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RISING OBESITY: AN UNINTENDED CONSEQUENCE OF THE ANITSMOKING CAMPAIGN?

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RISING OBESITY: AN UNINTENDED CONSEQUENCE OF THE ANITSMOKING CAMPAIGN?

by

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Submitted in partial fulfillment
of the requirements for
Honors in the Department of Economics

UNION COLLEGE
June, 2012

ABSTRACT

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Obesity is the fastest growing health issue currently in the United States, as its prevalence has risen to over 30%, up from 14% in 1980 (Chou et al. 2004). As a result, the percentage of the population dealing with chronic health conditions has also been on the rise. Although the obesity epidemic is on the rise, smoking rates in the United States have declined from 33% to under 20% over the same time period, and from about 42% in 1965 (Todeschini et al. 2010). Thus, many economists have inferred that the declining smoking prevalence may partially be contributing to the rising obesity epidemic. Existing evidence shows that smoking cessation leads to significant weight gain.

This study examines the effects of state expenditures on antismoking programs on BMI and obesity levels overtime. It is hypothesized that the anti-smoking programs, although efficient in increasing the cessation of smoking, are unintentionally increasing obesity prevalence. If this is the case, the anti-smoking campaign may not be as effective in improving the general health of the public as has been assumed. Based on data mainly from the Behavioral Risk Factor Surveillance System for the years 2000 to 2010, and taking into account lagged variables, ordinary least squares regression results show that antismoking expenditures are positively and significantly correlated to BMI and obesity. This paper also tests the theory that the antismoking campaign may be inducing people to adopt healthier lifestyles, as suggested by some previous literature. Results show that rising antismoking expenditures decrease the probability that an individual will be a smoker, but do not affect whether an individual makes other healthier lifestyle choices, measured by exercise and dietary-intake variables. To combat this unintentional consequence of the antismoking campaign, some antismoking expenditures need to be shifted to anti-obesity programs.

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CHAPTER ONE

INTRODUCTION

A. The Growing Obesity Epidemic

The obesity epidemic has been heavily increasing over the past few decades in the United States. There has been a 100 percent increase in the number of obese individuals from the late 1970s to 2000, from about 14 percent of the population to about 30 percent (Chou et al. 2004). In 2008, that number had risen to about 34 percent (Ogden and Carroll 2010). A rise in obesity also means a greater percentage of overweight individuals. In 2008, 34 percent of the US population was also overweight. Thus almost 70 percent of the US population is either overweight or obese (Ogden and Carroll 2010). Furthermore, if the obesity trend continues at its current pace, estimates show that 51.5 percent of the adult population will be obese and 86.3 percent will overweight or obese by 2030. By 2048, all American adults would be overweight or obese (Wang et al. 2008).

Obesity is having a BMI (body mass index) of 30 or greater. BMI is a measure of body fat based on an individual's weight and height, defined as the individual's body weight (in kilograms) divided by the square of his or her height (in meters). Being overweight is having a BMI of 25-29.9, normal weight is having a BMI of 18.5-24.9, and underweight is having a BMI of less than 18.5. Unfortunately, the overweight and obesity ranges of BMI are becoming of the norm. The average BMI has increased from 25.16 to 27.85 from the late 1970s to 2000 (Chou et al. 2004).

The most serious issue in midst of all this, however, are the morbidity and mortality numbers that obesity epidemic brings with it. Excess weight and obesity are associated with a number of illnesses including hypertension, insulin resistance and diabetes mellitus, cardiovascular disease, hypertriglyceridemia, low high-density-lipoprotein cholesterol, and high total-and low-density-lipoprotein cholesterol (Sunyer 1991). Many of these conditions have been plaguing an increasing proportion of the population over the same time frame as the obesity epidemic. Furthermore, many of these conditions such as type 2 diabetes mellitus, gallbladder disease, coronary heart disease, high blood cholesterol level, high blood pressure, and osteoarthritis, become more prevalent and severe within the overweight and obese population as weight levels rise (Must et al. 1999). Furthermore, obesity is responsible for over 300,000 premature deaths per year in the US, while tobacco, alcohol, and illicit drugs are responsible for about 400,000, 100,000, and 20,000 deaths per year, respectively (Chou et al. 2004). However, given the rising trend of the obesity epidemic, obesity is projected to become the number one cause of preventable death soon.

As obesity is on its rise, so are the costs of obesity-associated diseases. In 2008, medical care costs related to obesity were estimated to be $147 billion (CDC 2011), accounting for about 10 percent of all medical costs. This comes to be being a cost of $1429 higher for people who are obese than for people of normal weight (CDC 2011). As these numbers rise with obesity, it is a major concern for the US as healthcare costs have been rising very rapidly over the past few decades, taking up over 17 percent of the US GDP (OECD 2011). Thus fighting obesity is not just for the sake of the health of people, but for the sake of the economy as well.

However, given that the obesity epidemic is only growing in the US, it is obvious that the current initiatives and programs to subdue this epidemic are not effective. There have been programs to educate the public on obesity and its related diseases and programs to educate the public on the importance of exercises and eating healthy. There have been efforts in some states to build more parks and trails and to promote fitness classes, both in schools and out of schools. However, these programs have not been enough to cause people to change their lifestyles. As long as people continue with their current unhealthy lifestyle, in regards to eating and exercise, the obesity epidemic will continue to grow.

B. The Declining Smoking Epidemic

The obesity epidemic is not the only behavioral epidemic the US has faced in recent decades. Smoking was a huge one, and arguably may still be. However, unlike obesity, smoking rates have been declining over the past few decades. Smoking rates have declined significantly from 42 percent in 1965 to under 20 percent in 2007. Subsequently, lung cancer rates have also dropped significantly. Over the same time period, the obesity epidemic and its related diseases have followed just the opposite trend as discussed above. Furthermore, obesity is on its way to topple smoking as the number one preventable cause of death. The dramatic declines in smoking rates are due to nothing but the successful antismoking campaign in this country. The antismoking campaign has become huge since it was first initiated in the 1960s after the Surgeon General's report on smoking and lung cancer was published. Since then, the "war on tobacco" has made its way through many channels to educate the public on the harmful effects on smoking, whether it has been through smoking bans in public places, rises in cigarette prices and taxes, advertisements (on billboards, magazines, television commercials), warning labels on cigarette packs, educational programs, or hotlines and therapies to help smokers quit. A rise in cigarette prices has been a major component of the anti-smoking campaign, as the real price of cigarettes rose by 164% between 1980 and 2001 (Chou et al. 2004). This increase in cigarette prices was in part due to four Federal excise tax hikes, numerous state tax hikes, and state lawsuits filed against cigarette makers to recover Medicaid funds spent treating diseases related to smoking (Chou et al. 2004). Furthermore, the campaign has successfully changed much of the public's view on smoking especially with the recognition of the dangers of second-hand smoking. Over the same time period, there has been a substantial increase in the percentage of the population residing in states that have enacted clean indoor air laws that restrict smoking in public places. The proportion of the population residing in states that restrict smoking in the workplace rose from 6% in 1980 to 42% in 1999 (Chou et al. 2004). The anti-smoking campaign has only grown since, as hundreds of millions of dollars go into fighting smoking every year.

C. Unintended Consequence?

Because of the opposite trends of obesity and smoking over the same time period, some have suggested that the decline in smoking is partially contributing to the rise in obesity. This seems plausible both biologically and economically. Biologically speaking, inhaled nicotine activates the nervous system to release epinephrine into the bloodstream, thereby making the heart rate quicker and strengthening the force of the heart's contraction. All this work causes more calories to be burned, increasing metabolism. Thus when some people quit smoking, their metabolic rate decreases, causing weight gain. Furthermore, cigarette smoking suppresses appetite and enjoyment of food by dulling one's taste buds, making food less appealing and possibly causing people to eat less (Baum 2009). Economically speaking, for some smokers, cigarettes and food are substitutes. At over nine dollars in some states, a pack of cigarettes can cost more than a full meal. If smokers are spending their money on cigarettes, they are less likely to spend their money on some food items, such as fast food. Thus, when some of these smokers quit, their food consumption increases, enticing weight gain. Also, people attempting to reduce or quit smoking, may be faced with "oral fixation." Their habits of having cigarettes in the mouth may require them to substitute something else, such as food, causing them to eat more. Many individual quitters notice significant weight gain. This potential weight gain is what even holds back a small percentage of smokers from quitting. Thus, as smoking rates heavily declined over 50 percent in the past few decades, collectively, those quitters may have contributed enough weight gain to increase obesity rates to a certain extent. Thus, it can be argued that the antismoking campaign is somewhat fueling the obesity trend.

D. The Contribution and Organization of this Paper

Using 2000-2010 data, mainly from CDC's Behavioral Risk Factor Surveillance System (BRFSS) and from the Campaign for Tobacco-Free Kids 2011 annual report, this paper investigates the effects of the antismoking campaign on BMI levels and obesity rates for all fifty states (plus the District of Columbia) over that time period. The main focus of this paper is to investigate whether there is a correlation between how much states spend on antismoking and obesity levels of those states. Controlling for unemployment rates, annual income, cigarette prices, states' spending on obesity preventions, and other factors, the effects of states' expenditures on antismoking on obesity prevalence is calculated through regression analysis. Furthermore, this paper also tests the theory that the antismoking campaign may be inducing people to adopt healthier lifestyles, as suggested by some previous literature. Thus, the effects of state antismoking expenditures are also tested on variables indicative of a person's health lifestyle choices – smoking status, exercise status, and fruits and vegetables consumption.

Results show that antismoking expenditures, as well as cigarette prices, are positively and significantly correlated to BMI and obesity. Furthermore, rising antismoking expenditures decrease the probability that an individual will be a smoker. However, they do not significantly affect the probability that an individual is regularly exercising and ambiguously affect daily fruits and vegetables consumption.

The organization of this paper is as follows: Chapter Two provides a review of existing literature regarding the effects of cigarette costs (prices and taxes) and smoking cessation on obesity rates. Chapter Three presents the econometric model used to investigate the effects of the antismoking campaign on obesity rates. Chapter Four describes the selection of the data samples and the descriptive statistics for the samples, Chapter Five presents the regression analysis of the models, and Chapter Six concludes the paper.

CHAPTER TWO

A REVIEW OF THE EFFECTS OF CIGARETTE COSTS AND SMOKING CESSATION ON OBESITY

This chapter provides a review of the existing literature on cigarette costs and smoking cessation on obesity. It reviews empirical studies identifying factors that affect BMI and obesity, examines the success of the antismoking campaign, and relates smoking costs and cessation on obesity rates. The majority of the literature regarding this subject is fairly recent. Furthermore, there is a discrepancy presented by the literature regarding whether smoking costs and smoking cessation are positively or negatively correlated with BMI levels and obesity rates, and whether or not the relationships are significant.

A. Factors Affecting Obesity

There is a broad range of factors that affect BMI levels and obesity rates. Chou et al. (2004) examine many factors that may be responsible for the 50% increase in the number of obese adults in the US since the 1970s. The authors examine societal factors that influence the cost of nutritional and leisure time choices made by individuals, such as the per capita number of fast-food and full-service restaurants, meal prices in each type of restaurant, food consumed at home, cigarette and alcohol prices, and clean indoor air laws. The authors explain the increasing prevalence of obesity rather than explaining why a given individual is obese because genetic characteristics of the population change slowly while the incidence of obesity has increased rapidly (Chou et al. 2004). The authors use individual-level data from the 1984-1999 Behavioral Risk Factor Surveillance System (BRFSS) and analyze the determinants of BMI using OLS regression. They also control for individual factors such as age, race, household income, years of formal schooling completed, and marital status.

Many of the potential determinants of BMI included in this study are based on trends in aggregate time series data. For example, the growth in restaurants has been substantial, as the per capita number of fast-food restaurants doubled between 1972 and 1997 while the per capita number of full-service restaurants rose by 35% (Chou et al. 2004). Another significant trend the authors mention is the anti-smoking campaign, which substantiated in the 1970s. The authors note the importance of including cigarette prices as a variable because the rise in the real cost of cigarette smoking may have reduced smoking, which tends to increase weight (Chou et al. 2004).

Based on the BRFSS sampling data, Chou et al. (2004) find that between 1984 and 1999, BMI increased from 24.94 to 27.07 kg/m^2, and the number of obese adults more than doubled from 11.0 to 24.04%. Furthermore, many of the coefficients for their variables have the expected signs and are statistically significant. Individual characteristics play a substantial role on BMI. Age has an inverted U-shaped effect on BMI, where BMI peaks at an age of 57 and the probability of being obese peaks at an age of 45. Non-Hispanic Blacks and Hispanics have higher values of both outcomes than Whites, while other races have much lower values and even have a negative coefficient. Males have higher BMIs than females. However, females are more likely to be obese. Marital status also plays a role as married and widowed persons have higher BMIs than never married and divorced persons. This is possibly due to the notion that never married and divorced persons may be looking to get married and hence not controlling weight is an unattractive factor. Married persons would worry less about this as they are not looking for a partner. As real household income increase, BMI decreases. More educated people are less likely to be obese as they are more educated on how to maintain a healthier lifestyle and the numerous health dangers of not doing so and being overweight or obese.

The per capita number of restaurants has a significant positive effect on BMI. Furthermore, the real fast-food restaurant price, the real food at home price, and the real full-service restaurant price have significant negative effects on BMI.

Clean indoor air laws do not show a consistent pattern on BMI. Restrictions in restaurants on cigarette smoking have no effect on BMI, even though these restrictions would encourage a substitution of food for cigarettes. Restrictions in state and local government workplaces and private workplaces are associated with higher levels of BMI and obesity rates, but the coefficients are not significant. On the other hand though, restrictions in elevators, public transportation, and theatres increase BMI and obesity rates and the coefficients are significant as well.

Cigarette prices have positive effects on BMI, which indicate substitution between cigarette and food, or calories and nicotine. Chou et al. (2004) states that these results indicate an unintended consequence of the anti-smoking campaign and that rising cigarette prices have contributed to the upward trend in obesity. In fact, this is the first paper in economics literature to make this correlation. On the other hand, alcohol prices have a negative effect on BMI, indicating the calories and alcohol are complements.

Of all of these correlations, per capita number of restaurants has the largest contribution to BMI, accounting for 61% of the actual growth in BMI and 65% of the rising obesity prevalence. Per capita number of restaurants has the largest elasticity of BMI at 0.17, which is six times greater than the value of the income elasticity. Furthermore, a 10% increase in the number of restaurants increases the probability of being obese by 1.4 percentage points, or a 10% increase in the per capita number of restaurants is associated with a growth in the obesity rate from 17.5 to 18.9%. In more apparent terms, a 10% increase in the per capita number of restaurants raises the obesity rate by 8% in a fixed population. Cigarette prices rank second accounting for an effect on BMI and obesity as large as one-third that of per capita number of restaurants.

B. The Effectiveness of the Antismoking Campaign

Before it can be assumed that there is a correlation between the antismoking campaign and obesity, as this paper seeks to find out, whether or not the antismoking campaign has in itself been successful in reducing smoking prevalence needs to be examined first. Many studies, both on statewide and national levels, have shown so.

Warner (1977) predicts that in the absence of the campaign, the per capita consumption of cigarettes would have exceeded its actual 1975 value by 20 to 30%. Furthermore, he argues that this is a conservative estimate, as it does not take into account many behavioral changes of smokers such as the shift to lower tar and nicotine cigarettes that may not be as harmful. Warner attributes the success of the campaign to its many assets including the Surgeon General's Report in 1964 on the harmful effects on smoking, television and radio advertisements, rises in cigarette taxes and prices, and governmental policies and legislation.

In a more recent study, Farrelly et al. (2005) examine the effects of the American Legacy Foundation's "truth" campaign, the first national antismoking campaign to discourage tobacco use among the young. This national "truth" campaign was initiated after a successful similar campaign that was established in the state of Florida in 1998. Two years after the campaign was initiated, the prevalence of any past 30-day smoking among middle and high school students dropped by 40% and 18% respectively (Bauer et al. 2000). The agenda of the national "truth" campaign was to approach the youth with hard-hitting advertisements that depict at-risk youths rejecting tobacco and that reveal deceptive tobacco industry marketing tactics appears to be effective (Farrelly et al. 2005). Here, Farrelly et al. (2005) conduct a dose-response relationship between the level of exposure to the campaign and smoking prevalence. The authors examine the overall change in the prevalence of youth smoking (by grades 8. 10, and 12) from 1997 to 2002. They find that over the five-year period, smoking prevalence decreased by 36%, in which eighth-grade students showed the largest decline at 45% and 12th grade students showed the smallest decline at 27%. Furthermore, the decline in smoking prevalence among the youth was excelled after the "truth" campaign was launched in 2000. In the years prior to the campaign, there was an annual percentage decline of 3.2%, as compared to the annual percentage decline of 6.8% after the launch of the campaign (Farrelly et al. 2005).

C. The Effects of Cigarette Prices and Taxes on Obesity Prevalence

Chou et al. (2004) were the first economics literature known to correlate cigarette prices with obesity and find that BMI and obesity are significantly increasing in cigarette prices, as mentioned above. Rashad and Grossman (2004) using the same BRFSS data set over the same time period also come to the same conclusion. On the other hand, other studies have shown the contrary in relation to cigarette costs and BMI and obesity. Gruber and Frakes (2006) find that cigarette taxes significantly decrease BMI and obesity using the same data set as well. Their results shows that a $1.00 rise in cigarette taxes lower BMI by 0.151 and decreases the probability of becoming obese by 1.5%. Gruber and Frakes also show that the results are similar with or without the variables of state-level food prices, number of restaurants, and clean indoor air laws. According to Gruber and Frakes, the conflicting results may be due to whether time trend covariates are specified non-parametrically (Baum 2009). Chou et al. (2004) and Rashad and Grossman (2004) use a quadratic time trend while Gruber and Frakes (2006) use time dummy variables and state-specific linear time trends (Baum 2009). Furthermore, Gruber and Frakes (2006) use cigarette taxes while Chou et al. (2004) and Rashad and Grossman (2004) use cigarette prices.

Baum (2009) expands on these studies due to the conflicting results in the literature. Baum uses National Longitudinal Survey of Youth (NLSY79) panel data instead of BRFSS data set. He also uses both cigarette taxes and prices because the literature has not been able to agree on which is the more appropriate factor to use. Chou et al. prefer to use cigarette prices because cigarette taxes fail to incorporate exogenous state variation in the cost of production and in the market share (Baum 2009). On the contrary, Gruber and Frakes prefer to use cigarette taxes because cigarette prices may be endogenous, as cigarette prices are partially determined by cigarette demand and those states where demand is high may invest less in health and consequently have more obesity (Baum 2009). Baum estimates BMI and the probability of being obese using multivariate regression analysis, including a standard set of covariates controlling for gender, race/ethnicity, age, education, marital status, household composition (number of children), and urban residence. Furthermore, Baum examines the effects of cigarette costs on a treatment group likely to be affected by changes in cigarette costs, respondents who by the 1992 survey report had smoked at least 100 cigarettes, and also on a comparison group unlikely to be affected by cigarette costs, respondents who by 1992 had smoked fewer than 100 cigarettes. Baum chooses the cutoff year for these groups as 1992 because by then, the respondents are between the ages of 27 and 34, and so, he assumes that if they have not yet been smokers, they are unlikely to become one in successive years. This assumption is validated by the fact that the 1994 and 1998 surveys show that 94.73% of those in the comparison groups continued being non-smokers as expected (Baum 2009).

Because of the opposite findings between Chou et al. (2004) and Rashad and Grossman (2004) and Gruber and Frakes (2006), Baum (2009) replicates their methods of using a quadratic time trend and year dummy variables, respectively, with both cigarette prices and taxes. Baum obtains the same results as the previous authors did with their models. However, as Gruber and Frakes previously indicated, the estimates are sensitive to the time trend specification used. Hence, when a quadratic time trend is used in the Gruber and Frakes model instead of year dummy variables, the effects of cigarette taxes become insignificant. Likewise, when year dummy variables are used in the Chou et al. and Rashad's and Grossman models, the positive effects of cigarette prices also become insignificant. Furthermore, the estimates are also sensitive to whether cigarette prices and taxes are used. Baum shows that when cigarette taxes have statistically significant negative effects, cigarette prices have statistically insignificant effects. Likewise, when cigarette prices have statistically significant positive effects, cigarette taxes have statistically insignificant effects. These difference in using cigarette prices and taxes are not expected since state cigarette price variation is at least partially composed of state cigarette tax variation (Baum 2009). Perhaps the different effects of cigarette taxes and prices are due to them being correlated with different state-specific time trends (Baum 2009).

Hence, Baum controls for state-specific time trends by estimating difference-in-difference models by using treatment and comparison groups as described above. Results show that rises in both cigarette prices and taxes significantly increase BMI for the treatment group (those who by 1992 smoked at least 100 cigarettes). There were occasional negative effects of cigarette costs for the comparison group, suggesting that correlation exists between state time trends and cigarette costs. Increasing cigarette taxes by $0.77 increases BMI by 0.60 index points. Likewise, increasing cigarette prices by the same amount increases BMI by 0.35 index points. This positive correlation between cigarette costs and weight is also greater for those with less income and for those who are younger. Furthermore, rises in cigarette prices and taxes also have positive significant effects on obesity overweight for the treatment group. Increasing cigarette taxes and prices by $0.77 increase the prevalence of obesity by 3.4 and 1.7 percentage points, respectively. Increasing cigarettes taxes and prices by $0.77 increase the prevalence of overweight between 2.8 and 5.8 percentage points. However, this specific approach for estimating difference-in-difference models suffers from limitations (Courtemanche 2009). People who never smoked 100 cigarettes because of high prices in their states are incorrectly assigned to the control group. At the same time, people who used to smoke but quit and would not start again regardless of how cheap cigarette would become are incorrectly assigned to the treatment group (Courtemanche 2009).

Baum (2009) also takes into account the effects of lagged variable costs. The weight of an individual is not independent for each period as current weight depends on the stock weight over time. Therefore, current cigarette costs may affect current weight, but past cigarette costs may also affect current weight through their effects on past weight. Baum incorporates this with one-, two-, and three-year lags. Results show that the positive effects of lagged cigarette taxes on BMI are approximately 10% greater than the effects of current cigarette taxes on BMI. Lagged variables are more substantial for obesity prevalence, as the effects of lagged cigarette taxes on obesity are approximately 35% larger than the effects of current cigarette taxes on obesity.

Courtemanche (2009) adds to the previous literature by focusing much more on the long run effects of cigarette costs on weight by including lags of cigarette prices and taxes as simply examining contemporaneous prices and taxes may not fully represent the total effect. He includes lags for three reasons: cigarette smoking may lag price changes, changes in daily caloric intake and expenditure patterns may lag changes in smoking, and changes in weight may lag changes in calories consumed or expended. Smoking may lag price changes because the long-run price elasticity of addictive goods is stronger than the short-run price elasticity, as people may need long times to quit their addiction (Courtemanche 2009). Daily caloric intake and expenditure may lag because for smokers who quit and then target other health-related goals such as weight loss, some time may pass before smoking is no longer a threat and they are able to devote their energy to these other goals (Courtemanche 2009). Changes in weight may lag because caloric intake and expenditure patterns since weight is a capital stock and is dependent on caloric intake and expenditure of previous periods (Courtemanche 2009).

Unlike the previous literatures, Courtemanche uses both NLSY79 and the BRFSS datasets. He calculates BMIs of the respondents from the NLSY79 dataset. He incorporates the difference groups from Baum (2009) by utilizing a variable from the 1992 survey, in which respondents were asked whether they smoked at least 100 cigarettes in their lifetime. He utilizes the BRFSS data on cigarette smoking, food consumption, and exercise as dependent variables. He also sums BRFSS variables to determine the number of times per week the individual ate fruits or vegetables. He also includes other variables such as unemployment rates, the number of fitness and sports clubs per 10,000 residents, and a grocery price index to control for food prices.

Courtemanche replicates both the Chou et al. (2004) and the Gruber and Frakes (2006) models, however using the NLSY79 data set instead of the BRFSS, and then adds lags to both models by accounting for five years of lags. He then uses a linear functional form in all the regressions. Lastly, he tests the sensitivity of the results to the use of the BRFSS data instead of the NLSY79 data.

The results show that the different methodologies used in the previous literature come to the same conclusion when lags of cigarette prices and taxes are included. That is cigarette prices and taxes have a negative effect on weight in the replicated studies after lag is incorporated. Using the Chou et al. (2004) model with lag, a permanent $1 increase in cigarette prices reduced BMI by 0.26 to 0.37 units and reduces the probability of being obese by 1.4 to 2.5 percentage points. Using the Gruber and Frakes (2006) model with lag, a permanent $1 increase in cigarette prices reduces BMI by 0.33 to 0.49 units and reduces the probability of being obese by 1.1 to 2.0 percentage points. These results show that there are large delays in effects of changes in prices and taxes on weight. This is further solidified by the fact that the coefficients on average price and tax in the current and preceding year are insignificant in all sixteen regressions of the study except for one at the 10% level. On the other hand, the effect of average price and tax in the fourth and fifth years is negative, large, and significant in all regressions. This indicates that a reduction in body weight resulting from a rise in cigarette price does not occur until a few years after the price change (Courtemanche 2009).

He argues that the negative effects of cigarette prices on weight make sense as reducing smoking has the potential to result in lower weights through psychological phenomena that would lead to healthier eating and exercise habits. People who attempt to reduce or quit smoking and those who are successful in doing so may have a renewed sense on interest about their health and lifestyles, pushing them to improve their health beyond just reducing tobacco intake, such as by controlling their eating and exercising. Overcoming a smoking addiction may also instill confidence to adopt a healthier lifestyle. On the contrary, developing a smoking addiction may deter this confidence. However, other literature shows that people have a depletable stock of willpower (Courtemanche 2009). Thus, smokers may therefore use most of their willpower to quit smoking and have no more willpower left to resist other temptations, causing them to eat more or not exercise. However, if the smoker is able to quit completely, then this may replenish his stock of willpower to fight off other temptations. Smokers may also feel that making healthy lifestyle choices such as eating healthy and exercising are of no benefit if their already deteriorating health is due to smoking. Smokers who may quit smoking may fear weight gain, and hence may adopt healthier eating and exercise choices. Also, smoking makes exercise more difficult by reducing lung capacity. Hence, quitting smoking may then allow those people to exercise more.

D. Smoking Cessation Increases Obesity Prevalence

While the previous literature presented has linked cigarette costs to body weight and obesity, other literature directly links the final step of cigarette costs and the antismoking campaign to obesity – smoking cessation. Because rising cigarette prices causes less people to smoke, smoking cessation may increase obesity prevalence. According to a 1990 U.S. Surgeon General review of over a dozen studies, 58-87% of people who quit smoking gained weight of about four pounds on average (Courtemanche 2009). However, most of these studies were carried over very short periods of time.

Williamson et al. (1991) conducted a study behind the notion that the prospect of weight gain discourages smokers from quitting. The authors linked changes in body weight to changes in smoking status in adults 25 to 74 years of age by studying nationally representative cohort of smokers and nonsmokers followed from 1971 to 1984 to determine the mean weight gain attributable to the cessation of smoking, as well as the risk of gaining various amounts of weight upon the cessation of smoking. The participants of the study were weighed in the First National Health and Nutritional Examination Survey (NHANES I, 1971 to 1975) and then weighed again in the NHANES I Epidemiologic Follow-up Study (1982 to 1984). Unlike the other studies discussed, the weights of participants in this study were actually measured, instead of just being reported by the participants themselves. There were 748 men and 1137 women continuing smokers and 409 men and 359 women who had quit smoking for a year or more. However, a limitation of the study is the use of self-reports to assess smoking status. Self-reports can lead to misclassification of some smokers as quitters, especially when it later became less socially acceptable (Williamson et al. 1991).

The authors also adjusted for cofounders of the relation between weight gain and smoking status, such as age, BMI at baseline, physical activity, alcohol consumption, illnesses, and reproductive history.

Results from the study showed that those who quit smoking had a slightly higher BMI at base line. Sustained quitters, both male and female, gained the most weight. The women who continued to smoke and the men who smoked intermittently gained the least weight. The mean weight gain attributed to the cessation of smoking was 2.8 kg in men and 3.8 kg in women after cessation. However, 9.8% of the men and 13.4% of the women who quit gained more than 13 kg.

For men, the risk of gaining 8 to 13 kg was highest in the recent quitters of smoking at 20.2%. The next highest risk was for sustained quitters at 12.5%. Former smoker had the lowest risk at 4.7%. Furthermore, the risk of gaining more than 13 kg was highest in the sustained quitters at 9.8%, and former smokers, those who had never smoked, and continuing smokers has the smallest risks. The categories of females at the highest and lowest risks of gaining more than 13 kg were the same as the males. Regression analysis showed that smoking cessation had a substantial effect on weight gain. The odd ratios for weight gain for both male and female sustained quitters increased with the degree of weight gain (gain of over 13 kg), relative to the continuing smokers. On the other hand, for both males and females, recent cessation was more weakly associated with a gain of over 13 kg. The intermittent smokers, those who had never smoked, and former smokers had only moderately elevated odd ratios for any amount of weight gain. Overall, men and women who quit smoking were 8.1 and 5.8 times, respectively, more likely than continuing smokers to gain over 13 kg. However, by the end of the study, smoking cessation caused the mean BMI of the quitters to rise to that of the subjects who had never smoked. The authors state that this suggests that smoking lowers weight and then upon cessation, weight tends to return to the level of people who have never smoked.

Another similar study was carried out by Flegal et al. (1995). They examined weight gain over a 10-year period associated with the cessation of smoking. They also used data from NHANES like Williamson et al. (1991). The respondents were asked to report their current weight and their weight 10 years earlier. Respondents were also categorized according to their reported use of tobacco products. Current smokers had the lowest age-adjusted prevalence of overweight and the lowest BMI, while those who had quit within the past 10 years had the highest age-adjusted changes in BMI. Furthermore, 16% of the men and 21% of the women who had quit within the past 10 years gained over 15 kg. The authors also calculated the effect of smoking cessation on the increase in the prevalence of overweight by calculating the prevalence of overweight that would have been expected if those who had quit smoking within the past 10 years had instead continued to smoke. The estimated prevalence of overweight for this group was 15.7 percentage points lower for men and 10.3 percentage points for women. Furthermore, if all current smokers had quit smoking within the past 10 years, the estimated prevalence of overweight was 14.2 percentage points higher for men and 8.9 percentage points higher for women. Because of this, the authors attribute the increase in prevalence of overweight partially to smoking cessation. The authors conclude that smoking cessation accounts for a small portion of the recent increase in overweight prevalence, being a quarter of the increase among men and a sixth among women. However, as in the previous study, the limitations of this study are in the nature of the data. The smoking statuses of the respondents are self-reported. Furthermore, respondents were required to list their current weights as well as from 10 years ago. This is very inaccurate way of obtaining data as your weight from a decade ago is very hard to estimate properly.

A study by Todeschini et al. (2010) is the most recent literature in examining the effects of smoking cessation on BMI and obesity. They mainly use BRFSS data like Chou et al. (2004) and Gruber and Frakes (2006) to obtain BMI data. The data set also includes demographic and economic status variables, as well as alcohol and tobacco consumption information. The authors use the Bureau of Labor for the state unemployment rates, consumer price index, food price, and number of fast food restaurants. They also take into account state regulation regarding tobacco use from 1970 to 2007. They examine the effects of quitting smoking over the time period of the data set on the individual's weight.

The authors replicate the models from Gruber and Frakes (2006) and Chou et al. (2004) with their own data. They find that the Gruber and Frakes (2006) correlation that BMI decreased with increases in tobacco prices is now insignificant using the 1985-2007 waves. When quitting smoking is included as one of the determinants of BMI in the Chou et al. (2004) model, cigarette taxes are no longer significant, but quitting smoking is.

Todeschini et al. (2010) find that smokers gain significant weight upon quitting smoking. A 10% decrease in the incidence of smoking leads to an average gain of 2.3 to 3 pounds. Furthermore, marginally reducing the number cigarettes that a person smokes does not significantly affect weight. Therefore, the authors conclude, that the weight gain associated with the cessation of smoking results through the extensive margin of the substitution effect, and not from the intensive margin (Todeschini et al. 2010). Furthermore, smoking cessation significantly affects the weights of only men and not women. Smoking cessation also increases the odds of becoming overweight and obese, with the elasticity of quitting smoking to obesity being 0.58. They also find that many variables used in the previous studies such as food and alcohol prices have very minimal effects on BMI.

E. Moving Forward

There has been a discrepancy in the literature regarding whether or not rises in cigarette costs (prices and taxes) lead to an increase in overweight and obesity prevalence. Some literature has shown so, while other literature shows the contrary. There seems to be a consistency in literature, however, regarding that cessation of smoking leads to an increase in overweight and obesity prevalence. Both types of literature make the assumption that smoking rates decrease with increases in prices, and obviously with smoking cessation, and hence increase obesity rates. However there are other factors that have been causing smoking rates to decrease, such as the anti-smoking campaign. Although rising cigarette costs are a result of the anti-smoking campaign, the majority of the time their revenues are not put into anti-smoking programs. In fact, some states put none of the rising cigarette taxes collected into anti-smoking programs. Anti-smoking programs portray to the public the harmful effects of smoking and provide many resources to help smokers quit. Hence if antismoking programs are effectively helping reduce the smoking rates, there is a chance that they are unintentionally increasing obesity rates. This paper intends to test this relationship.

CHAPTER THREE

ECONOMETRIC MODEL

This chapter presents the econometric model used in this analysis as well as a description of the source data from the BRFSS data sets (2000-2010), the Campaign for Tobacco-Free Kids 2011 Annual Report, the U.S. Bureau of Labor, and the U.S. Census Bureau.

A. Econometric Model

The following econometric models were used in this study to examine the effects of the antismoking campaign on obesity prevalence:

Model I: BMI = β0 + β1MALE + β2AGE + β3MARRIED + β4WIDOWED + β5SEPARATED + β6DIVORCED + β7UNMAR_COUPLE + β8BLACK + β9HISPANIC + β10MULTIRACIAL + β11OTHER + β12HI_SCH + β13SOME_COL + β14MORE_COL + β15INC_10K20K + β16INC_20K35K + β17INC_35K50K + β18INC_50K75K + β19INC_MORE75K + β20UNEMP + β21CPRICE + β22ANTISMOK + β23YEAR + β24STATE + Ɛ

Model II: OBESE = β0 + β1MALE + β2AGE + β3MARRIED + β4WIDOWED + β5SEPARATED + β6DIVORCED + β7UNMAR_COUPLE + β8BLACK + β9HISPANIC + β10MULTIRACIAL + β11OTHER + β12HI_SCH + β13SOME_COL + β14MORE_COL + β15INC_10K20K + β16INC_20K35K + β17INC_35K50K + β18INC_50K75K + β19INC_MORE75K + β20UNEMP + β21CPRICE + β22ANTISMOK + β23YEAR + β24STATE + Ɛ

Model III: SMOKER = β0 + β1MALE + β2AGE + β3MARRIED + β4WIDOWED + β5SEPARATED + β6DIVORCED + β7UNMAR_COUPLE + β8BLACK + β9HISPANIC + β10MULTIRACIAL + β11OTHER + β12HI_SCH + β13SOME_COL + β14MORE_COL + β15INC_10K20K + β16INC_20K35K + β17INC_35K50K + β18INC_50K75K + β19INC_MORE75K + β20UNEMP + β21CPRICE + β22ANTISMOK + β23YEAR + β24STATE + Ɛ

Model IV: EXERCISER = $\beta0 + \beta1MALE + \beta2AGE + \beta3MARRIED + \beta4WIDOWED + \beta5SEPARATED + \beta6DIVORCED + \beta7UNMAR\_COUPLE + \beta8BLACK + \beta9HISPANIC + \beta10MULTIRACIAL + \beta11OTHER + \beta12HI\_SCH + \beta13SOME\_COL + \beta14MORE\_COL + \beta15INC\_10K20K + \beta16INC\_20K35K + \beta17INC\_35K50K + \beta18INC\_50K75K + \beta19INC\_MORE75K + \beta20UNEMP + \beta21CPRICE + \beta22ANTISMOK + \beta23YEAR + \beta24STATE + \varepsilon$

Model V: FRTSERV = $\beta0 + \beta1MALE + \beta2AGE + \beta3MARRIED + \beta4WIDOWED + \beta5SEPARATED + \beta6DIVORCED + \beta7UNMAR\_COUPLE + \beta8BLACK + \beta9HISPANIC + \beta10MULTIRACIAL + \beta11OTHER + \beta12HI\_SCH + \beta13SOME\_COL + \beta14MORE\_COL + \beta15INC\_10K20K + \beta16INC\_20K35K + \beta17INC\_35K50K + \beta18INC\_50K75K + \beta19INC\_MORE75K + \beta20UNEMP + \beta21CPRICE + \beta22ANTISMOK + \beta23YEAR + \beta24STATE + \varepsilon$
where ε is the error term.

Table A: Definitions of dependent and independent variables used in econometric models of this study

Dependent Variables	
BMI	BMI of the individual
OBESE	Dichotomous variable that equals 1 if the individual is obese
SMOKER	Dichotomous variable that equals 1 if the individual currently smokes (Only takes into account those individuals who have smoked at least 100 cigarettes in their lifetime.)
EXERCISER	Dichotomous variable that equals 1 if the individual has been involved in physical activity over the past month other than their work
FRTSERV	Number of fruits and vegetables servings per day consumed by the individual
Independent Variables	
MALE	Dichotomous variable that equals 1 if the individual is male
AGE	Age of the respondent
MARRIED	Dichotomous variable that equals 1 if the individual is married
WIDOWED	Dichotomous variable that equals 1 if the individual is widowed
SEPARATED	Dichotomous variable that equals 1 if the individual is separated
DIVORCED	Dichotomous variable that equals 1 if the individual is divorced
UNMAR_COUPLE	Dichotomous variable that equals 1 if the individual is part of an unmarried couple
NEV_MAR*	Dichotomous variable that equals 1 if the individual has never married
WHITE*	Dichotomous variable that equals 1 if the individual is white
BLACK	Dichotomous variable that equals 1 if the individual is black
HISPANIC	Dichotomous variable that equals 1 if the individual is Hispanic
MULTIRACIAL	Dichotomous variable that equals 1 if the individual is multiracial
OTHER	Dichotomous variable that equals 1 if the individual is of any other race
LESS_HI*	Dichotomous variable that equals 1 if the individual has not completed high school
HI_SCH	Dichotomous variable that equals 1 if the individual is a high school graduate or has a GED, but has no further education
SOME_COL	Dichotomous variable that equals 1 if the individual has completed some years of college but less than four years

MORE_COL	Dichotomous variable that equals 1 if the individual has completed four years of college or has some post-college education
INC_LESS10K*	Dichotomous variable that equals 1 if the individual's annual income is less than $10,000
INC_10K20K	Dichotomous variable that equals 1 if the individual's annual income is between $10,000 and $20,000
INC_20K35K	Dichotomous variable that equals 1 if the individual's annual income is between $20,000 and $35,000
INC_35K50K	Dichotomous variable that equals 1 if the individual's annual income is between $35,000 and $50,000
INC_50K75K	Dichotomous variable that equals 1 if the individual's annual income is between $50,000 and $75,000
INC_MORE75K	Dichotomous variable that equals 1 if the individual's annual income is greater than $75,0000
UNEMP	Unemployment rate in respondent's state
CPRICE	Average cigarette price in respondent's state
ANTISMOK	Per-capita antismoking expenditure of the individual's state
YEAR	Year dummy variables for years 2000-2010
STATE	State dummy variables for all 50 states (plus the District of Colombia)

* Indicates variables dropped when regressing models to avoid perfect multicollinearity.

B. Dependent Variables

The purpose of this study is to examine the effects of the antismoking campaign on the prevalence of obesity. As described in the previous sections, overweight and obesity trends are affected by numerous variables. Furthermore, whether an individual is obese or not depends on his or her BMI (a BMI of 30 or greater is indicative of obesity). Thus BMI is the dependent variable in the first econometric model. The second econometric model uses a dichotomous variable OBESE to test the probability that an individual will be obese based on all the independent variables.

Furthermore, additional models are run (Models III, IV, and V) to test the effectiveness of the antismoking campaign. Courtemanche (2009), one of the more recent studies, finds that rising cigarette costs are correlated with a long-term reduction in BMI and obesity. He further states that this relationship holds as people make healthier eating and exercise decisions after a rise in cigarette prices. Thus, these models are run to test this relationship as well as the effects of antismoking expenditures on adopting healthier lifestyles. The effectiveness of the antismoking campaign expenditures and cigarette prices are directly tested on the individual's smoking status (as the dependent variable) – whether or not that individual is currently a smoker. Likewise, the individual's exercise status is also treated as a dependent variable, as well as the number of fruits and vegetables servings consumed per day. If people who quit smoking tend to adopt healthier lifestyles, then rises in cigarette prices and antismoking expenditures should lead to increase in both fruits and vegetables consumption and exercise status.

C. Independent Variables

The BMI of an individual, and whether or not that individual is obese, can be affected by several variables. Many physical and societal characteristics of the individual play roles in affecting an individual's BMI. Gender plays a role as more females than males tend to be obese (Chou et al. 2004). With age, metabolism decreases, leading to increased weight. Marital status can also play a role. Single individuals may be more inclined to stay in shape to look more attractive as they may be looking for a partner. Married individuals, on the other hand, may not take this into account, as they no longer care as much for their appearance, and thus may have higher BMIs. The same can be applied for divorced and widowed individuals, with widowed persons having higher BMIs than divorced persons (Chou et al. 2004).

Lastly, race also plays a role in metabolism, as certain races tend to be more obese than others. According to Chou et al. (2004), Blacks and Hispanics are more likely to be overweight and obese. Certain races are also more susceptible to certain diseases that tend to lead to direct weight gain or more sedentary lifestyles that in turn lead to weight gain.

Education levels can also have a significant impact on BMI. Less educated people tend to adopt less healthy lifestyles, as they are not as educated on eating healthy and staying fit. They may not be properly educated on the harmful consequences of such lifestyles.

Annual household incomes and state unemployment rates can also influence BMI. People with low incomes and without jobs are more likely to be overweight and obese, as they tend to adopt less healthy lifestyles. They tend to live in areas that have less access to gyms and other fitness centers. Furthermore, they may not be able to afford such services. Lower income people may also tend to eat cheaper, more fattening fast foods more often.

Cigarette prices can also affect obesity rates taking into account that smokers may view cigarettes and food items as substitutes. Higher cigarette prices may influence more smokers to quit, causing their BMIs to increase. Furthermore, higher cigarette prices may deter people from even initiating the habit of smoking, eliminating any potential negative effects on weight the smoking may have caused. Although cigarette taxes have also shown to affect BMI, and in some studies, have had the opposite effect on BMI as cigarette prices did, once lagged variables are taken into account, they both have the same effect on BMI as shown in Courtemanche

(2009). Thus, only one cigarette cost variable is included in this study, as lagged variables will be taken into account in this study as well. Furthermore, cigarette prices are majorly inclusive of cigarette taxes, and consumers mainly base their decision on whether or not to buy cigarettes after viewing their prices, and not so much their taxes. For this reason, cigarette taxes are not included in this model.

The main focus of the independent variables in this study, however, is the states' antismoking campaign expenditures. As discussed previously, there is a possible correlation between antismoking and obesity prevalence given the opposite polarities of their trends over the past few decades. This coincides with the biological standpoint between smoking cessation and weight gain and the economic perspective of the substitution of cigarette smoking and food consumption. Thus, higher expenditures fueling the antismoking campaign may influence smokers to quit, leading to higher individual BMIs and higher obesity prevalence. Furthermore, because antismoking expenditures are in millions of dollars, they have been converted to per capita dollars for the models used in this study.

D. Regression Analysis Method

The data for the econometric model for each variable is observed every year from 2000-2010 at an individual level. Each state and year will be included as dummy variables in the model. Ordinary least squares (OLS) regressions are carried out for all models in this study. Results are weighted to the population weight.

CHAPTER FOUR

SELECTING THE SAMPLE FROM MULTIPLE DATA SOURCES

This chapter describes the data sources used in this study – CDC's Behavioral Risk Factor Surveillance System (BRFSS), the Campaign for Tobacco-Free Kids 2011 Annual Report, The Tax Burden on Tobacco, Volume 45, 2010, and the Bureau of Labor Statistics. It then presents the descriptive statistics for the data set samples.

A. Overview of the Center for Disease Control and Prevention Behavioral Risk Factor Surveillance System

The majority of the data in this study comes from CDC's Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is the largest telephone health survey system in the world that has been tracking health conditions and risk behaviors primarily related to chronic disease, injury, and preventable infectious diseases in adult populations by interviewing over 350,000 every year, monthly, since 1984 in all 50 states of the U.S., the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam. The survey provides demographic, economic, and societal status variables as well for each respondent. Data are collected from random sample of adults only aged 18 years or older. All states have been participating in the survey since 1995.

B. Overview of The Campaign for Tobacco-Free Kids 2011 Annual Report

The Campaign for Tobacco-Free Kids is one of the largest promoting institutions of the antismoking campaign in the U.S. Their mission is to reduce tobacco use around the world by promoting public policies to prevent the youth from smoking, helping smokers quit and protect the general public from the harms of secondhand smoke. Their annual reports summarize their progress from the previous year. The '2011 Annual Report: Leadership by Design' has antismoking expenditures for all states from 2000-2011.

C. Overview of the Tax Burden on Tobacco, Volume 45, 2010

The Tax Burden on Tobacco is a report on tobacco revenue and industry statistics that has been annually released since 1949. Having been first produced by the Virginia-based Tobacco Tax Council, it is now produced by the economic consulting firm Orzechowski and Walker. The publication contains historical yearly data on the tobacco industry for all states, including federal, state, and local tobacco taxes, state cigarette taxes, state cigarette prices, etc.

D. Overview of the Bureau of Labor Statistics

The Bureau of Labor Statistics of the U.S. Department of Labor is a national statistical agency that collects and organizes data such as measures of labor market activity, working conditions, and price changes in the economy. Data is disseminated to the public, the U.S. Congress, other Federal agencies, state and local governments, and businesses. Examples of data made readily available for the public are those of inflation and prices, unemployment, productivity, pays and benefits, etc.

E. Selection of the Sample and Descriptive Statistics

The sample from the BRFSS data set used in this paper contains 2,962,615 observations for the years 2000-2010 across from all 50 states plus the District of Columbia. Table 1 (p 53) shows the summarized descriptive statistics from the BRFSS data set. Displayed are all the dependent variables and independent from the BRFSS used in the models of this study.

The average BMI of the respondents was 27.4 and 26.3% of the respondents were obese. 40.8% of the respondents who had smoked at least 100 cigarettes over their lifetime were still current smokers (Note that this is much higher than the percentage of the total population that are current smokers). 71.7% of the respondents were involved in some physical activity over the past month other than their work. The average number of fruits and vegetables servings consumed per day by the respondents was 3.68 (the variable for fruits and vegetables consumption was not available for the years 2004, 2006, 2008, and 2010).

About 41% of the respondents were male. The average age of the respondents was approximately 52 years. 56.1% of the respondents were married, 11.5% were widowed, 2.3% were separated, 14.6% were divorced, 2.47% were part of an unmarried couple, and 13.0% were never married. 80.3% of the respondents were white, 7.7% were black, 5.6% were Hispanic, 1.9% was multiracial, and 4.0% were of other race. 29.8% of the respondents had only completed high school while 9.1% had not even completed high school. 27.1% had some college education but did not complete it and 33.9% had at least completed college and perhaps received further education. 42.8% of the respondents had annual household incomes under $35,000, 16.7% had incomes between $35,000 and $50,000, 16.8% had incomes between $50,000 and $75,000, and 23.7% had incomes greater than $75,000.

The other independent variables (antismoking campaign expenditures, cigarette prices, and unemployment rates) were state-level measures collected from sources outside the BRFSS – the Campaign for Tobacco-Free Kids 2011 Annual Report, The Tax Burden on Tobacco, Volume 45, 2010, and The Bureau of Labor Statistics. Each variable was collected for all states and time periods and then merged together. This sample contains 561 observations. The descriptive statistics for this data set are shown in Table 2 (p 54).

The average antismoking expenditure per capita by all states over the eleven-year period was $3.04, with a standard deviation of $2.93. Thus, there is a wide spread distribution of how much states spend on antismoking programs. Furthermore, a closer look at the data shows that this variation does not only exist widely from state to state, as some states do not spend anything at all on antismoking programs while other states spend as high as $18.64 per capita, but also from year to year for a particular state. The average cigarette prices were $5.15 and the average unemployment rate was 5.8%. All dollar figures were adjusted for inflation to 2010 dollars.

CHAPTER FIVE

ESTIMATION RESULTS: QUANTIFYING THE EFFECTS OF THE ANTISMOKING CAMPAIGN ON BMI AND OBESITY

This chapter presents the regression results and analysis of the econometric models described in Chapter Three. First, the effects of the antismoking campaign on BMI and the probability of being obese are quantified. The same regressions are then taken into account with lagged variables for antismoking expenditures and cigarette prices. Lastly, the effect of the antismoking campaign on healthier lifestyle is quantified, again with and without lagged variables.

A. The Effects of Cigarette Prices and Antismoking Expenditures on BMI and Obesity

Table 3 (p 55) shows the regression results for Model I and Model II without lagged variables, examining the effects of antismoking campaign expenditures on BMI and the probability of being obese. Column 1 of Table 3 shows the regression results with BMI as the dependent variable and Column 2 shows the regression results with OBESE as the dependent variable. Antismoking expenditure is positively correlated with BMI, but the effect is insignificant. Antismoking expenditure shows no effects on the probability of being obese. Likewise cigarette prices are positively correlated with both BMI and the probability of being obese, but the effects are insignificant as well. Thus, these results suggest that current antismoking expenditures and cigarette prices have no effect on BMI or obesity.

Because current antismoking expenditures and cigarette prices showed insignificant effects, lagged variables for these were included in the models to examine if these variables have any long term effects, as it takes time for people to adjust and bring change to their habitual lifestyles; past cigarette prices and past antismoking expenditures may have effects on current BMI. Tables 4 (p 56) and 5 (p 58) shows the regressions of Models I and II, respectively, with lagged variables. For both tables, Column 1 has only one-year lagged variables for both antismoking expenditures and cigarette prices, Column 2 has one- and two-year lagged variables, Column 3 has one- to three-year lagged variables, Column 4 has one- to four-year lagged variables, Column 5 has one- to five-year lagged variables, and Column 6 has only 5-year lagged variables.

When taking into account lagged variables, cigarette prices show significant effects on BMI (Table 4). One-year lagged cigarette prices are significant at the 10% level and increase BMI by 0.044 for every one-dollar increase in prices (Column 1). When two-year lagged cigarette prices are also included (Column 2), the effect of cigarette prices is stronger, increasing BMI by 0.054, and also being significant at the 10% level. Furthermore, when one-, two-, and three-year lagged variables are all included (Column 3), then only one-year lagged cigarette prices show significant effects at the 10% level, increasing BMI by 0.056. When just five-years lagged prices are included (Column 6), however, effects again become insignificant. Despite the effects on BMI, even when taking into account lagged variables for cigarette prices, the results remain insignificant on the probability of being obese (Table 5). Hence, rises in cigarette prices may cause people to reduce or quit smoking, increasing their BMI, but not to the extent that they may become obese.

These results are generally inline with Baum (2009), who also shows that when lagged cigarette prices are taken into account, a rise in cigarette prices leads to a rise in BMI. However, Baum (2009) gets significant results even without lagged variables, as opposed to this study. Furthermore, Baum's coefficients for BMI are much stronger and significant. These differences are probably due to the fact that Baum (2009) had both a treatment and comparison group in his study, with the treatment group being only those people who had smoked at least 100 cigarettes in their lifetime. Thus, the chances of those people being smokers is greater, and hence, the effects of cigarette prices on them would be larger, based on the notion that smokers who quit tend to gain more weight due to a decline in metabolism. However, the results from this study are in complete opposition to in Courtemanche (2009), which finds a negative correlation between cigarette prices and BMI.

The effects of antismoking expenditures also become significant when lagged. When one-, two-, and three-year lagged variables are regressed, the effects of one-year lagged antismoking expenditures per capita are significant at the 5% level and increase BMI by 0.020 for every one-dollar increase in per capita antismoking expenditure. Like with cigarette prices, when only five-year lagged expenditures are included, the effects on BMI become insignificant. Furthermore, unlike cigarette prices, lagged antismoking expenditures have significant effects on the probability of being obese, at the 1% level. When one-, two-, and three-year lagged antismoking expenditures are included, one-year lagged expenditures increase the probability of being obese by 0.002 for every dollar increase in per-capita spending (Column 3 of Table 5). Because these effects are insignificant for cigarette prices but significant for antismoking expenditures, it shows that the antismoking expenditures may affect BMI to an extent beyond what cigarette prices can – to the extent of not just increasing BMI, but increasing the chances of becoming obese, which is constituted by a BMI of 30 or greater. Thus, only including cigarette costs in these models, as in previous studies, may not fully capture the factors that cause people to reduce or quit smoking, inducing changes in their BMIs. Furthermore, testing the effects of antismoking expenditures on a treatment group, like discussed above for cigarette prices, may increase the magnitude of the coefficients.

The significant effects of the lagged variables described above indicate that current cigarette prices and antismoking expenditures do not carry on significant effects on causing people to reduce or quit smoking (and hence causing their BMIs to increase) until after one year. Thus, current BMI would depend on cigarette prices and antismoking programs from at least one year ago, and not current prices and programs. This is plausible as people do not quit smoking right away. Rather they need time to adjust their smoking habits to reduce it or even quit it. Furthermore, the effects are short-term and only carry on for one year, as mainly only the one-year lagged variables in the regressions are significant and not the longer lagged variables. There are some plausible explanations for this. One is that the effects of cigarette price raises and antismoking programs continually need to be advocated as their effects soon become mitigated. A rise in cigarette prices may deter people from smoking because of economical reasons, but after a certain time, in this case a year, they may be able to adjust to those price increases, and hence the effect on BMI from reducing or quitting smoking goes away. Likewise, in the case of antismoking, people continually need to be made aware of the harmful effects of smoking. A graphical depiction on ad advertisement or billboard may deter somebody from smoking at first, but they may then become desensitized to it, and thus it may no longer have an effect on them. Another possibility is that during the early stages of smoking cessation, people crave for food more in place of cigarettes, and thus tend to gain weight. Furthermore, because fast food and cigarettes are substitutes for some smokers, they may start eating more fast food, causing weight gain. These people may then be able to adjust to their new lifestyles of not smoking throughout the cessation process, mitigating the increased cave food and its effects on BMI. On the other hand, some may even go back to smoking after some time, which would also negate the initial effects of quitting smoking on BMI.

B. The Effects of Other Independent Variables on BMI and Obesity

The other independent variables from Models I and II are also significantly related to BMI and obesity (at the 1% level) (Table 3), except for UNEMP and WIDOWED. The results are mainly inline with the previous literature. Being male increases BMI by 0.954 and increases the probability of being obese by 0.015. BMI also increases with every year of age by 0.022, as metabolism decreases with age. Being married also increases BMI by 1.060 and the probability of being obese by 0.055. This is true as married individuals are not looking for partners and thus care less about their physical appearance. The same is true for separated and divorced individuals and unmarried couples, and their coefficients are very similar as well. These variables are in comparison to those never married individuals; this variable was dropped to avoid multicollinearity. Being black increases BMI by 1.932 and increases the probability of being obese by 0.116, in relation to white people. Hispanics also have higher BMIs than whites as shown. Being from other races on the other hand decreases BMI by 0.825 and the probability of being obese by 0.047. These results show that race does play a factor in an individual's BMI. Education is also shown to play a role. The coefficients show that in relation to those individual who had not completed high school (the variables LESS_HI has been dropped), as education years increase, BMI decreases. Being a high school graduate decreases BMI by 0.142, having some college education decreases BMI by 0.151, and being a college graduate or having more education decreases BMI by 1.028. Being of the final category also decreases the probability of being obese by 0.077. Thus, as people are more educated, they are less likely to be overweight and obese, as they may be more aware of their health and of the harmful consequences of not controlling weight and keeping an unhealthy lifestyle. Income follows the same trend; as income increases, BMI decreases, as shown by the segmented income variables. In relation to those who earn less than $10,000 per year, earning between $20,000 and $35,000 decreases BMI by 0.563, and earning more than $75,000 decreases BMI by 1.088 and the probability of being obese by 0.070. This agrees with the notion that people with greater incomes are more likely to have access to gyms, fitness centers, and other mean to control their weight. Furthermore, the less wealthy people may tend to eat cheaper unhealthier types of food, which would cause weight gain. Based on this, unemployment was hypothesized to lead to increases in BMI and obesity. However, the coefficients are not significant.

C. The Effects of Rising Cigarette Prices and the Antismoking Campaign on Healthier Lifestyle Choices

Literature, such as Gruber and Frakes (2006) and Courtemanche (2009), that finds the opposite correlation to that found in this study, between cigarette costs and BMI and obesity – that increased cigarette costs lower BMI and obesity rates – state that this negative correlation is plausible as people who quit smoking also tend to adopt healthier lifestyles. Thus, they will not just quit smoking, but they will now also be more aware in other aspects of their health such as eating and exercising. Hence, cigarette prices which may induce smoking cessation or reduction may cause BMI to increase, but this effect will be overshadowed by the adopting of healthier lifestyles, which will in turn lower BMI. Hence, the theory holds that cigarette costs lead to a long-term reduction in BMI and obesity. To test this assumption, Models III, IV, and V, as described in Chapter Three, are regressed to quantify the effects of cigarette prices and antismoking campaign expenditures on life-style factors of the individuals as dependent variables. The dependent variables for Models III, IV, and V, respectively, are smoking status of the individual as in whether or not he or she is a current smoker (variable SMOKER), the exercising status of the individual as in whether or not that individual has been taking part in any physical activity over the past 30 days other than their work (variable EXERCISER), and the daily consumption of fruits and vegetables by the individual (variable FRTSERV).

Tables 6 (p 60) and 7 (p 62) show the regression results for Model III (SMOKER as the dependent variable). Column 1 of Table 6 shows the regression without any lagged variables for cigarette prices and antismoking expenditures, Column 2 shows the regression with only one-year lagged variables, Column 3 shows the regression with one- and two-years lagged variables, Column 4 shows the regression with one- to three-years lagged variables, and Column 5 shows the regression with one- to four-year lagged variables. Column 1 of Table 7 shows the regression with one- to five-years lagged variables and Column 2 shows the regression with only five-year lagged variables. Tables 8 (p 64) and 9 (p 66) and Tables 10 (p 68) and 11 (p 70) follow the same format for Models IV and V, respectively.

i. The Effects of Rising Cigarette Prices and the Antismoking Campaign on Current Smoking Status.

The SMOKER dependent variable takes into account only those individuals who have smoked at least 100 cigarettes in their lifetime. Only current cigarette prices significantly affect whether the individual is a current smoker or not (Table 6). Current cigarette prices are significant at the 1% level and decrease the probability of the individual being a smoker by 0.007 for each one-dollar rise in prices (Column 1). When one-year lagged cigarette prices are included, current cigarette prices are still significant, but now at the 5% level, and decrease the probability of being a smoker by 0.006 (Column 2). However, the lagged cigarette prices are not significant. Furthermore, when greater lagged cigarette price variables are included (Columns 3-4 and Column 1 and 2 of Table 7), even the effects of current cigarette prices on determining whether the individual is a smoker also become insignificant. This shows that it is only the current cigarette prices that influence whether or not the individual is currently a smoker. Many people may not be smokers one year because of high cigarette prices but may be smokers the next year if cigarette prices fall, and vice-versa.

Unlike cigarette prices, both current and lagged antismoking expenditures affect whether the individual is a current smoker or not. Current antismoking expenditures are significant at the 10% level when no lagged antismoking expenditures are included, and decrease the probability of being a smoker by 0.001 for every one-dollar per capita increase in antismoking expenditure. However, when lagged antismoking expenditures are included, the effects of current antismoking expenditures become insignificant. When one-year lagged antismoking expenditures are included (Column 1 of Table 6), only the lagged value is significant at the 10% level, decreasing the probability of being obese by 0.001. When two- and three-year lagged variables are also included, the effects of one-year lagged antismoking expenditures become significant at the 5% level and decrease the probability of being a smoker by 0.002. Furthermore, when one- to five-year lagged variables are all included (Column 1 of Table 7), two-, four-, and five-year lagged antismoking expenditures all become significant at the 5% level and decrease the probability of being a smoker by 0.002. As compared to the effects of cigarette prices on the probability of being a smoker with only current prices decreasing the probability, these results show that the effects of the antismoking expenditures and campaign carry on over time. Hence, the antismoking campaign is more effective in deterring someone from becoming a smoker over the long run as opposed to just rising cigarette prices. Furthermore, because effects of current antismoking expenditures become insignificant once lagged expenditures are taken into account, the effects of the antismoking campaign are not sudden, like cigarette prices, but rather take time. For example, programs and services designed to help smokers quit do not work overnight, but rather the individual is helped over time to quit their smoking habits. This can even take years for some people.

ii. *The Effects of Rising Cigarette Prices and the Antismoking Campaign on Current Exercise Status.*

Current cigarette prices do not significantly affect whether or not the individual has been taking part in any physical activity (outside from their work) over the past month at all levels (Column 1 of Table 8, p 64). However, one-year lagged cigarette prices are significant at the 5% level when they are included (Column 2) and decrease the probability of the individual exercising by 0.006 for every one-dollar increase in cigarette prices. Furthermore, when two-and four-year lagged cigarette prices are included (Columns 3 and 5), one year-lagged cigarette prices become insignificant, and two-year lagged cigarette prices become significant at the 5% level and decrease the probability of exercising by 0.008. These results are in contrast with the assumption that people reducing or quitting smoking adopt healthier lifestyles that would cause BMI to decrease. This is again in contrast with Courtemanche (2009), which shows that a rise in cigarette prices increases exercise. Rather, according to the results here, a rise in cigarette prices decreases the probability of the individual exercising. This can be explained by the fact that when current smokers reduce or quit smoking, their metabolisms decrease. Thus, if a rise in cigarette prices is pushing smokers to quit, as shown in Model III, their decrease in metabolism may also decrease their ability to exercise.

Current antismoking expenditures also do not significantly affect whether the individual has been taking part in any physical activity over the past month at all significant levels. In contrast to cigarette prices, however, when multiple year lagged variables are included (Column 5 of Table 8 and Column 1 of Table 9, p 66), four-year lagged antismoking expenditures increase the probability of the individual exercising by 0.002, as opposed to decreasing it. However, this value is only significant at the 10% level, and there are not any lagged antismoking expenditure variables that are significant at any stronger significant levels.

iii. *The Effects of Rising Cigarette Prices and the Antismoking Campaign on Fruits and Vegetables Consumption*

Current cigarette prices do not significantly affect the daily number of fruits and vegetables consumed by the individual (Column 1 of Table 10, p 68). However, lagged cigarette prices do. When one-year lagged cigarette prices are included (Column 2), the effects are significant; a one-dollar increase in cigarette prices decreases daily fruits and vegetables consumption by 0.047. However, when more larger lagged variables are included, the results are ambiguous, showing lagged variables with both positive and negative effects on fruits and vegetables consumption. For example, when one- to four-year lagged variables are included, two-year lagged cigarette prices decrease fruits and vegetables consumption by 0.099 for every dollar increase in cigarette prices, while three-year lagged cigarette prices increase fruits and vegetable consumption by 0.097 for every dollar increase in cigarette prices, both being significant at the 5% level. Also, when five-year lagged variables are included (Table 11, p 70), two-year lagged cigarette prices decrease fruits and vegetables consumption by 0.152, while three-year lagged cigarette prices increase consumption by 0.184 for every dollar increase in cigarette price, both being significant at the 1% level.

Current antismoking expenditures also do not significantly affect fruits and vegetables consumption. Furthermore, the effects of lagged antismoking expenditures are contradicting, just like for lagged cigarette prices, with some variables showing positive significant effects and others showing negative significant effects.

The results for this set of regressions, with fruits and vegetables consumption as the dependent variable, are not conclusive in determining the direction of the effect of cigarette prices and antismoking expenditures on fruits and vegetables consumption. Furthermore, although a rise in cigarette prices decreases the probability that an individual is regularly exercising, as discussed above, this in itself is not substantial evidence to conclude that a rise in cigarette prices promotes unhealthier lifestyles. The evidence also does not favor the assumption made by the past literature, that people who quit smoking may adopt healthier lifestyles.

CHAPTER SIX

CONCLUSIONS

A. Summary of Findings

Using data from the BRFSS, The Campaign for Tobacco-Free Kids 2011 Annual Report, The Tax Burden on Tobacco, and The Bureau of Labor Statistics, this paper uses regression analysis to investigate the effects of the antismoking campaign on BMI and obesity levels throughout all 50 states (plus DC). Unlike previous studies that just took into account the effects of cigarette costs on BMI and obesity, this paper also includes state antismoking expenditures as a determinant as well.

The study finds that once lagged variables are taken into account, both cigarette prices and antismoking expenditures are significantly and positively correlated with BMI and obesity. Thus, the results are inline with the hypothesis that the antismoking campaign has been unintentionally contributing to the obesity epidemic. Moreover, the results from this study were not substantial in determining whether or not cigarette prices and the antismoking campaign promote healthier lifestyles, as put forth by previous studies.

B. Limitations of the Study

While the study finds that antismoking expenditures are positively correlated with BMI, the discrepancy between the positive correlation of cigarette prices on BMI found in this study and the negative correlation of cigarette prices on BMI found in Courtemanche (2009) raises some questions. It is not known how results would turn out if antismoking expenditures were included in Courtemanche's model.

There was also limitation in the availability of data. A very crucial determinant for BMI and obesity may in fact be state anti-obesity program expenditures, just like antismoking expenditures is a strong determinant for smoking status. However, this data is not available. Furthermore, the data available to test the assumption that the antismoking campaign may possibly be encouraging healthier lifestyle was also limited. The data for the same variables Courtemanche used to test the same hypothesis were not available from the BRFSS for the years used in this study. Hence, dichotomous variables for smoking and exercise had to be used instead of quantified variables as in the case of Courtemanche (2009). Furthermore, data on fat consumption was also not available as were for Courtemanche's years.

C. Policy Implications

Because the smoking epidemic has been subdued, but there has been a failure to do the same for the obesity epidemic, and because of the fact that obesity may soon overtake smoking as the number one preventable cause of death, state legislators need to make a push for a shift in focus. The antismoking campaign has been successful after millions of dollars, year after year, have been put in it. The same needs to be done for obesity. Furthermore, this study implies that the antismoking campaign, while being supremely successful on one end, is partially contributing to the obesity trend. Thus, some of the expenditures need to be shifted to combat obesity. There will be far greater benefit for the general health of the public and for the sake of controlling health care costs in this country if that is done so, as obesity has been shown to lead to a greater number as well as more expensive chronic health conditions than does smoking.

D. Suggestions for Further Research

It would be essential to examine which antismoking programs have been most effective and which have been least effective in reducing smoking prevalence, as there are a wide variety of such programs. To do so, expenditures on different antismoking programs could be regressed on BMI and obesity. This could give some insight to legislators as to where it would be most cost effective to shift some of the expenditures from the antismoking campaign to an anti-obesity campaign.

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Table 1: Descriptive statistics for variables obtained from the BRFSS.

VARIABLES	Mean	St. Dev.	Min.	Max.
bmi	27.401	5.838	4.780	99.998
obese	0.263	0.440	0	1
smoker	0.408	0.491	0	1
exerciser	0.717	0.450	0	1
frtserv	3.682	2.205	0	152.77
male	0.409	0.492	0	1
age	51.843	16.737	18	99
married	0.561	0.496	0	1
widowed	0.115	0.319	0	1
separated	0.023	0.150	0	1
divorced	0.146	0.353	0	1
unmar_couple	0.0247	0.155	0	1
nev_mar	0.130	0.336	0	1
white	0.803	0.398	0	1
black	0.077	0.266	0	1
hispanic	0.056	0.229	0	1
multiracial	0.019	0.135	0	1
other	0.040	0.196	0	1
less_hi	0.091	0.288	0	1
hi_sch	0.298	0.458	0	1
some_col	0.271	0.445	0	1
more_col	0.339	0.473	0	1
inc_less10k	0.054	0.225	0	1
inc_10k20k	0.140	0.347	0	1
inc_20k35k	0.234	0.423	0	1
inc_35k50k	0.167	0.373	0	1
inc50k75k	0.168	0.374	0	1
inc_more75k	0.237	0.425	0	1

*This data set contains 2,962,615 observations.
*The BMI maximum value of 99.998 does not refer to the code in the BRFSS codebook for a missing value. This is an actual measurement of BMI for a respondent. There are number of BMI measurements of over 90 for respondents in this dataset.
*The measure of 0.408 for the variables SMOKER does not refer to the entire population but rather only to those individuals who have smoked at least 100 cigarettes in their lifetime.
*The variable FRTSERV is not available for the years 2004, 2006, 2008, and 2010.

Table 2: Descriptive statistics for variables obtained from other sources.

VARIABLES	Mean	St. Dev.	Min.	Max.
antismok	3.043	2.932	0	18.639
cprice	5.146	1.054	3.517	10.061
unemp	5.819	2.181	2.300	14.900

*This data set contains 561 observations.

*This data set is compiled from the Campaign for Tobacco-Free Kids 2011 Annual Report, The Tax Burden on Tobacco, Volume 45, 2010, and the Bureau of Labor Statistics.

Table 3: Estimates for regressions that use BMI and dichotomous obese as dependent variables.

VARIABLES	(1) bmi	(2) obese
male	0.954***	0.015***
	(0.013)	(0.001)
age	0.022***	0.001***
	(0.000)	(0.000)
married	1.060***	0.055***
	(0.023)	(0.002)
widowed	-0.001	-0.003
	(0.033)	(0.002)
separated	1.089***	0.052***
	(0.054)	(0.004)
divorced	0.918***	0.047***
	(0.028)	(0.002)
unmar_couple	0.516***	0.020***
	(0.047)	(0.003)
black	1.932***	0.116***
	(0.026)	(0.002)
hispanic	0.709***	0.031***
	(0.031)	(0.002)
multiracial	0.381***	0.023***
	(0.055)	(0.004)
other	-0.825***	-0.047***
	(0.035)	(0.002)
hi_sch	-0.142***	-0.014***
	(0.030)	(0.002)
some_col	-0.151***	-0.016***
	(0.031)	(0.002)
more_col	-1.028***	-0.077***
	(0.031)	(0.002)
inc_10k20k	-0.246***	-0.012***
	(0.046)	(0.003)
inc_20k35k	-0.563***	-0.032***
	(0.044)	(0.003)
inc_35k50k	-0.567***	-0.035***
	(0.045)	(0.003)
inc_50k75k	-0.596***	-0.037***
	(0.045)	(0.003)
inc_more75k	-1.088***	-0.070***
	(0.045)	(0.003)
antismok	0.003	0.000
	(0.004)	(0.000)
cprice	0.020	0.001
	(0.019)	(0.001)
unemp	-0.010	-0.001
	(0.009)	(0.001)
Constant	25.501***	0.215***
	(0.100)	(0.007)
Observations	2,962,615	2,962,615
R-squared	0.047	0.027

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

Table 4: Estimates for regressions that use BMI as the dependent variable, with lagged variables for cigarette prices and antismoking expenditures.

VARIABLES	(1) bmi	(2) bmi	(3) bmi	(4) bmi	(5) bmi	(6) bmi
male	0.939***	0.930***	0.909***	0.905***	0.888***	0.888***
	(0.014)	(0.015)	(0.015)	(0.016)	(0.018)	(0.018)
age	0.022***	0.021***	0.020***	0.019***	0.019***	0.019***
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
married	1.055***	1.035***	1.030***	1.031***	1.020***	1.020***
	(0.025)	(0.026)	(0.028)	(0.030)	(0.033)	(0.033)
widowed	-0.012	-0.048	-0.072*	-0.087**	-0.118***	-0.118***
	(0.035)	(0.036)	(0.038)	(0.040)	(0.042)	(0.042)
separated	1.100***	1.064***	1.072***	1.074***	1.078***	1.078***
	(0.057)	(0.060)	(0.065)	(0.070)	(0.075)	(0.075)
divorced	0.901***	0.901***	0.919***	0.918***	0.916***	0.916***
	(0.030)	(0.032)	(0.034)	(0.036)	(0.040)	(0.040)
unmar_couple	0.500***	0.479***	0.480***	0.508***	0.511***	0.511***
	(0.049)	(0.052)	(0.055)	(0.059)	(0.065)	(0.065)
black	1.945***	1.941***	1.911***	1.897***	1.891***	1.891***
	(0.028)	(0.029)	(0.031)	(0.032)	(0.035)	(0.035)
hispanic	0.730***	0.722***	0.712***	0.715***	0.705***	0.704***
	(0.031)	(0.033)	(0.034)	(0.037)	(0.040)	(0.040)
multiracial	0.739***	0.756***	0.725***	0.708***	0.694***	0.694***
	(0.061)	(0.064)	(0.066)	(0.070)	(0.076)	(0.076)
other	-1.148***	-1.162***	-1.197***	-1.197***	-1.229***	-1.229***
	(0.035)	(0.036)	(0.038)	(0.041)	(0.044)	(0.044)
hi_sch	-0.092***	-0.090***	-0.071**	-0.050	-0.018	-0.017
	(0.032)	(0.033)	(0.035)	(0.038)	(0.041)	(0.041)
some_col	-0.086***	-0.061*	-0.026	0.009	0.049	0.049
	(0.032)	(0.034)	(0.036)	(0.039)	(0.042)	(0.042)
more_col	-0.973***	-0.971***	-0.954***	-0.928***	-0.891***	-0.890***
	(0.032)	(0.034)	(0.036)	(0.038)	(0.041)	(0.041)
inc_10k20k	-0.262***	-0.261***	-0.275***	-0.295***	-0.285***	-0.285***
	(0.049)	(0.052)	(0.055)	(0.059)	(0.065)	(0.065)
inc_20k35k	-0.575***	-0.586***	-0.617***	-0.637***	-0.644***	-0.644***
	(0.046)	(0.049)	(0.052)	(0.057)	(0.062)	(0.062)
inc_35k50k	-0.589***	-0.607***	-0.650***	-0.697***	-0.697***	-0.697***
	(0.047)	(0.050)	(0.053)	(0.058)	(0.064)	(0.064)
inc_50k75k	-0.599***	-0.615***	-0.655***	-0.688***	-0.694***	-0.694***
	(0.047)	(0.050)	(0.053)	(0.058)	(0.063)	(0.063)
inc_more75k	-1.097***	-1.114***	-1.166***	-1.215***	-1.240***	-1.240***
	(0.048)	(0.050)	(0.053)	(0.058)	(0.064)	(0.064)
antismok	0.003	0.002	-0.008	-0.007	-0.001	-0.002
	(0.006)	(0.007)	(0.008)	(0.009)	(0.010)	(0.009)
smoklag1	0.003	0.007	0.020**	0.009	0.008	
	(0.005)	(0.007)	(0.008)	(0.010)	(0.012)	

VARIABLES	(1) bmi	(2) bmi	(3) bmi	(4) bmi	(5) bmi	(6) bmi
smoklag2		-0.003	-0.005	0.000	-0.014	
		(0.006)	(0.008)	(0.008)	(0.010)	
cprice	-0.018	-0.017	-0.033	-0.022	-0.016	-0.015
	(0.023)	(0.025)	(0.026)	(0.028)	(0.030)	(0.026)
cpricelag1	0.044*	0.019	0.056*	0.032	0.037	
	(0.026)	(0.030)	(0.032)	(0.035)	(0.038)	
cpricelag2		0.054*	0.047	0.037	0.025	
		(0.029)	(0.035)	(0.039)	(0.043)	
unemp	-0.015	-0.009	-0.010	-0.006	0.002	-0.006
	(0.010)	(0.010)	(0.011)	(0.011)	(0.012)	(0.012)
smoklag3			0.005	0.005	0.006	
			(0.006)	(0.008)	(0.008)	
cpricelag3			0.034	0.054	0.058	
			(0.032)	(0.039)	(0.046)	
smoklag4				0.009	0.011	
				(0.007)	(0.009)	
cpricelag4				-0.036	-0.010	
				(0.034)	(0.043)	
smoklag5					0.000	0.004
					(0.007)	(0.006)
cpricelag5					-0.028	-0.040
					(0.038)	(0.031)
Constant	26.157***	26.082***	26.452***	26.192***	26.602***	27.229***
	(0.132)	(0.164)	(0.241)	(0.249)	(0.364)	(0.247)
Observations	2,813,943	2,647,090	2,449,399	2,235,583	1,988,820	1,988,820
R-squared	0.047	0.046	0.045	0.044	0.043	0.043

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

Table 5: Estimates for regressions that use dichotomous obese as the dependent variable, with lagged variables for cigarette prices and antismoking expenditures.

VARIABLES	(1) obese	(2) obese	(3) obese	(4) obese	(5) obese	(6) obese
male	0.016***	0.016***	0.017***	0.017***	0.018***	0.018***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
age	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
married	0.055***	0.054***	0.054***	0.055***	0.055***	0.055***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
widowed	-0.004	-0.005*	-0.006**	-0.005*	-0.006*	-0.006*
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
separated	0.053***	0.052***	0.054***	0.055***	0.058***	0.058***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.006)	(0.006)
divorced	0.046***	0.047***	0.048***	0.049***	0.050***	0.050***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
unmar_couple	0.019***	0.017***	0.017***	0.018***	0.019***	0.019***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
black	0.117***	0.117***	0.115***	0.115***	0.115***	0.115***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
hispanic	0.032***	0.032***	0.033***	0.033***	0.034***	0.034***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
multiracial	0.043***	0.044***	0.043***	0.040***	0.039***	0.039***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
other	-0.065***	-0.067***	-0.070***	-0.069***	-0.072***	-0.072***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
hi_sch	-0.010***	-0.010***	-0.009***	-0.007***	-0.005*	-0.005*
	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
some_col	-0.011***	-0.009***	-0.008***	-0.006**	-0.003	-0.003
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
more_col	-0.075***	-0.074***	-0.074***	-0.073***	-0.071***	-0.071***
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
inc_10k20k	-0.012***	-0.012***	-0.011***	-0.011***	-0.011**	-0.011**
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
inc_20k35k	-0.031***	-0.031***	-0.032***	-0.032***	-0.032***	-0.032***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
inc_35k50k	-0.035***	-0.035***	-0.036***	-0.037***	-0.036***	-0.036***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
inc_50k75k	-0.036***	-0.035***	-0.035***	-0.035***	-0.034***	-0.034***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
inc_more75k	-0.069***	-0.068***	-0.069***	-0.070***	-0.071***	-0.071***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
antismok	0.000	0.000	-0.000	-0.000	0.000	0.001
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
smoklag1	0.000	0.001	0.002***	0.001	0.001	
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	
smoklag2		-0.000	-0.001	-0.000	-0.001	

VARIABLES	(1) obese	(2) obese	(3) obese	(4) obese	(5) obese	(6) obese
		(0.000)	(0.001)	(0.001)	(0.001)	
cprice	-0.002	-0.002	-0.003	-0.002	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
cpricelag1	0.001	0.001	0.004	0.002	0.002	
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	
cpricelag2		0.001	0.001	0.002	-0.000	
		(0.002)	(0.003)	(0.003)	(0.003)	
unemp	-0.001	-0.001	-0.001	-0.001	-0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
smoklag3			0.000	0.001	0.001	
			(0.000)	(0.001)	(0.001)	
cpricelag3			0.001	0.002	0.005	
			(0.002)	(0.003)	(0.003)	
smoklag4				0.000	0.000	
				(0.001)	(0.001)	
cpricelag4				-0.002	-0.001	
				(0.003)	(0.003)	
smoklag5					0.000	0.000
					(0.001)	(0.000)
cpricelag5					0.000	-0.000
					(0.003)	(0.002)
Constant	0.267***	0.268***	0.288***	0.263***	0.276***	0.310***
	(0.010)	(0.012)	(0.018)	(0.019)	(0.027)	(0.018)
Observations	2,813,943	2,647,090	2,449,399	2,235,583	1,988,820	1,988,820
R-squared	0.028	0.027	0.027	0.026	0.026	0.026

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

Table 6: Estimates for regressions that use dichotomous smoker as the dependent variable, with lagged variables for cigarette prices and antismoking expenditures for up to four years.

VARIABLES	(1) smoker	(2) smoker	(3) smoker	(4) smoker	(5) smoker
male	-0.009***	-0.008***	-0.007***	-0.008***	-0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
age	-0.010***	-0.010***	-0.010***	-0.010***	-0.010***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
married	-0.104***	-0.107***	-0.107***	-0.109***	-0.112***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
widowed	-0.036***	-0.037***	-0.040***	-0.044***	-0.046***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
separated	0.048***	0.047***	0.048***	0.045***	0.045***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
divorced	0.033***	0.031***	0.031***	0.029***	0.026***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
unmar_couple	-0.015***	-0.016***	-0.019***	-0.022***	-0.023***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)
black	0.039***	0.041***	0.042***	0.045***	0.042***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
hispanic	-0.062***	-0.062***	-0.065***	-0.065***	-0.065***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
multiracial	0.057***	0.059***	0.056***	0.055***	0.051***
	(0.006)	(0.006)	(0.007)	(0.007)	(0.008)
other	0.033***	0.045***	0.045***	0.041***	0.038***
	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
hi_sch	-0.033***	-0.034***	-0.034***	-0.034***	-0.036***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
some_col	-0.077***	-0.078***	-0.078***	-0.078***	-0.079***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
more_col	-0.170***	-0.171***	-0.171***	-0.172***	-0.174***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
inc_10k20k	-0.022***	-0.022***	-0.024***	-0.024***	-0.022***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
inc_20k35k	-0.047***	-0.047***	-0.050***	-0.051***	-0.051***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
inc_35k50k	-0.071***	-0.071***	-0.074***	-0.077***	-0.077***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
inc_50k75k	-0.102***	-0.103***	-0.106***	-0.107***	-0.110***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
inc_more75k	-0.147***	-0.147***	-0.152***	-0.154***	-0.155***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
antismok	-0.001*	-0.001	-0.000	-0.001	-0.002
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
smoklag1		-0.001*	-0.002**	-0.002**	-0.002
		(0.001)	(0.001)	(0.001)	(0.001)
cprice	-0.007***	-0.006**	-0.004	-0.004	-0.005

VARIABLES	(1) smoker	(2) smoker	(3) smoker	(4) smoker	(5) smoker
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
cpricelag1		0.002	0.001	0.001	-0.000
		(0.003)	(0.004)	(0.004)	(0.004)
unemp	-0.003***	-0.003***	-0.003**	-0.003***	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
smoklag2			0.000	-0.001	0.000
			(0.001)	(0.001)	(0.001)
cpricelag2			0.003	0.002	-0.000
			(0.003)	(0.004)	(0.004)
smoklag3				0.001	0.001
				(0.001)	(0.001)
cpricelag3				-0.001	-0.003
				(0.004)	(0.004)
smoklag4					-0.001
					(0.001)
cpricelag4					0.001
					(0.004)
Constant	1.205***	1.205***	1.178***	1.201***	1.230***
	(0.011)	(0.018)	(0.019)	(0.027)	(0.033)
Observations	1,414,189	1,342,549	1,260,130	1,163,750	1,059,170
R-squared	0.184	0.184	0.185	0.186	0.186

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

Table 7: Estimates for regressions that use the dichotomous smoker as the dependent variable, with lagged variables for cigarette prices and antismoking expenditures for five years.

VARIABLES	(1) smoker	(2) smoker
male	-0.007***	-0.007***
	(0.002)	(0.002)
age	-0.009***	-0.009***
	(0.000)	(0.000)
married	-0.112***	-0.112***
	(0.004)	(0.004)
widowed	-0.050***	-0.050***
	(0.005)	(0.005)
separated	0.049***	0.049***
	(0.007)	(0.007)
divorced	0.023***	0.023***
	(0.004)	(0.004)
unmar_couple	-0.022***	-0.022***
	(0.007)	(0.007)
black	0.040***	0.040***
	(0.004)	(0.004)
hispanic	-0.066***	-0.066***
	(0.005)	(0.005)
multiracial	0.050***	0.050***
	(0.008)	(0.008)
other	0.038***	0.038***
	(0.006)	(0.006)
hi_sch	-0.035***	-0.035***
	(0.004)	(0.004)
some_col	-0.079***	-0.079***
	(0.004)	(0.004)
more_col	-0.172***	-0.172***
	(0.004)	(0.004)
inc_10k20k	-0.022***	-0.022***
	(0.005)	(0.005)
inc_20k35k	-0.052***	-0.052***
	(0.005)	(0.005)
inc_35k50k	-0.079***	-0.079***
	(0.006)	(0.006)
inc_50k75k	-0.113***	-0.113***
	(0.006)	(0.006)
inc_more75k	-0.159***	-0.159***
	(0.006)	(0.006)
antismok	-0.002	-0.002**
	(0.001)	(0.001)
smoklag1	-0.002*	
	(0.001)	
smoklag2	0.002**	
	(0.001)	
smoklag3	0.001	
	(0.001)	
smoklag4	-0.002**	
	(0.001)	
smoklag5	0.002**	0.001*
	(0.001)	(0.001)
cprice	-0.002	-0.003
	(0.003)	(0.003)
cpricelag1	0.000	
	(0.004)	
cpricelag2	0.000	
	(0.005)	
cpricelag3	0.002	
	(0.005)	
cpricelag4	0.002	
	(0.005)	
cpricelag5	0.002	0.003

VARIABLES	(1) smoker	(2) smoker
	(0.004)	(0.004)
unemp	-0.003**	-0.003**
	(0.001)	(0.001)
Constant	1.174***	1.198***
	(0.036)	(0.023)
Observations	942,249	942,249
R-squared	0.184	0.184

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

Table 8: Estimates for regressions that use dichotomous exerciser as the dependent variable, with lagged variables for cigarette prices and antismoking expenditures for up to four years

VARIABLES	(1) exerciser	(2) exerciser	(3) exerciser	(4) exerciser	(5) exerciser
male	0.030***	0.031***	0.031***	0.031***	0.031***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
age	-0.002***	-0.002***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
married	-0.033***	-0.030***	-0.028***	-0.025***	-0.025***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
widowed	-0.033***	-0.032***	-0.029***	-0.029***	-0.030***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
separated	-0.045***	-0.046***	-0.048***	-0.051***	-0.055***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
divorced	-0.038***	-0.037***	-0.036***	-0.037***	-0.038***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
unmar_couple	-0.011**	-0.011**	-0.010**	-0.010*	-0.012**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
black	-0.037***	-0.038***	-0.037***	-0.035***	-0.032***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
hispanic	-0.038***	-0.039***	-0.038***	-0.035***	-0.034***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
multiracial	-0.011**	-0.005	-0.005	-0.004	0.002
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
other	-0.045***	-0.036***	-0.035***	-0.034***	-0.035***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
hi_sch	0.072***	0.069***	0.068***	0.065***	0.062***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
some_col	0.138***	0.135***	0.132***	0.128***	0.123***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
more_col	0.190***	0.187***	0.184***	0.182***	0.177***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
inc_10k20k	0.032***	0.034***	0.034***	0.035***	0.035***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
inc_20k35k	0.088***	0.090***	0.089***	0.091***	0.092***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
inc_35k50k	0.130***	0.132***	0.132***	0.132***	0.132***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
inc_50k75k	0.157***	0.159***	0.159***	0.157***	0.157***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
inc_more75k	0.197***	0.199***	0.199***	0.197***	0.198***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
antismok	-0.000	0.000	0.001	0.001	0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
smoklag1		0.000	0.000	0.000	0.000
		(0.001)	(0.001)	(0.001)	(0.001)
cprice	-0.003	-0.000	0.001	0.001	0.001

VARIABLES	(1) exerciser	(2) exerciser	(3) exerciser	(4) exerciser	(5) exerciser
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
cpricelag1		-0.006**	-0.001	-0.001	0.002
		(0.003)	(0.003)	(0.003)	(0.004)
unemp	0.002**	0.002**	0.002	0.002	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
smoklag2			-0.001	-0.000	-0.000
			(0.001)	(0.001)	(0.001)
cpricelag2			-0.008**	-0.007*	-0.008**
			(0.003)	(0.004)	(0.004)
smoklag3				-0.000	-0.001
				(0.001)	(0.001)
cpricelag3				-0.001	-0.002
				(0.003)	(0.004)
smoklag4					0.001*
					(0.001)
cpricelag4					0.001
					(0.004)
Constant	0.590***	0.604***	0.631***	0.611***	0.601***
	(0.011)	(0.017)	(0.018)	(0.026)	(0.031)
Observations	1,414,189	1,342,549	1,260,130	1,163,750	1,059,170
R-squared	0.075	0.075	0.075	0.073	0.072

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

Table 9: Estimates for regressions that use dichotomous exerciser as the dependent variable, with lagged variables for cigarette prices and antismoking expenditures for five years.

VARIABLES	(1) exerciser	(2) exerciser
male	0.032***	0.032***
	(0.002)	(0.002)
age	-0.002***	-0.002***
	(0.000)	(0.000)
married	-0.024***	-0.024***
	(0.003)	(0.003)
widowed	-0.030***	-0.030***
	(0.004)	(0.004)
separated	-0.057***	-0.057***
	(0.008)	(0.008)
divorced	-0.039***	-0.039***
	(0.004)	(0.004)
unmar_couple	-0.010	-0.010
	(0.006)	(0.006)
black	-0.030***	-0.030***
	(0.004)	(0.004)
hispanic	-0.031***	-0.031***
	(0.005)	(0.005)
multiracial	0.006	0.006
	(0.007)	(0.007)
other	-0.034***	-0.034***
	(0.006)	(0.006)
hi_sch	0.060***	0.059***
	(0.004)	(0.004)
some_col	0.120***	0.120***
	(0.004)	(0.004)
more_col	0.176***	0.176***
	(0.004)	(0.004)
inc_10k20k	0.031***	0.031***
	(0.006)	(0.006)
inc_20k35k	0.085***	0.085***
	(0.006)	(0.006)
inc_35k50k	0.125***	0.126***
	(0.006)	(0.006)
inc_50k75k	0.152***	0.152***
	(0.006)	(0.006)
inc_more75k	0.192***	0.192***
	(0.006)	(0.006)
antismok	0.001	0.001
	(0.001)	(0.001)
smoklag1	-0.001	
	(0.001)	
smoklag2	0.001	
	(0.001)	
smoklag3	-0.001	
	(0.001)	
smoklag4	0.002*	
	(0.001)	
smoklag5	-0.001	-0.000
	(0.001)	(0.001)
cprice	0.002	0.001
	(0.003)	(0.003)
cpricelag1	-0.001	
	(0.004)	
cpricelag2	-0.008*	
	(0.005)	
cpricelag3	-0.005	
	(0.005)	
cpricelag4	0.001	
	(0.005)	
cpricelag5	-0.004	-0.002

VARIABLES	(1) exerciser	(2) exerciser
	(0.004)	(0.003)
unemp	0.001	0.002
	(0.001)	(0.001)
Constant	0.680***	0.612***
	(0.034)	(0.022)
Observations	942,249	942,249
R-squared	0.072	0.072

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

Table 10: Estimates for regressions that use daily consumption of fruits and vegetables as the dependent variable, with lagged variables for cigarette prices and antismoking expenditures for up to four years.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	frtserv	frtserv	frtserv	frtserv	frtserv
male	-0.443***	-0.449***	-0.447***	-0.445***	-0.424***
	(0.011)	(0.011)	(0.012)	(0.013)	(0.015)
age	0.012***	0.011***	0.010***	0.010***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
married	-0.034	-0.027	-0.033	-0.062**	-0.076**
	(0.021)	(0.023)	(0.024)	(0.027)	(0.033)
widowed	-0.082***	-0.082***	-0.092***	-0.100***	-0.114***
	(0.026)	(0.028)	(0.029)	(0.032)	(0.038)
separated	-0.120***	-0.148***	-0.151***	-0.174***	-0.217***
	(0.039)	(0.042)	(0.042)	(0.048)	(0.058)
divorced	-0.229***	-0.226***	-0.229***	-0.258***	-0.291***
	(0.023)	(0.025)	(0.026)	(0.030)	(0.036)
unmar_couple	0.095**	0.101**	0.097**	0.039	-0.001
	(0.038)	(0.042)	(0.043)	(0.047)	(0.057)
black	0.056**	0.062**	0.066***	0.063**	0.071**
	(0.023)	(0.025)	(0.025)	(0.028)	(0.032)
hispanic	0.127***	0.114***	0.115***	0.099***	0.101**
	(0.032)	(0.032)	(0.032)	(0.036)	(0.043)
multiracial	0.226***	0.294***	0.297***	0.299***	0.301***
	(0.044)	(0.051)	(0.052)	(0.059)	(0.070)
other	0.121***	0.173***	0.173***	0.141***	0.133**
	(0.035)	(0.040)	(0.041)	(0.046)	(0.055)
hi_sch	0.135***	0.124***	0.129***	0.127***	0.129***
	(0.021)	(0.023)	(0.023)	(0.027)	(0.032)
some_col	0.397***	0.385***	0.390***	0.396***	0.401***
	(0.021)	(0.023)	(0.023)	(0.026)	(0.031)
more_col	0.718***	0.718***	0.724***	0.729***	0.741***
	(0.022)	(0.025)	(0.025)	(0.028)	(0.033)
inc_10k20k	0.092***	0.104***	0.100***	0.097**	0.092*
	(0.032)	(0.035)	(0.036)	(0.041)	(0.051)
inc_20k35k	0.161***	0.164***	0.162***	0.159***	0.139***
	(0.030)	(0.032)	(0.033)	(0.037)	(0.045)
inc_35k50k	0.185***	0.194***	0.192***	0.189***	0.169***
	(0.031)	(0.034)	(0.035)	(0.039)	(0.049)
inc_50k75k	0.210***	0.221***	0.220***	0.235***	0.227***
	(0.031)	(0.033)	(0.034)	(0.038)	(0.047)
inc_more75k	0.303***	0.307***	0.308***	0.313***	0.288***
	(0.032)	(0.035)	(0.036)	(0.040)	(0.048)
antismok	-0.002	-0.002	-0.002	-0.002	-0.005
	(0.003)	(0.005)	(0.005)	(0.006)	(0.009)
smoklag1		-0.002	-0.005	-0.006	-0.003
		(0.004)	(0.006)	(0.007)	(0.012)
cprice	-0.022	0.014	0.013	0.027	0.008

VARIABLES	(1) frtserv	(2) frtserv	(3) frtserv	(4) frtserv	(5) frtserv
	(0.017)	(0.021)	(0.023)	(0.025)	(0.032)
cpricelag1		-0.047**	-0.042	-0.045	0.000
		(0.023)	(0.029)	(0.036)	(0.048)
unemp	-0.014*	-0.012	-0.006	0.000	0.013
	(0.007)	(0.008)	(0.008)	(0.009)	(0.011)
smoklag2			0.008	-0.004	-0.013
			(0.005)	(0.007)	(0.009)
cpricelag2			-0.013	-0.066*	-0.099**
			(0.027)	(0.037)	(0.046)
smoklag3				0.012**	0.011
				(0.006)	(0.008)
cpricelag3				0.060*	0.097**
				(0.032)	(0.049)
smoklag4					-0.008
					(0.007)
cpricelag4					-0.008
					(0.036)
Constant	3.088***	3.378***	3.151***	3.017***	3.000***
	(0.084)	(0.116)	(0.149)	(0.201)	(0.294)
Observations	757,034	685,394	669,396	573,016	468,436
R-squared	0.041	0.040	0.040	0.039	0.037

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

Table 11: Estimates for regressions that use daily consumption of fruits and vegetables as the dependent variable, with lagged variables for cigarette prices and antismoking expenditures for five years.

VARIABLES	(1) frtserv	(2) frtserv
male	-0.424***	-0.424***
	(0.015)	(0.015)
age	0.009***	0.009***
	(0.001)	(0.001)
married	-0.076**	-0.076**
	(0.033)	(0.033)
widowed	-0.114***	-0.114***
	(0.038)	(0.038)
separated	-0.217***	-0.218***
	(0.058)	(0.058)
divorced	-0.291***	-0.291***
	(0.036)	(0.036)
unmar_couple	-0.001	-0.002
	(0.057)	(0.057)
black	0.071**	0.071**
	(0.032)	(0.032)
hispanic	0.102**	0.100**
	(0.043)	(0.043)
multiracial	0.302***	0.302***
	(0.070)	(0.070)
other	0.133**	0.133**
	(0.055)	(0.055)
hi_sch	0.129***	0.129***
	(0.032)	(0.032)
some_col	0.401***	0.401***
	(0.031)	(0.031)
more_col	0.741***	0.741***
	(0.033)	(0.033)
inc_10k20k	0.091*	0.092*
	(0.051)	(0.051)
inc_20k35k	0.138***	0.139***
	(0.045)	(0.045)
inc_35k50k	0.168***	0.169***
	(0.049)	(0.049)
inc_50k75k	0.227***	0.228***
	(0.047)	(0.047)
inc_more75k	0.288***	0.288***
	(0.048)	(0.048)
antismok	-0.007	-0.011
	(0.009)	(0.007)
smoklag1	0.006	
	(0.012)	
smoklag2	-0.024**	
	(0.010)	
smoklag3	0.022**	
	(0.009)	
smoklag4	-0.023**	
	(0.010)	
smoklag5	0.015*	0.001
	(0.008)	(0.005)
cprice	-0.018	0.008
	(0.034)	(0.027)
cpricelag1	0.071	
	(0.055)	
cpricelag2	-0.152***	
	(0.053)	
cpricelag3	0.184***	
	(0.062)	
cpricelag4	-0.148**	
	(0.062)	
cpricelag5	0.142**	0.048

VARIABLES	(1) frtserv	(2) frtserv
	(0.057)	(0.032)
unemp	0.017	0.021*
	(0.011)	(0.011)
Constant	2.580***	2.713***
	(0.301)	(0.199)
Observations	468,436	468,436
R-squared	0.037	0.037

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