0.019**	-0.013
	(0.023)	(0.040)	(0.009)	(0.025)
month8	-0.031	-0.019	-0.010	-0.022
	(0.022)	(0.038)	(0.009)	(0.025)
month9	-0.012	0.010	-0.012	-0.005
	(0.022)	(0.038)	(0.009)	(0.024)
month10	-0.024	0.047	-0.004	0.015
	(0.022)	(0.038)	(0.009)	(0.024)
month11	0.000	-0.008	-0.020**	-0.023
	(0.022)	(0.039)	(0.009)	(0.025)
month12	-0.027	-0.013	-0.032***	-0.033
	(0.022)	(0.039)	(0.009)	(0.025)
Constant	0.199***	0.025	0.125***	-0.052
	(0.034)	(0.061)	(0.015)	(0.043)
Observations	2417	2417	10343	10343

#Per capita per week/10

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6. Estimates of the effects of smoking bans on smoking behaviors using NCS data

	Local or state bans			Imposed state bans only		
	Cigarettes/day[1]	Quit attempt[2]	Successful quit[2]	Cigarettes/day	Quit attempt	Successful qu
Ban coverage	-0.469	-0.009	-0.007	0.382	-0.021	-0.009
	(0.389)	(0.026)	(0.007)	(0.330)	(0.015)	(0.008)
Anti-smoking sentiment	-2.480***	0.072	0.037***	-1.892**	0.144***	0.051***
	(0.782)	(0.053)	(0.013)	(0.924)	(0.055)	(0.015)
age18_24	-3.122***	0.088***	-0.034***	-3.036***	0.104***	-0.031***
	(0.466)	(0.025)	(0.009)	(0.523)	(0.030)	(0.012)
age25_34	-1.336***	0.019	-0.041***	-1.139**	0.041*	-0.039***
	(0.394)	(0.022)	(0.007)	(0.502)	(0.023)	(0.009)
age35_44	0.940**	-0.022	-0.045***	0.975**	-0.001	-0.042***
	(0.433)	(0.020)	(0.007)	(0.474)	(0.021)	(0.010)
age45_54	2.612***	-0.044***	-0.046***	2.716***	-0.033	-0.047***
	(0.337)	(0.016)	(0.007)	(0.428)	(0.021)	(0.009)
age55_64	2.469***	-0.012	-0.032***	2.313***	0.000	-0.032***
	(0.435)	(0.020)	(0.006)	(0.506)	(0.022)	(0.008)
female	-2.460***	0.029***	-0.025***	-2.486***	0.026***	-0.029***
	(0.131)	(0.006)	(0.005)	(0.153)	(0.007)	(0.006)
black	-6.199***	0.034***	0.024**	-6.532***	0.034**	0.022**
	(0.223)	(0.013)	(0.009)	(0.230)	(0.015)	(0.010)
hisp	-6.847***	-0.039	-0.013*	-6.798***	-0.064***	-0.018***
	(0.473)	(0.026)	(0.007)	(0.684)	(0.016)	(0.007)
rlesshs	2.918***	-0.061***	-0.033***	3.330***	-0.061***	-0.039***
	(0.293)	(0.019)	(0.006)	(0.275)	(0.021)	(0.007)
rhighsch	2.170***	-0.047***	-0.024***	2.450***	-0.042**	-0.028***
	(0.232)	(0.014)	(0.006)	(0.272)	(0.017)	(0.006)
rsomecol	1.661***	-0.015	-0.007	1.897***	-0.016	-0.010
	(0.228)	(0.011)	(0.005)	(0.269)	(0.014)	(0.007)
divor_seper	1.133***	-0.022**	-0.030***	1.033***	-0.025*	-0.032***
	(0.216)	(0.010)	(0.005)	(0.268)	(0.013)	(0.006)
widow	0.751**	-0.017	-0.027***	0.604	-0.026	-0.035***
	(0.368)	(0.015)	(0.009)	(0.428)	(0.021)	(0.011)
single	-0.168	-0.025**	-0.021***	-0.411	-0.036***	-0.024***
	(0.231)	(0.010)	(0.006)	(0.257)	(0.012)	(0.007)
nchild	0.078	0.005	-0.001	0.066	0.006	-0.001
	(0.062)	(0.003)	(0.002)	(0.078)	(0.005)	(0.003)
nadm	0.112	-0.018***	-0.006*	-0.005	-0.019***	-0.006
	(0.101)	(0.005)	(0.003)	(0.141)	(0.006)	(0.004)
nadf	0.224	-0.020***	-0.010***	0.249	-0.024***	-0.015***
	(0.186)	(0.006)	(0.002)	(0.216)	(0.008)	(0.004)
inc_quin1	0.307	-0.034**	-0.010	0.140	-0.038**	-0.006
	(0.328)	(0.017)	(0.007)	(0.357)	(0.017)	(0.009)
inc_quin2	0.730**	-0.029**	-0.014**	0.496	-0.020	-0.009
	(0.331)	(0.014)	(0.006)	(0.359)	(0.014)	(0.007)
inc_quin3	0.707**	-0.032***	-0.010	0.677**	-0.032**	-0.003
	(0.270)	(0.011)	(0.007)	(0.319)	(0.013)	(0.008)
inc_quin4	0.074	-0.020	-0.003	-0.257	-0.027**	0.003
	(0.262)	(0.015)	(0.007)	(0.298)	(0.011)	(0.009)
gmmcare	0.871**	-0.001	-0.002	1.192**	0.020	0.004
	(0.356)	(0.018)	(0.008)	(0.473)	(0.022)	(0.011)
nocare	-0.086	-0.056***	-0.008*	0.084	-0.055***	-0.004
	(0.193)	(0.007)	(0.005)	(0.219)	(0.011)	(0.006)
emp_part	0.043	0.022*	0.011	-0.162	0.034**	0.009
	(0.301)	(0.012)	(0.007)	(0.326)	(0.015)	(0.010)

emp_retired	0.514	0.020	0.018**	0.045	0.034*	0.016
	(0.389)	(0.015)	(0.008)	(0.398)	(0.018)	(0.010)
emp_unemployed	0.597**	-0.002	-0.008	0.492	-0.002	0.001
	(0.261)	(0.020)	(0.010)	(0.293)	(0.027)	(0.013)
emp_disabled	2.028***	0.095***	0.021*	1.655***	0.114***	0.032**
	(0.480)	(0.020)	(0.012)	(0.434)	(0.024)	(0.015)
emp_student	-0.560	0.001	0.003	-0.137	0.014	0.015
	(0.654)	(0.034)	(0.019)	(0.959)	(0.047)	(0.028)
emp_homemaker	1.218***	0.026**	0.022**	0.962**	0.026**	0.027**
	(0.310)	(0.011)	(0.010)	(0.384)	(0.012)	(0.014)
_Wave23	0.484*	0.030***	-0.011**	0.445	0.031**	-0.011
	(0.261)	(0.011)	(0.006)	(0.305)	(0.015)	(0.008)
_Wave25	0.112	0.051**	0.031***	0.087	0.029	0.034***
	(0.329)	(0.020)	(0.010)	(0.415)	(0.018)	(0.011)
_Wave27	-0.751**	0.031**	-0.004	-0.911**	0.024	0.001
	(0.326)	(0.014)	(0.007)	(0.341)	(0.018)	(0.009)
_Wave29	-0.500	0.034*	0.010	-0.613	0.025	0.011
	(0.423)	(0.019)	(0.010)	(0.486)	(0.022)	(0.012)
_Wave31	-0.643**	0.020	-0.010*	-0.759**	0.018	-0.009
	(0.313)	(0.015)	(0.006)	(0.366)	(0.016)	(0.007)
_Wave33	-0.607*	0.000	0.010	-0.671	0.003	0.008
	(0.349)	(0.019)	(0.008)	(0.469)	(0.022)	(0.010)
_Wave35	-0.997***	0.013	-0.005	-1.044***	-0.006	-0.002
	(0.232)	(0.014)	(0.007)	(0.372)	(0.017)	(0.009)
_Wave37	-1.810***	-0.143***	-0.033***	-1.770***	-0.158***	-0.038***
	(0.287)	(0.015)	(0.008)	(0.363)	(0.018)	(0.010)
_Wave39	-1.799***	-0.137***	-0.035***	-1.798***	-0.149***	-0.036***
	(0.330)	(0.016)	(0.008)	(0.432)	(0.017)	(0.009)
Constant	16.698***			16.806***		
	(0.644)			(0.802)		
Observations	17989	19915	20987	12876	14226	14963

1: OLS estimation; 2: Marginal effects from Probit models
Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7. Two-part model estimates of the effects of smoking bans on smoking related expenditures using CES data

	Any smoking related expenditures	Smoking related expenditures[#]
Ban coverage	-0.017	-0.311*
	(0.017)	(0.169)
Anti-smoking sentiment	-0.165***	-0.015
	(0.031)	(0.291)
age_foodmanager	-0.016***	0.058**
	(0.003)	(0.029)
emp_retired	-0.051***	-0.125
	(0.012)	(0.128)
emp_home	-0.042***	0.096
	(0.011)	(0.115)
emp_school	-0.091***	-0.337
	(0.019)	(0.322)
emp_ill	0.058***	0.213
	(0.018)	(0.131)
emp_unemply	0.085	0.388
	(0.054)	(0.370)
emp_other	0.001	0.241
	(0.059)	(0.554)
fmlesshs	0.145***	0.162
	(0.016)	(0.116)
fmhighsch	0.109***	0.345***
	(0.011)	(0.093)
fmsomecol	0.102***	0.257***
	(0.011)	(0.094)
famsize	0.239***	-2.454***
	(0.062)	(0.531)
nchild	-0.036***	0.292***
	(0.007)	(0.059)
income_capita	0.031***	0.191**
	(0.008)	(0.088)
black	-0.039***	-0.298***
	(0.010)	(0.103)
other	-0.035**	-0.263
	(0.015)	(0.171)
single	-0.028*	0.758***
	(0.015)	(0.143)
adults_nochd	-0.043***	0.277**
	(0.012)	(0.121)
single_parent	-0.006	0.317**
	(0.017)	(0.158)
other_famtype	0.049***	0.104
	(0.013)	(0.100)
month2	0.008	0.109
	(0.017)	(0.155)
month3	0.007	0.057
	(0.017)	(0.149)
month4	0.007	0.140
	(0.017)	(0.150)
month5	0.004	0.246
	(0.017)	(0.153)
month6	-0.012	0.409***
	(0.016)	(0.159)

month7	-0.011	0.298*
	(0.016)	(0.158)
month8	0.017	0.050
	(0.017)	(0.150)
month9	-0.010	0.222
	(0.016)	(0.154)
month10	-0.002	0.110
	(0.016)	(0.153)
month11	-0.001	0.077
	(0.017)	(0.158)
month12	-0.007	0.101
	(0.016)	(0.155)
Constant		1.023***
		(0.238)
Observations	12760	2417

Per adult per week/10
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1