

Essays on Economic Determinants of Weight Outcomes

Essay One: The Effects of the Food Stamp Program and the Minimum Wage on Obesity
Essay Two: The Effects of Fast Food Television Advertising on Obesity

by

In Kyu Kim

**A dissertation submitted to the Graduate Faculty in Economics
in partial fulfillment of the requirements for the degree of
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Abstract

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Advisor: Professor Michael Grossman

This dissertation is motivated by the dramatic increase in the prevalence of obesity in the United States since 1980. According to the 1999 – 2000 National Health and Nutrition Examination Survey, 64 percent of U.S. adults are either overweight or obese. Moreover, the percentage of the population classified as obese has more than doubled since 1980. This dissertation focuses on the impacts of policies that increase resources available to low-income households and on the impact of fast food advertising on weight outcomes. It consists of two essays.

The first essay investigates the effects of two important programs, the Food Stamp Program and the minimum wage, on obesity in low-income households. Results indicate that FSP participation curves the prevalence of obesity in the United States, while the state minimum wage has no causal effect on obesity. The effects of the Food Stamp Program on obesity in low-income households are large compared to the corresponding effects in non-low-income households. Evidence from the Behavioral Risk Factors Surveillance Survey (BRFSS) between 1993 and 2002 (a time series of state cross sections) contradicts the hypotheses that the body mass index and the prevalence of obesity are positively related to FSP participation or to minimum wage levels. These

findings control for a variety of demographic characteristics, food prices, and state and year fixed effects. As a result of this study, my conclusion is that the increase in Food Stamp Program monthly benefits reduces the risks of obesity participating for low-income households.

The second essay attempts to examine the effects of television advertising for fast food restaurants on weight outcomes among television watching populations using the Behavioral Risk Factors Surveillance Survey (BRFSS). The units of analysis are Designated Market Area (DMA). As defined by Competitive Media Reporting (CMR), a DMA consists of the counties which make up a city's television viewing area with a high degree of economic and social integration through television. The data are arranged as pooled cross section and times series and include observations from 1996 through 1999 because the advertising measures are limited to that period. These measures were obtained from Competitive Media Reporting and pertain to spot television advertising for fast food restaurants. This essay investigates the impacts of the number of advertisements aired on body mass index (BMI) and obesity. The positive effects of fast food television advertising are small but significant.

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Essay One

The Effects of the Food Stamp Program and the Minimum Wage on Obesity

1. Introduction

The Food Stamp Program (FSP) and minimum wage legislation have been used as instruments to eliminate poverty by policy makers for many years. As one of 15 food and nutrition programs,¹ FSP is the largest federally-funded food assistance program in the United States. This program provides poor people with credits used only for food purchases. The Food Stamp Act of 1977 states that the Food Stamp Program is intended to permit low-income households to obtain a more nutritious diet by increasing their purchasing power. To be eligible for food stamps, financial and non-financial factors are considered. In terms of financial aspect, households should have gross incomes below 130 percent of the Federal poverty guidelines,² while they must have net incomes below 100 percent of the poverty guidelines to be eligible. With reference to non-financial phase, households have up to \$2,000 in countable assets.³ The minimum wage also has been used in lowering poverty since the minimum wage legislation was enacted in 1938.⁴ This is another federal policy which helps low-income households.

Although the common purpose of these programs is to reduce hunger and poverty, these two federal programs have been suspected of driving up the rates of obesity among

¹ Food Stamp Program, Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), WIC Farmers Market Nutrition Program, National School Lunch Program, School Breakfast Program, Summer Food Service Program, Emergency Food Assistance Program, Commodity Supplemental Food Program, Special Milk Program, Food Distribution Program for the Elderly, Commodity Distribution to Charitable Institutions and to Soup Kitchens and Food Banks, Nutrition Education and Training (FSE&T) Program, and Nutrition Assistance Program in Puerto Rico and the Northern Mariana Islands

² The Federal poverty guidelines mean minimum income requirements to use, are issued each year in the Federal Registrar by the Department of Health and Human Services (HHS) and determine financial eligibility for certain federal programs. Alaska and Hawaii have different values of the federal poverty guidelines. The federal poverty guidelines depend on household size.

³ If there is a member age 60 or older in the household, the maximum countable assets will be \$3,000. In this study the non-financial aspect is disregarded for choosing the persons who are eligible for the Food Stamp Program because limited availability of the data used.

⁴ The Fair Labor Standards Act (FLSA)

low-income households, those with incomes below the poverty guideline because the rate of obesity for low-income households is larger than that of non-low-income households. The third National Health and Nutrition Examination Survey (NHANES) conducted, between 1999 and 2000, shows that 65 percent of U.S. adults are either overweight or obese.

Obesity is measured by the body mass index (BMI), which is defined as weight in kilograms divided by height in meters squared (kg/m^2). A BMI of 30 and above is classified as obese, and a value between 25 and 29.9 is labeled overweight. The percentage of the population classified as obese has more than doubled since 1980. The Surgeon General stipulates that overweight and obese people are at risk for heart disease, certain types of cancer, type 2 diabetes, strokes, arthritis, breathing problems, and psychological disorders, such as depression.⁵ As heart disease is the leading cause of death in the United States,⁶ obesity is considered as the most serious health problem in the United States.

Even though the FSP and minimum wage are very helpful in eliminating food scarcity and poverty for low-income households, Douglas J. Besharov raises questions about whether federal policies and programs are unintentionally contributing to obesity problems.

Today, the central nutritional problem facing the poor – indeed, all Americans – is not too little food, but too much of the wrong food in that direction. But despite a striking increase in obesity among the needy, federal feeding

⁵ Office of the Surgeon General, U.S. Public Health Service, U.S. Department of Health and Human Services

⁶ National Vital Report

*programs still operate under their nearly half-century-old objective of increasing food consumption.*⁷

He points out that overconsumption of food in low-income households is the main cause of obesity. However, this argument is controversial.

This paper is organized as follows. In Section 2, I provide a brief review of relevant studies that examine the relationship between the FSP or the minimum wage and weight outcomes. In Section 3 I use a simple economic model based on health production function and set up some channels and hypotheses. Also, I discuss econometric models to examine the effects of the FSP and the minimum wage on weight outcomes. In Section 4 I describe the data used in this paper and show descriptive statistics. Finally, the empirical results are represented in Section 5.

2. Background

The relationship between the Food Stamp Program (FSP) or the minimum wage and obesity is complex. In this paper I consider the effects of FSP participation and FSP monthly benefits on obesity levels. There is little literature to examine the relationship between FSP participation and obesity.

Townsend et al. (2001) examine the relationship between the FSP and overweight using data from the nationally representative 1994 – 1996 Continuing Survey of Food Intakes by Individuals (CSFII). They classify three different groups: severely insecure

⁷ This is cited from the article which appeared in The Washington Post, December 8, 2002.

women, mildly insecure women, and secure women. They use a logistic regression model with controlling food insecurity, ethnicity, age, education, welfare status, occupation, urbanization, household size and lifestyle variables such as vigorous exercise and hours spent watching television or videotapes. They find a significant, positive relationship between Food Stamp Program participation and overweight for women, but not for men.

Gibson (2001) use the National Longitudinal Survey of Youth 1997 (NLSY97) with 9,022 youths to examine the effect of Food Stamp program participation on health for youths aged 12 – 18. One of health variables as dependent variables is overweight or obese. Independent variables are Food Stamp participation, income, poverty history, family structure, health insurance, other youth traits like age, gender, whether puberty has begun, and race. She uses a logit model and find that the relationship between FSP participation and obesity for youths is not significant.

Gibson (2002) studies the relationship between FSP and obesity for adults using the National Longitudinal Survey of Youth 1979 (NLSY79) with ages 20 to 40. To estimate the demand for health with obesity and body mass index (BMI), reduced-form models using the ordinary least square (OLS) regressions are used. Outcome variables are body mass index and obesity. FSP participation and Aid to Families with Dependent Children (AFDC) participation, family income, family size, marital status, education, and family characteristics that are expected to affect obesity comprised the control variables. Using these models she finds significant, positive effects for current and long-term FSP participation among low-income women in individual fixed effect model, but not for low-income married men.

The evidence for children and women strongly supports the view that Food Stamp Program participation leads to a prevalence of obesity. The relationship between FSP participation and obesity is more ambiguous for adult men and women. It is important in this context to examine the endogenous characteristics of FSP participation. Fortunately, a considerable body of literature has arisen that investigates the determinants of FSP participation. Fraker (1990) review a number of influencing factors: administrative hassles, ignorance regarding eligibility, lack of need, physical access problems, and the low value of the monthly benefit. He also emphasizes household characteristics and the value of the benefit as reasons why an eligible person does not participate in the program. He draws the following conclusions: (1) relatively high education reduces FSP participation, (2) eligible persons in older age brackets have lower participation rates, (3) increases in the size of benefits result in greater participation in the program. Many studies place central emphasis on the last of these three factors. None of these studies, however, go on to investigate the relationship between FSP monthly benefits and obesity.

The relationship between the minimum wage and obesity is equally unaddressed by these studies. An increase in the minimum wage might affect obesity through a corresponding change in fast food consumption habits. Card and Krueger (1994) find that an increased minimum wage raises prices of meals at fast-food restaurants in a survey of 410 fast-food restaurants in New Jersey and eastern Pennsylvania. Lee et al. (2000) also find that increasing the minimum wage increase overall food prices. The findings suggest that the increased prices of fast food that resulted from a raise in the minimum wage might lead to the reduction in consumption of fast food. It follows, then, that obesity levels would be improved by a decrease in the consumption of fast food.

3. Economic Model and Empirical Specification

The Simple Economic Model

The purpose of this study is to examine how an increase of food consumption through food stamps affects health outcomes with regard to obesity. To take into account the effect of FSP participation or the change of FSP monthly benefits on obesity, two simple economic theories can be used.

In order to determine the economic effects of FSP participation, consider the simple model for consumer maximization. Suppose that an individual maximizes his utility with his given tastes or preferences. The individual has the following utility function

$$(1) \quad U = U(HF, FF, C)$$

$$(2) \quad \text{subject to } HF \cdot P_{HF} + FF \cdot P_{FF} + C \cdot P_C = I$$

HF stands for consumption of home food, FF consumption of fast food, and C consumption of other non-food goods. P_{HF} , P_{FF} , and P_C are the prices of home food, fast food, and other non-food goods, respectively. I is the consumer's income. Assume that fast food goods represent the numeraire. Solving this consumer's problem using the Lagrange multiplier method, the following demand functions for home food and non-food goods can be obtained.

$$(3) \quad D_{HF} = D\left(\frac{P_{HF}}{P_{FF}}, \frac{P_C}{P_{FF}}, \frac{I}{P_{FF}}\right) \text{ and } D_C = D\left(\frac{P_{HF}}{P_{FF}}, \frac{P_C}{P_{FF}}, \frac{I}{P_{FF}}\right)$$

If the individual participates in the Food Stamp Program, the individual's consumption rates between home food and non-food goods change. FSP participation produces two

economic effects. First, FSP monthly benefits shift the budget constraint upward so that individuals can potentially buy more subsidized home food and non-food goods. Second, the shape of the new budget constraint is kinked at the subsidy level because the individual can buy only authorized home food goods. Graphically, these effects are shown in Figure 1. The question of whether food stamps leave an individual worse off is not treated in this paper. Demand for food depends on the relative price of home food compared with fast food, other goods, and income. The relative price of home food is negatively associated with consumption.

Suppose that an individual's improved health increases his satisfaction. The individual faces the following consumer problem:

$$(4) \quad U = U(HF, FF, C, H)$$

H represents the individual's health. Let the production of individual health by the household be described by the following household production function.

$$(5) \quad H = H(HF, FF, C, X, \eta)$$

X stands for health inputs which do not increase utility other than through their effects on H. η represents uncontrollable health endowments such as genetic endowment or environmental factors. Budget constraint is as follows:

$$(6) \quad HF \cdot P_{HF} + FF \cdot P_{FF} + C \cdot P_C + X \cdot P_X = I$$

Assume that X is the same for all individuals.⁸

$$U = U(HF, FF, C, H)$$

$$HF \cdot P_{HF} + FF \cdot P_{FF} + C \cdot P_C = I$$

⁸ X does not affect the determination of health outcome.

If other non-food goods can be used as a numeraire, the household's reduced-form demand functions for goods are derived as follows:

$$(7) \quad D_{HF} = D\left(\frac{P_{HF}}{P_C}, \frac{P_{FF}}{P_C}, \frac{I}{P_C}, \eta\right)$$

$$D_{FF} = D\left(\frac{P_{FF}}{P_C}, \frac{P_{HF}}{P_C}, \frac{I}{P_C}, \eta\right)$$

Then, the reduced-form demand function for the health outcome can be written as follows:

$$(8) \quad H = H\left(\frac{P_{HF}}{P_C}, \frac{P_{FF}}{P_C}, \frac{I}{P_C}, \eta\right)^9$$

Hypothesized Causal Relationship

Using FSP monthly benefits, FSP participants, minimum wages, food prices, and income, the following possible channels can link the Food Stamp Program with obesity. The hypothesized causal effects on obesity are summarized in Table 1.

FSP Benefits and Obesity

The monthly benefit for eligible persons is an important factor in determining whether a person participates in the Food Stamp Program. Prior studies have shown that higher FSP monthly benefits lead to a higher FSP participation rate among eligible people. Consumption of home food increases as a result of FSP participation. A participant might experience two different effects: dietary or nutritional effect and overconsumption effect. The goals of FSP are to provide low-income households with

⁹ The effect of the relative price of fast food (or home food) with home food (or fast food) on obesity is negative. $\left(\frac{\partial H}{\partial(P_{FF}/P_C)} < 0 \text{ and } \frac{\partial H}{\partial(P_{HF}/P_C)} < 0\right)$

more food and to improve the nutritional quality of recipients' diet. FSP provides the recipients with more consumption on home food. An increased consumption of home food has beneficial nutritional effects because home food contains more nutritional nutrients than fast food. Increasing home food consumption for low-income households, then, plays role in curving the risk of obesity. The monthly benefit would thus seem to have a positive effect in reducing obesity. The second effect is the overconsumption effect. If a participant has already consumed the proper level of home food, a further increase of home food may lead to overconsumption, or excessive food consumption. This, in turn, could counter the positive effects of monthly benefits on obesity. If the nutritional or dietary effect outweighs the overconsumption effect, overall obesity rates would be reduced. This is the central hypothesis of this study. Moreover, low-income households have a larger impact on obesity rates than non-low-income households because FSP, and the accompanying issue of home food and fast food, is mostly an issue for low-income households.

Food Stamp Program Participation

Food Stamp Program recipients can be considered as resource-constrained persons. They are more likely to participate in the program. People who participate in the program are likely to eliminate food insecurity and hunger. In terms of food insecurity, low-income households can be classified as extremely food insecure, moderately food insecure and food secure. FSP participation and obesity is therefore interpreted in the context of food insecurity and obesity.¹⁰ For food secure people, food stamps give rise to excessive consumption of home food. However, people with food security may not

¹⁰ Frongillo, Edward A. "Understanding Obesity and Program Participation in the Context of Poverty and Food Insecurity." *The Journal of Nutrition* 133, pp. 2117 – 2118, Jul 2003.

participate in the program because they put more value on other activities. In general FSP participation reduces the risk of obesity because FSP recipients may suffer severe malnourishment. My hypothesis is that Food Stamp Program participation reduces the risk of obesity. In addition, the effects of FSP participation are more profound in low-income households than non-low-income households.

Minimum Wages and Obesity

An increase of the minimum wage leads to the increase of real income resources. A change in the minimum wage affects obesity rates differently between low-income and non-low-income households in terms of food choices. For low-income households an increase of income resulting from an increased minimum wage often results in an increase in consumption of nonhealthful products such as alcohol, cigarettes, and fast food rather than nutritional home food. A rise in the minimum wage is thus often connected to a rise in the consumption on fast food. The hypothesized causal effect of an increase in the minimum wage on obesity is therefore positive for low-income households. By contrast, increased income resources give rise to an increase of consumption of nutritional home food for non-low-income households. In this case, an increase in the minimum wage results in the reduction in rates of obesity. The hypothesized effects, then, on rising rates of obesity, are positive for low-income households and negative for non-low-income households.

Food Price and Obesity

Economic theory states that an increase in food prices causes a reduction of food consumption. In other words, the relationship between food price and obesity is negative based on the law of demand. The increased price of home food or fast food curbs

consumption of both types of food. Lower prices of home food or fast food result in higher levels of consumption for both home food and fast food. Therefore, the negative effects of food price on obesity comprise a major hypothesis of this study.

Income and Obesity

Income has different effects on obesity rates. Chou et al. (2002) allow for a nonlinear effect of household income and find negative effects on obesity rates. However, expected income effects could be modified to incorporate at low levels of income if low-income people weighed more than their recommended weight. Lakdawalla and Philipson (2002) make this argument. An increase of income leads to higher levels of real resources. The effect of an increased income on obesity is equivalent to the effect of an increase in the minimum wage. Therefore, income may have positive effects on obesity rates for low-income households and negative effects for non-low-income households.

Empirical Strategies

The primary goal of the empirical analysis is to investigate both the impacts of the Food Stamp Program benefits on participants and the minimum wage rate on obesity levels. To do this, I aggregate individual observations obtained from the Behavioral Risk Factor Surveillance System (BRFSS) between 1993 and 2002 to establish state-specific weight-adjusted and demographic variables. I also use the panel model without time and state fixed effects as the baseline models. The panel data used in this paper consists of the set of state-specific regressors and the set of state-specific dependant variables. My basic regression equation is expressed as follows:

$$(9) \quad Y_{st} = FSP_{st} \delta + MW_{st} \phi + P_{st} \rho + X_{st} \beta + e_{st}$$

where s indexes states, t indexes time periods, Y is a state-specific body mass index, or the percentage of obesity, FSP is the monthly benefit or the monthly average number of FSP participants, MW is the level of individual state minimum wage, P is the relative price of fast food compared to food at home, and X is a set of demographical variables. I run the regressions separately for low-income and non-low-income households, thereby allowing for a variation of coefficients between income categories. Time and state fixed effects are added to the baseline model.

$$(10) \quad Y_{st} = FSP_{st}\delta + MW_{st}\phi + P_{st}\rho + X_{st}\beta + \gamma_t + \psi_s + e_{st}$$

In the time and state fixed effects model, I use the vector of time dummy variables, γ , to absorb unobserved period-specific factors affecting body mass index or a state-year-specific obesity rate. This model assumes that γ has the same effect on the mean response for every state. In other words, γ is a spatial-invariant and it accounts for any year-specific effect that is not included in the regression. It is either called the time effect or time heterogeneity. The parameter, ψ_s , encompasses all unobserved, time-constant factors that affect body mass index or obesity rates. ψ_s represents the unobserved state fixed effect: it shows all factors affecting the body mass index or obesity percentages that do not change over time. Characteristics for each state differ greatly across the United States in terms of climate, lifestyles, political features, and so on. The dummy variable for each state is generated in order to control for these state heterogeneities. A variety of state-level characteristics are expected to affect the body mass index and the obesity percentage variables.

4. Data

The analyses in this paper are based on a set of data that are collected from diverse sources: Behavioral Risk Factor Surveillance System (BRFSS), State Minimum Wages, Food Stamp Program, ACCRA Price Index, and the Federal poverty guidelines. This section summarizes the data sets that are used in this paper. There are missing variables for some years due to data limitations. After I collect all the individual data from BRFSS, I aggregate the individual data. Because of variables missing from the ACCRA Price Index the balanced panel data cannot be constructed. Also some states do not have information for certain years in the BRFSS data set. I exclude State Maine in my study because of the unavailability of data for that state in ACCRA data. California, the District of Columbia, Hawaii, New Hampshire, New Jersey, Rhode Island, Tennessee, Vermont, and Wyoming have only partial information for all variables. I consider some information from those states as missing variables instead of using interpolation and extrapolation.¹¹ The panel used in this paper is unbalanced because the same time periods are not available for all cross section units. Using the unbalanced panel does not present a serious problem, however, because the inclusion of missing information does not really produce different results.

Food Stamp Program

Information on the Food Stamp Program includes the average monthly benefit per person and household and the average number of monthly participating persons and households. These are state-specific variables. The data are obtained from the Food & Nutrition Service (FNS) of the United States Department of Agriculture. Average monthly benefits per person and household are deflated by the Consumer Price Index

¹¹ In using interpolation and extrapolation the missed variables can be replaced by estimated values.

calculated from the U.S. Census Bureau. Likewise, average monthly participating persons and households are deflated by the state population to eliminate the effect of population growth. The trends of monthly benefit and participation are shown in Figure 2.

State Minimum Wages

The minimum wage has two standards: state and Federal minimum wage. Alabama, Arizona, Florida, Louisiana, Mississippi, South Carolina, and Tennessee do not have state minimum wage legislation. States whose minimum wage falls below the Federal minimum wage rate are shown in Table 2. If there is no state minimum wage or the state minimum wage is below the federal minimum wage, the higher minimum wage applies. The minimum wage data used in this paper are determined by the higher minimum wage between state and federal levels because the applied minimum wage is the higher wage between the two. Minimum wage data are obtained from the Monthly Labor Review and are deflated by the year-specific Consumer Price Index (CPI) to consider real minimum wage. The trend of the minimum wages deflated by CPI is shown in Figure 3. The state minimum wages are used as one of the policy variables to investigate the effects on obesity.

Weight-Adjusted Variables and Demographic Variable

The Behavioral Risk Factor Surveillance System (BRFSS) is the main source of data in this study and comprises an ongoing, nation-wide telephone survey funded by the Centers for Disease Control and Prevention (CDC). It first began interviewing respondents in 1984. This survey gathers information on both behavioral factors affecting

health and demographic characteristics. The number of adults and children surveyed by the BRFSS comprise the source that generates the total number of households. Different cutoffs in the number of households are used to segregate full sample data into the data systems with two different groups. A low-income household is defined as a household whose income lies below the federal poverty guideline based on household size. For example, consider a respondent in a household in New York whose gross income was \$14,000 in 2002. The federal poverty guideline is \$15,020 for a three-person household. Since the hypothetical household's gross income does not exceed the corresponding federal poverty guideline, the respondent falls into the category of low-income household. The sample size is 182,930¹² respondents for low-income households and 989,102 respondents for non-low-income households after deleting missing values between 1993 and 2002. For the purposes of this paper, I consider respondents of all ages first, then respondents 18-65 years of age in order to consider people of working age in the labor market. From this source I generate weight-adjusted variables like body mass index, which indicate whether a respondent is obese, and demographic variables like race, marital status, gender, real household income, education, and age. Individual observations are aggregated to generate state-level data. The aggregated data contain information about various socioeconomic characteristics of the individual states.

Information on weight and height are used to calculate the body mass index for an individual. Because the BRFSS has self-reported information on height and weight, the variables may contain measurement errors with underreporting their weight. Cawley (1999) developed procedures to correct those errors using the third National Health and

¹² The BRFSS between 1993 and 2002 has approximately 1.26 millions respondents. I consider respondents that were within low-income household status.

Nutrition Examination Survey (NHANES III), which includes both actual weight and height from physical examinations. Chou et al. (2002) employ these procedures as well. I use the raw data without corrections because the supplemental studies do little to change the results. Obesity variables are determined with criteria to identify the obesity of a person based on body mass index. Dummy variables for the obesity are generated for an individual respondent. The aggregation of dummy variable for the obesity presents the percentage of obese persons at a year in a state. Aggregate data for body mass index by state determine the average of body mass index by state. The BRFSS includes individuals aged 18-99. However, the diverse models that sample the working age (18-65) population are also taken into account.

Aggregate data for age and household income also demonstrate averages of age and real household income by state. Race, gender, and education are organized into their own categories indicating their respective groups. Once formed into dummy variables, these are aggregated. Aggregate data of race, sex, and education demonstrate specific percentages for their respective groups in each state. All individual variables are transformed into state-specific variables for this study.

Food Price

The ACCRA Cost of Living Index, which covers more than 300 cities, is calculated to show relative price for consumer goods and services in participating areas. To create prices of home food the following thirteen food items are used: steak, ground beef, bacon, frying chicken, tuna, whole milk, eggs, margarine, parmesan cheese, potatoes, bananas, lettuce, and bread. Hamburger, pizza, and 2-piece fried chicken are

used for calculating the fast food price.¹³ Each item has a weight value calculated through the average expenditure shares of a food. After multiplying the price of each food by a weighting value fixed over time, the price of home food is generated by adding them up. Although the ACCRA is the relative price, it does not reflect inflation. The ACCRA price index is deflated by the year-specific Consumer price Index (CPI) in order to consider the real relative price. Food prices are generated from cities and are then aggregated by state. The shortcoming of this calculation emerges from the way in which the food prices are constructed. In other words, these prices are aggregated over only a few cities in each state. These prices therefore cannot be perfectly representative of home and fast food.

5. Empirical Results

This section shows the summary statistics of the variables used and demonstrates how an increase in the Food Stamp Program benefit or the minimum wage affects obesity rates. The regression results for body mass index are shown first, followed by a discussion of the effects on the prevalence rate of obesity.

Descriptive Statistics

Table 3 and Table 4 set forth the definition of variables used in this paper and summary statistics for all the variables used on all ages between 1993 and 2002. The unit of observation is the state-specific level. The data cover 50 states and the years 1993-2002. The first column numerates all variables used in the samples. The second and third columns show the means and standard deviations of each variable for low-income

¹³ Chou et al. (2000) use these prices using the same methodologies.

households and non-low-income households, respectively. The sample size for low-income and non-low-income households is 182,930 and 989,102. These individual respondents are aggregated with 474 state-specific variables. The average of body mass index for low-income households, 26.69, is larger than that for non-low-income households, 25.95. The percentage of obesity is higher in the low-income households. Figure 4 illustrates the patterns of obesity for the two groups. This study demonstrates how the patterns of determinants for body mass index or obesity differ between low- and non-low-income households. Food Stamp Program participation and household statistics are defined as the average state-specific number of FSP participants deflated by the state population.

Body Mass Index (BMI)

Table 5 and Table 6 show the estimated coefficients of three econometric specifications for two groups, low-income and non-low-income households. While Table 5 covers results from respondents of all ages, Table 6 uses the data aggregated from observations of respondents between 18 and 65. The dependent variable is body mass index. Demographic variables include age, age squared, real income, real income squared, some high school, high school graduate, female, black, Hispanic, other races, married, divorced, widowed, single, and separated.¹⁴ The regression results of body mass index for low-income households are contained in the first three columns and the last three columns for non-low-income households. For low-income households, the benefit of food stamps has a negative, significant effect on body mass index in the baseline and the

¹⁴ The results of demographic variables are not reported because the data used in the regression are aggregated from individual data in BRFSS and aggregation eliminates heterogeneity.

model with state fixed effect in Table 5 and Table 6. The results indicate that if dietary effects outweigh overconsumption effects, the increase of FSP benefits reduces the average body mass index of a state.¹⁵ However, the benefits of food stamps do not have significant effects on body mass index in the model which controls for state fixed effect, time effect, and demographic factors. Time effects are significant over time in the model with state and time fixed effect. This means that heterogeneous factors are absorbed into the patterns over time. For non-low-income households, the beneficial effects on body mass index are also negative and significant in the baseline and state fixed effect model. The negative coefficient indicates that a person who participates in the Food Stamp Program because of an increase in benefits is more likely to undergo a reduction in body mass index. Impacts on body mass index in low-income households are greater than those in non-low-income households. A member of a low-income household is more likely to be affected by an increase in the benefit of the Food Stamp Program than one from a non-low-income household. An increase in \$10 of benefits lowers the state average of body mass index by about 0.6 % in low-income households, whereas non-low-income households experience a reduction effect in body mass index by 0.4%. This reduction in mass index as a result of increased benefits might cause some surprise since many researchers find that an increase in food stamps gives rise to a higher prevalence of obesity in low-income households.

There is, however, no causal relationship between state minimum wages and body mass index in low-income households. For non-low-income households, the minimum wage rate has significant, negative effects on body mass index in models (2) and (3) of Tables 5 and 6. An increase in the state minimum wage of \$1 reduces the average state-

¹⁵ Refer to Section 3.

specific body mass index by 0.09% in model (2) of Table 5. This result indicates that a member of a non-low-income household experiences negative effects on body mass index when there is an increase of income resources.

The relative price of home food in relation to fast food used as one of the independent variables, has negative impacts on body mass index in all models of Table 5 in low-income households. All the coefficients for low-income households are negative throughout all the age ranges. However, non-low-income households can experience both positive and negative effects on body mass index. These results demonstrate that the behavior of low-income households conform more closely general economic theory. Non-low-income households are not as affected by the change of fast food compared to low-income households. The reduction effect of price on body mass index is the most significant variable for low-income households.

Model (2) uses state fixed effects. In the third column of Tables 5 and 6, incorporating the time fixed effect into model (2) results does not produce significant coefficients of FSP benefit. Time effects are significantly positive and continue to increase in recent years. The time effect may be explained by the change of lifestyle over time in both groups.

Tables 7 through 12 report results of regression using data grouped by education, gender, and race. Tables 7 and 8 examine the regression results of benefits of food stamps and state minimum wage rates using data grouped by college education. While Table 7 presents the results in respondents with college degrees, Table 8 shows the results of those without college degree. Table 7 and Table 8 display more pronounced effects of benefit in low-income households on body mass index than those in non-low-income

households. The state minimum wage rates have no impact on low-income households. For non-low-income households in which at least one member has a college degree, there is a significant, negative relationship between the state minimum wage rate and body mass index. There is little difference in benefit effects between college graduates and non-college graduates in low-income households. The FSP beneficial effects of the FSP for non-college graduates regarding the body mass index is greater than for college graduates in non-low-income households. Taking all the results into consideration, state minimum wage rates have no effects on body mass index while time effects are positive and significant. The different determinants of body mass index by gender are shown in Table 9 and Table 10, with similar results. Table 11 and Table 12 show that the effects of benefits in non-white low-income households are greater than in white low-income households. For low-income households between white and nonwhite there is little difference of FSP benefits effects on body mass index.

Tables 13 through 20 display the regression results using models with Food Stamp Program participation as an alternative independent variables. The FSP participation percentage is obtained from the monthly average number of participants deflated by state population. In Table 13 and Table 14, negative FSP participation effects are found for low-income households.¹⁶ Non-low-income households also experience negative effects, but to a lesser degree than low-income households. This implies that low-income households are more likely to be affected by participation in the FSP. For college graduates in non-low-income households, there is no significant effect. This demonstrates that members of non-low-income households with college degrees are less likely to

¹⁶ Jones et al. (2003) find that food-insecure girls who participate in nutrition program have a reduced risk for overweight compared to girls in nonparticipating households.

participate in the Food Stamp Program. However, the effects of program participation in non-low-income households where no one has a college degree are significantly negative in models (1) and (3). In Table 17 and Table 18, low-income females are not affected by the relative price of fast food in relation to home food prices, while low-income males are affected.

Obesity

FSP benefits per person and per household and FSP participation per capita and per household, are used as four alternative FSP-related variables. In Table 21, the first four columns show the different results when each alternative variable is included in the state fixed effect model. Also, the number of states with significant and insignificant fixed effects is reported in the seventh and eighth row. Table 21 compares results of the effects of alternative FSP-related variables for low-income households with those for non-low-income households. The negative effects of FSP benefits and participation, except for FSP participation per household, are significantly larger for low-income households than for non-low-income households. For example, a \$1 increase in the FSP reduces the percentage of obesity by 0.3. FSP participation variables are not significant for non-low-income households. While the effects of the minimum wage are insignificant for low-income households, they are negatively significant for non-low-income households. An increase in relative price reduces the obesity rate because of a decrease in consumption of food. Table 21 also indicates that while twenty states have a significant state fixed effect for low-income households, twenty-nine states have insignificant effects.

The results for low-income and non-low-income households regarding the working ages of 18-65 are shown in Table 22. Most findings are consistent with those of Table 21. Minimum wages have significantly negative effects on obesity for non-low-income households. However, food prices do not have any significant effect on obesity for non-low-income households. These results strongly suggest that price increases reduce the prevalence of obesity substantially.

Table 23 provides a comparison of results for low-income households along racial lines. The reduction effect of FSP benefits is almost identical for households regardless of racial identity. For all races the effect of the minimum wage rate on obesity is insignificant. The reduction effect for obesity for non-white, however, is strong in low-income households. Non-whites experience has stronger effects due to food prices than whites.

Table 24 and Table 25 show the regression results by education and gender respectively in low-income households. There is no difference in the effects of benefits for obesity in low-income households for these two groups. Within low-income households college graduates are less likely to be obese.

6. Conclusions

Even though some researchers have found that there is a positive relationship between the Food Stamp Program and obesity for children or women in low-income households, no studies have successfully examined comparisons of the effects of the program on obesity for low-income and non-low-income households. This paper examines the comparisons of determinants of body mass index and obesity for low-

income and non-low-income households. The empirical results show that the Food Stamp Program in fact reduces the risk of obesity while minimum wage rates have no effect on it in low-income households. These results suggest that the Food Stamp Program plays a significant role in providing nutritious food in its role as a nutritional assistance program and that increases in the minimum wages rate increase real income resources.

Table 1 Hypothesized Causal Relationship

	Expected Signs	
Benefits in the FSP	Negative	FSP benefits \uparrow \rightarrow FSP Participation \uparrow \rightarrow Consumption on Home Food \uparrow \rightarrow BMI \uparrow (Overconsumption Effect) \rightarrow BMI \downarrow (Dietary Effect) Dietary effect dominates \rightarrow Negative effect Overconsumption effect dominates \rightarrow Positive effect
FSP Participation	Negative	FSP Participation \uparrow \rightarrow BMI \downarrow
Minimum Wage	Positive or Negative	The change of Income Resource: For low-income MW \uparrow \rightarrow Consumption on Fast Food \uparrow \rightarrow BMI \uparrow For non-low-income MW \uparrow \rightarrow Consumption on Home Food \downarrow \rightarrow BMI \downarrow
Food Price	Negative	The price of Food \uparrow \rightarrow Consumption \downarrow \rightarrow BMI \downarrow
Income	Positive or Negative	Low-Income: Income \uparrow \rightarrow Consumption \uparrow \rightarrow BMI \uparrow (Positive effect) Non-Low-Income: Income \uparrow \rightarrow Consumption \downarrow or Nutritional food \uparrow \rightarrow BMI \downarrow (Negative effect)

Table 2 The State Minimum Wage and The Federal Minimum Wage

States with Minimum Wage Rates Higher than the Federal ¹⁷	States with Minimum Wage Rates the Same as the Federal	States with Minimum Wage Rates Lower than the Federal	States with No Minimum Wage Law
Alaska, California, Connecticut, Delaware, District of Columbia, Hawaii, Massachusetts, Oregon, Rhode Island, Vermont, Washington	Arkansas, Colorado, Georgia, Idaho, Illinois, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Pennsylvania, South Dakota, Texas, Utah, Virginia, West Virginia, Wisconsin, Wyoming	Kansas, Michigan, New Mexico, Ohio	Alabama, Arizona, Florida, Louisiana, Mississippi, South Carolina, Tennessee

* This table is based on Jan 1, 2004.

¹⁷ Maine has been dropped from this study because of data limitation.

Table 3 Definition of Variables

Variable Name	Definition
Body Mass Index (BMI)	Average state-specific Body Mass Index (BMI)
Obese	State-specific percentage of being obese
Food Stamp Program Benefits Per Capita	Average state-specific monthly benefit per person deflated by Consumer Price Index
Food Stamp Program Benefits Per Household	Average state-specific monthly benefit per household deflated by Consumer Price Index
Food Stamp Participation Per capita	Average state-specific number of persons monthly participating in Food Stamp Program deflated by state population
Food Stamp Participation Households	Average state-specific number of households monthly participating in Food Stamp Program deflated by state population
Minimum Wage	State-specific minimum wage deflated by Consumer Price Index
Real Home Food Price	Relative price of home food with fast food deflated by Consumer Price Index
Demographic Variables	
Some High School	State-specific percentage of respondents to complete at least 9 years but less than 12 years of formal schooling
High School Graduate	State-specific percentage of respondents to complete 12 years of formal schooling
Some College	State-specific percentage of respondents to complete at least 13 years but less than 16 years of formal schooling
College Graduate	State-specific percentage of respondent to complete college
Black non-Hispanic	State-specific percentage of black respondents, not Hispanic
Hispanic	State-specific percentage of Hispanic respondents
Other races	State-specific percentage of respondents classified by other races, not white neither black
Female	State-specific percentage of female respondents
Married	State-specific percentage of married respondents
Divorced	State-specific percentage of divorced respondents
Widowed	State-specific percentage of widowed respondents
Single	State-specific percentage of single respondents
Separated	State-specific percentage of separated respondents
Household Income	Average state-specific household income deflated by Consumer Price Index
Age	Average state-specific age of respondents

Table 4 Means and Standard Deviations of Variables

Variable	Low-Income Household		Non-Low-Income Household	
	Mean	Standard Deviation	Mean	Standard Deviation
BMI	26.69	0.829	25.95	0.576
Obese	0.235	0.051	0.17	0.035
Age	45.3	3.007	46.05	1.637
Household Income	6698.3	907.3	29394.7	4474.4
Some High School	0.179	0.046	0.059	0.020
High School Graduate	0.382	0.045	0.315	0.049
Some College	0.240	0.058	0.288	0.036
College Graduate	0.083	0.031	0.310	0.066
Black non-Hispanic	0.162	0.168	0.076	0.092
Hispanic	0.104	0.131	0.046	0.052
Other races	0.059	0.083	0.035	0.047
Female	0.677	0.043	0.552	0.025
Married	0.330	0.068	0.580	0.066
Divorced	0.186	0.040	0.131	0.020
Widowed	0.154	0.050	0.087	0.019
Single	0.244	0.066	0.159	0.053
Separated	0.055	0.023	0.021	0.010
Aggregate Sample Size (Individual Sample Size)	474 (182,930)		474 (989,102)	

Statistics of state-year values

	Mean	Standard Deviation
FSP Benefits per Person	43.7	5.054
FSP Benefits per household	105.99	16.76
FSP Participants	81.2	38.705
FSP Participants Households	33.53	16.47
Minimum Wage	3.10	0.392
Home Food Price	1.16	0.087
Fast Food Price	0.742	0.075
Relative Food Price	1.572	0.119
Sample Size	474	

Table 5 The Effects of the FSP Benefit and the Minimum Wage on BMI

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Benefit	-0.057** (-8.24)	-0.056** (-5.38)	-0.006 (0.54)	-0.035** (-6.15)	-0.038** (-6.68)	-0.004 (0.73)
Minimum Wage	0.035 (0.48)	0.081 (1.02)	-0.016 (-0.18)	-0.075 (-1.44)	-0.092** (-2.56)	-0.115** (-3.01)
Food Price Ratio	-0.998* (-1.76)	-2.208** (-3.07)	-0.177** (-0.24)	0.48 (1.11)	-1.165** (-3.04)	0.252 (1.0)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes**	No	Yes	Yes
Time Effect	No	No	Yes	No	No	Yes**
Observations	474	474	474	474	474	474

Table 6 The Effects of the FSP Benefit and the Minimum Wage on BMI (18-65)

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Benefit	-0.05** (-6.89)	-0.055** (-4.92)	-0.006 (0.42)	-0.028** (-5.01)	-0.036** (-6.72)	0.005 (0.99)
Minimum Wage	0.04 (0.48)	0.054 (0.63)	-0.054 (-0.55)	-0.052 (-1.0)	-0.087** (-2.62)	-0.126** (-3.27)
Food Price Ratio	-0.644 (-1.04)	-1.956** (-2.54)	-0.018 (-0.02)	0.926** (2.37)	-0.749** (-2.09)	0.21 (0.78)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	472	472	472	474	474	474

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, female, black, Hispanic, other races, married, divorced, widowed, single, and separated.

2. robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.

4. * significant at 10 percent and ** significant at 5 percent.

Table 7 The Effects of the FSP Benefit and the Minimum Wage on BMI
by College Education

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Benefit	-0.06** (-6.83)	-0.075** (-4.63)	0.01 (0.49)	-0.017** (-2.76)	-0.035** (-6.34)	0.003 (0.59)
Minimum Wage	-0.028 (-0.27)	0.182 (1.38)	-0.095 (-0.63)	-0.148** (-2.78)	-0.099** (-2.99)	-0.093** (-2.45)
Food Price Ratio	-1.13 (-1.4)	-3.057** (-2.8)	-0.446 (-0.36)	1.158** (2.47)	-0.929** (-2.27)	0.593** (2.04)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	472	472	472	474	474	474

Table 8 The Effects of the FSP Benefit and the Minimum Wage on BMI
by Non-College Education

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Benefit	-0.058** (-7.29)	-0.068** (-5.39)	0.002 (0.14)	-0.054** (-8.1)	-0.072** (-8.37)	-0.0035 (-0.43)
Minimum Wage	0.153* (1.8)	0.141 (1.46)	0.052 (0.44)	0.108* (1.66)	0.08 (1.3)	-0.051 (-0.83)
Food Price Ratio	-1.336** (-1.99)	-2.172** (-2.33)	0.098 (0.1)	-0.772 (-1.52)	-2.659** (-4.37)	-0.442 (-0.98)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes
Observations	472	472	472	474	474	474

1. Demographic variables include age, age squared, income, income squared, female, black, Hispanic, other races, married, divorced, widowed, single, and separated.
2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.
4. * significant at 10 percent and ** significant at 5 percent.

Table 9 The Effects of the FSP Benefit and the Minimum Wage on BMI by Female

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Benefit	-0.059** (-6.86)	-0.068** (-5.34)	0.014 (0.93)	-0.035** (-4.61)	-0.052** (-6.91)	0.003 (0.44)
Minimum Wage	0.059 (0.7)	0.091 (0.96)	-0.062 (-0.56)	-0.053 (-0.78)	-0.103** (-2.1)	-0.142** (-2.89)
Food Price Ratio	-0.406 (-0.6)	-1.249 (-1.39)	0.79 (0.85)	1.007* (1.81)	-1.229** (-2.07)	0.306 (0.87)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	472	472	472	474	474	474

Table 10 The Effects of the FSP Benefit and the Minimum Wage on BMI by Male

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Benefit	-0.054** (-7.46)	-0.061* (-4.73)	0.001 (0.08)	-0.029** (-6.96)	-0.034** (-5.73)	0.003 (0.6)
Minimum Wage	0.04 (0.47)	0.136 (1.23)	0.042 (0.31)	-0.08** (-1.99)	-0.083* (-1.93)	-0.073 (-1.5)
Food Price Ratio	-2.343** (-3.67)	-3.421** (-3.73)	-1.091 (-1.02)	-0.182 (-0.48)	-1.089** (-2.94)	0.435 (1.46)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	472	472	472	474	474	474

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, black, Hispanic, other races, married, divorced, widowed, single, and separated.

2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.

4. * significant at 10 percent and ** significant at 5 percent.

Table 11 The Effects of the FSP Benefit and the Minimum Wage on BMI by White

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Benefit	-0.054** (-9.04)	-0.069** (-5.98)	0.00003 (0.0)	-0.027** (-6.08)	-0.044 (-7.02)	0.001 (1.18)
Minimum Wage	0.112 (1.39)	0.17* (1.9)	0.078 (0.83)	-0.045 (-0.77)	-0.123** (-3.21)	-0.104** (-2.51)
Food Price Ratio	-1.119 (-1.63)	-2.471** (-2.85)	0.275 (0.3)	0.274 (0.65)	-2.096** (-3.68)	-0.039 (-0.13)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes
Observations	463	463	463	474	474	474

Table 12 The Effects of the FSP Benefit and the Minimum Wage on BMI by Non-White

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Benefit	-0.05** (-6.16)	-0.084** (-4.63)	0.021 (0.88)	-0.04** (-4.88)	-0.075** (-6.97)	0.007 (0.57)
Minimum Wage	-0.08 (-0.73)	-0.008 (-0.05)	-0.284 (-1.39)	-0.005 (0.07)	0.081 (0.93)	-0.02 (-0.21)
Food Price Ratio	0.412 (-0.45)	-3.608** (3.16)	-1.063 (0.86)	0.032 (0.04)	-2.74** (-3.42)	-0.068 (-0.10)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	454	454	454	457	457	457

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, female, married, divorced, widowed, single, and separated.

2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.

4. * significant at 10 percent and ** significant at 5 percent.

Table 13 The Effects of the FSP Participation and the Minimum Wage on BMI

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Participant per capita	-0.0028** (0.001)	-0.00368** (0.0018)	-0.001** (0.0003)	-0.0009* (0.0005)	-0.0018 (0.0014)	-0.00035** (0.00015)
Minimum Wage	0.006 (0.079)	0.081 (0.084)	-0.0034 (0.088)	-0.085 (0.054)	-0.078** (0.039)	-0.107** (0.038)
Food Price Ratio	-0.612 (0.613)	-2.221** (0.710)	-0.237 (0.757)	0.625 (0.444)	-1.063** (0.381)	0.231 (0.251)
Demographic*	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes	No	No	Yes
Observations	474	474	474	474	474	474

Table 14 The Effects of the FSP Participation and the Minimum Wage on BMI (18-65)

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Participant per capita	-0.0024** (-2.73)	-0.004** (-2.27)	-0.001** (-3.62)	0.0008* (-1.8)	-0.0017 (-1.23)	-0.0003 (-1.64)
Minimum Wage	0.022 (0.25)	0.053 (0.59)	-0.039 (-0.41)	-0.056 (-1.04)	-0.073** (-2.01)	-0.116** (-3.11)
Food Price Ratio	-0.287 (-0.43)	-1.966** (-2.57)	-0.077 (-0.1)	1.0** (2.53)	-0.627* (-1.74)	0.192 (0.71)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes*	Yes
Time Effect	No	No	Yes	No	No	Yes
Observations	472	472	472	474	474	474

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, female, black, Hispanic, other races, married, divorced, widowed, single, and separated.

2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.

4. * significant at 10 percent and ** significant at 5 percent.

Table 15 Effects of the FSP Participation and the Minimum Wage on BMI
by College Education

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Participant per capita	-0.0027* (-1.81)	-0.005* (-1.75)	-0.001* (-1.81)	0.0001 (0.32)	-0.001 (-1.12)	-0.0001 (-0.89)
Minimum Wage	-0.066 (-0.63)	0.198 (1.46)	-0.07 (-0.46)	-0.163** (-3.11)	-0.089** (-2.46)	-0.091** (-2.47)
Food Price Ratio	-1.084 (-1.24)	-3.157** (-2.91)	-0.489 (-0.4)	1.32** (2.89)	-0.818* (-1.91)	0.573* (1.95)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	472	472	472	474	474	474

Table 16 The Effects of the FSP Participation and the Minimum Wage on BMI
by Non-Col Education

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Participant per capita	-0.003** (-2.11)	-0.004 (-1.61)	-0.001** (0.0004)	-0.003** (-2.29)	-0.004 (-1.41)	-0.0006** (-2.24)
Minimum Wage	0.139 (1.48)	0.155 (1.52)	0.06 (0.52)	0.137* (1.94)	0.132* (1.9)	-0.054 (-0.88)
Food Price Ratio	-0.777 (-1.15)	-2.286** (-2.5)	0.053 (0.05)	-0.704 (-1.3)	-2.506** (-4.11)	-0.457 (-1.02)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	472	472	472	474	474	474

1. Demographic variables include age, age squared, income, income squared, female, black, Hispanic, other races, married, divorced, widowed, single, and separated.
2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.
4. * significant at 10 percent and ** significant at 5 percent.

Table 17 The Effects of the FSP Participation and the Minimum Wage on BMI by Female

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Participant per capita	-0.002 (-1.62)	-0.0043* (-1.65)	-0.001** (-3.02)	-0.001** (-2.25)	-0.003 (-1.52)	-0.0006** (-3.14)
Minimum Wage	0.03 (0.33)	0.098 (1.0)	-0.037 (-0.34)	-0.06 (-0.89)	-0.082 (-1.51)	-0.134** (2.8)
Food Price Ratio	0.128 (0.18)	-1.292 (-1.46)	0.743 (0.8)	1.138** (2.06)	-1.005* (-1.67)	0.282 (0.8)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	472	472	472	474	474	474

Table 18 The Effects of the FSP Participation and the Minimum Wage on BMI by Male

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Participant per capita	-0.0031** (-2.01)	-0.0036* (-1.83)	-0.00065 (-1.33)	-0.0004 (-0.8)	-0.001 (-0.8)	0.0001 (0.61)
Minimum Wage	0.0098 (0.11)	0.158 (1.41)	0.047 (0.37)	-0.09** (-2.1)	-0.072 (-1.59)	-0.068 (-1.43)
Food Price Ratio	-2.11** (-3.13)	-3.497** (-3.81)	-1.106 (-1.03)	-0.041 (-0.1)	-1.025** (-2.76)	0.436 (1.46)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	472	472	472	474	474	474

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, black, Hispanic, other races, married, divorced, widowed, single, and separated.

2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.

4. * significant at 10 percent and ** significant at 5 percent.

Table 19 The Effects of the FSP Participation and the Minimum Wage on BMI by White

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Participant per capita	-0.0038** (-1.96)	-0.0036 (-1.38)	-0.0007 (-1.3)	-0.0015** (-2.31)	-0.002 (-1.38)	-0.0004** (-2.49)
Minimum Wage	0.032 (0.36)	0.17* (1.84)	0.082 (0.88)	-0.057 (-0.94)	-0.118** (-2.78)	-0.099** (-2.47)
Food Price Ratio	-0.462 (-0.54)	-2.517** (-2.99)	0.239 (0.26)	0.654 (1.41)	-2.023** (-3.45)	-0.054 (-0.18)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	463	463	463	474	474	474

Table 20 The Effects of the FSP Participation and the Minimum Wage on BMI by Non-White

	Low-Income Households			Non-Low-Income Households		
	(1)	(2)	(3)	(1)	(2)	(3)
FSP Participant per capita	-0.0006 (-0.63)	-0.0048 (-1.59)	-0.001 (-1.39)	-0.0034* (-1.92)	-0.004 (-1.28)	-0.0004 (-0.94)
Minimum Wage	-0.18 (-1.61)	0.017 (0.1)	-0.242 (-1.21)	-0.057 (-0.71)	0.108 (1.1)	-0.0024 (-0.03)
Food Price Ratio	0.435 (0.45)	-4.036** (-3.44)	-1.103 (-0.88)	-0.437 (-1.25)	0.952** (2.96)	-0.086 (-0.34)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	454	454	454	457	457	457

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, female, married, divorced, widowed, single, and separated.

2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.

4. * significant at 10 percent and ** significant at 5 percent.

Table 21 The Effects of Food Stamp Program and the Minimum Wage on Obesity

	Low-Income Households				Non-Low-Income Households			
FSP Benefit per person	-0.003** (-5.26)				-0.002** (-6.41)			
FSP Benefit Per Household		-0.001** (-6.52)				-0.0009** (-7.1)		
FSP Participation Per Household			-0.0002* (-1.66)				-0.0001 (-1.16)	
FSP Participant per capita				-0.0004 (-1.61)				-0.0002 (-1.07)
Minimum Wage	0.003 (0.62)	0.002 (0.44)	0.003 (0.61)	0.004 (0.68)	-0.006** (-2.21)	-0.006** (-2.23)	-0.005* (-1.73)	-0.005* (-1.67)
Food Price Ratio	-0.133** (-2.81)	-0.118** (-2.51)	-0.134** (-2.84)	-0.136** (-2.87)	-0.056** (-2.18)	-0.046* (-1.78)	-0.048* (-1.89)	-0.048* (-1.86)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect (Significant)	20 States	21 States	23 States	23 States	28 States	32 States	31 States	31 States
State Fixed Effect (Insignificant)	29 States	28 States	26 States	26 States	21 States	17 States	18 States	18 States
Observations	474	474	474	474	474	474	474	474

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, female, black, Hispanic, other races, married, divorced, widowed, single, and separated.
2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.
4. * significant at 10 percent and ** significant at 5 percent.

Table 22 The Effects of Food Stamp Program and the Minimum Wage on Obesity (18-65)

	Low-Income Households				Non-Low-Income Households			
FSP Benefit per person	-0.003** (-4.62)				-0.0024** (-6.17)			
FSP Benefit Per Household		-0.0014** (-6.04)				-0.0009** (-6.26)		
FSP Participation Per Household			-0.0002* (-1.76)				-0.00009 (-1.1)	
FSP Participant per capita				-0.0004* (-1.72)				-0.0002 (-1.0)
Minimum Wage	0.003 (0.52)	0.002 (0.34)	0.003 (0.61)	0.003 (0.61)	-0.006** (-2.42)	-0.006** (-2.37)	-0.005* (-1.84)	-0.005* (-1.78)
Food Price Ratio	-0.11** (-2.15)	-0.093* (-1.82)	-0.111** (-2.84)	-0.113** (-2.2)	-0.028 (-1.09)	-0.02 (-0.77)	-0.018 (-0.72)	-0.018 (-0.7)
Demographic*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect (Significant)	23 States	22 States	24 States	26 States	30 States	33 States	30 States	30 States
State Fixed Effect (Insignificant)	25 States	26 States	24 States	22 States	19 States	16 States	19 States	19 States
Observations	472	472	472	472	474	474	474	474

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, female, black, Hispanic, other races, married, divorced, widowed, single, and separated.
2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.
4. * significant at 10 percent and ** significant at 5 percent.

Table 23 The Effects of Food Stamp Program and the Minimum Wage on Obesity by Race

	Low-Income Households							
	White				Non-White			
FSP Benefit per person	-0.004** (-5.64)				-0.0046** (-4.45)			
FSP Benefit Per Household		-0.002** (-7.27)				-0.002** (-4.72)		
FSP Participation Per Household			-0.0002 (-1.07)				-0.0003* (-1.65)	
FSP Participant per capita				-0.0003 (-0.93)				-0.0005 (-1.53)
Minimum Wage	0.006 (1.08)	0.005 (0.89)	0.006 (1.07)	0.007 (1.14)	0.002 (0.2)	-0.002 (0.14)	0.003 (0.32)	-0.004 (0.38)
Food Price Ratio	-0.121** (-2.15)	-0.1* (-1.77)	-0.122** (-2.19)	-0.123** (-2.2)	-0.206** (-2.76)	-0.169** (-2.26)	-0.229** (-3.03)	-0.237** (-3.15)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect (Significant)	22 States	32 States	28 States	25 States	32 States	33 States	33 States	32 States
State Fixed Effect (Insignificant)	26 States	16 States	20 States	23 States	14 States	13 States	13 States	14 States
Observations	463	463	463	463	454	454	454	454

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, female, married, divorced, widowed, single, and separated.
2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.
4. * significant at 10 percent and ** significant at 5 percent.

Table 24 The Effects of Food Stamp Program and the Minimum Wage on Obesity by Education

	Low-Income Households							
	Non-College-Graduate				College-Graduate			
FSP Benefit per person	-0.004** (-5.18)				-0.004** (-3.87)			
FSP Benefit Per Household		-0.002** (-6.63)				-0.002** (-4.89)		
FSP Participation Per Household			-0.0002 (-1.24)				-0.0003* (-1.82)	
FSP Participant per capita				-0.0004 (-1.12)				-0.0006* (-1.72)
Minimum Wage	0.004 (0.73)	0.003 (0.51)	0.005 (0.88)	0.006 (0.94)	0.012 (1.56)	-0.01 (1.3)	0.013 (1.58)	-0.014* (1.68)
Food Price Ratio	-0.103* (-1.67)	-0.078 (-1.27)	-0.11* (-1.8)	-0.112* (-1.84)	-0.219** (-3.25)	-0.193** (-2.88)	-0.224** (-3.31)	-0.23** (-3.4)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect (Significant)	15 States	14 States	21 States	21 States	21 States	18 States	24 States	24 States
State Fixed Effect (Insignificant)	34 Sates	35 States	28 States	28 States	28 States	31 States	25 States	25 States
Observations	472	472	472	472	472	472	472	472

1. Demographic variables include age, age squared, income, income squared, female, black, Hispanic, other races, married, divorced, widowed, single, and separated.
2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.
4. * significant at 10 percent and ** significant at 5 percent.

Table 25 The Effects of Food Stamp Program and the Minimum Wage on Obesity by Gender

	Low-Income Households							
	Female				Male			
FSP Benefit per person	-0.004** (-5.11)				-0.0037** (-4.01)			
FSP Benefit Per Household		-0.0004 (-1.38)				-0.0004 (-1.47)		
FSP Participation Per Household			-0.0002 (-1.48)				-0.0002 (-1.56)	
FSP Participant per capita				-0.0004 (-1.38)				-0.0004 (-1.47)
Minimum Wage	0.003 (0.48)	0.004 (0.65)	0.003 (0.56)	0.004 (0.65)	0.009 (1.22)	-0.011 (1.43)	0.01 (1.36)	-0.011* (1.43)
Food Price Ratio	-0.017* (-0.3)	-0.021 (-0.36)	-0.019 (-0.34)	-0.021 (-0.36)	-0.311** (-4.63)	-0.32** (-4.73)	-0.315** (-4.65)	-0.32** (-4.73)
Demographic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effect (Significant)	22 States	24 States	24 States	25 States	29 States	32 States	35 States	32 States
State Fixed Effect (Insignificant)	27 States	25 States	25 States	24 States	20 States	17 States	14 States	17 States
Observations	472	472	472	472	472	472	472	472

1. Demographic variables include age, age squared, income, income squared, some high school, high school graduate, some college, college graduate, black, Hispanic, other races, married, divorced, widowed, single, and separated.
2. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
3. All coefficients for demographic variables, state fixed effects, and time effects are not reported.
4. * significant at 10 percent and ** significant at 5 percent.

Figure 1 Food Stamp Program Participation and Utility Maximization

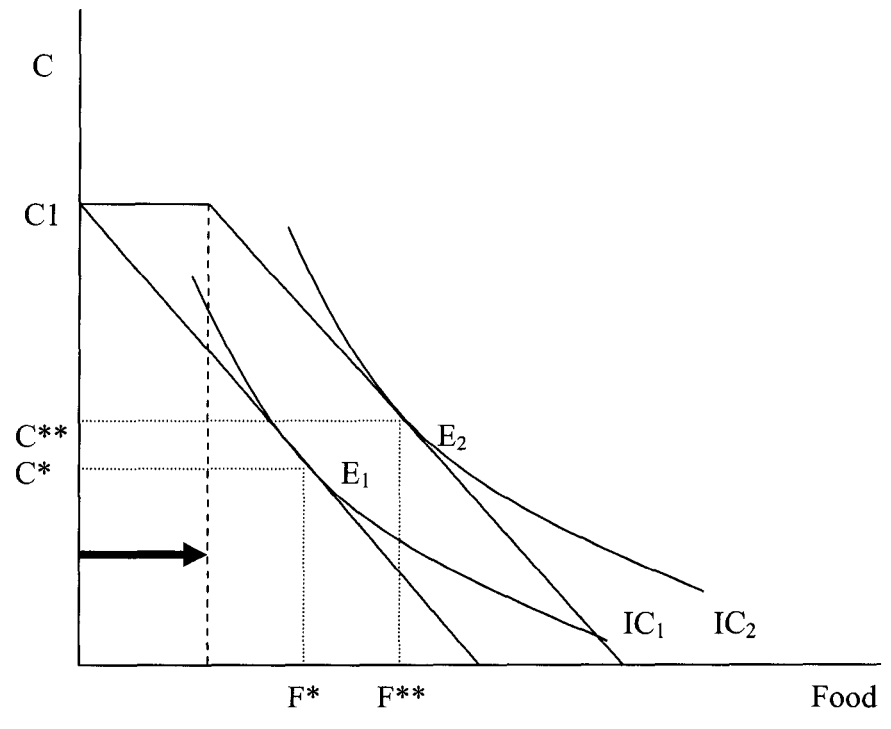


Figure 2
Trends in FSP Average Monthly Participation and Average Monthly Benefit

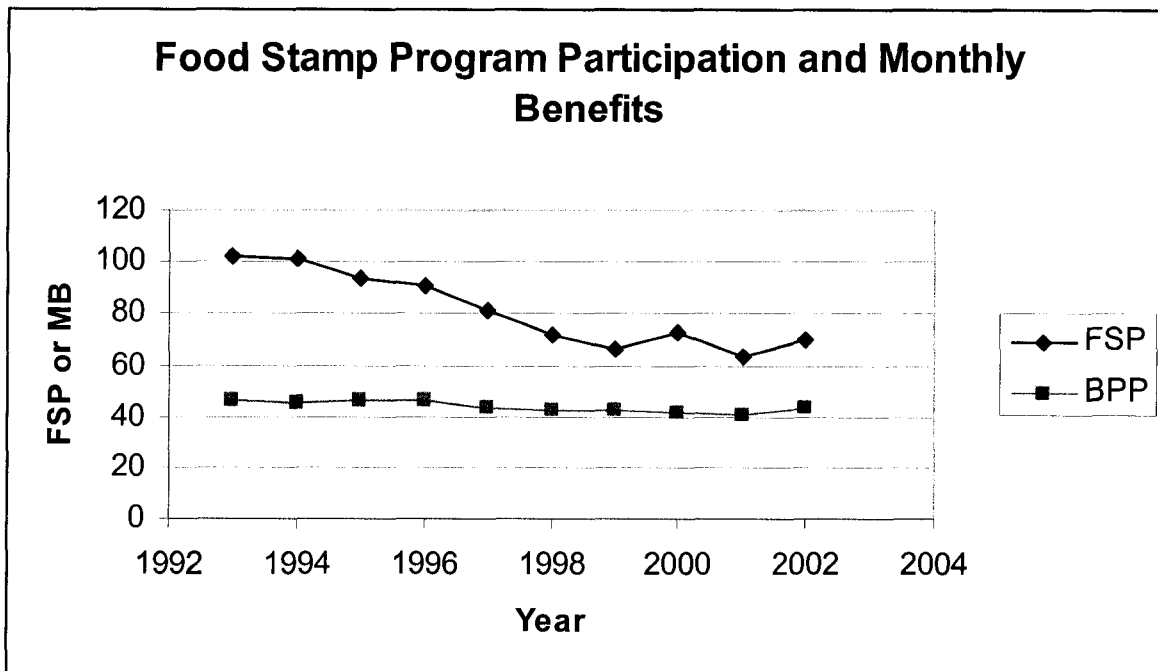


Figure 3 Trends in Minimum Wages

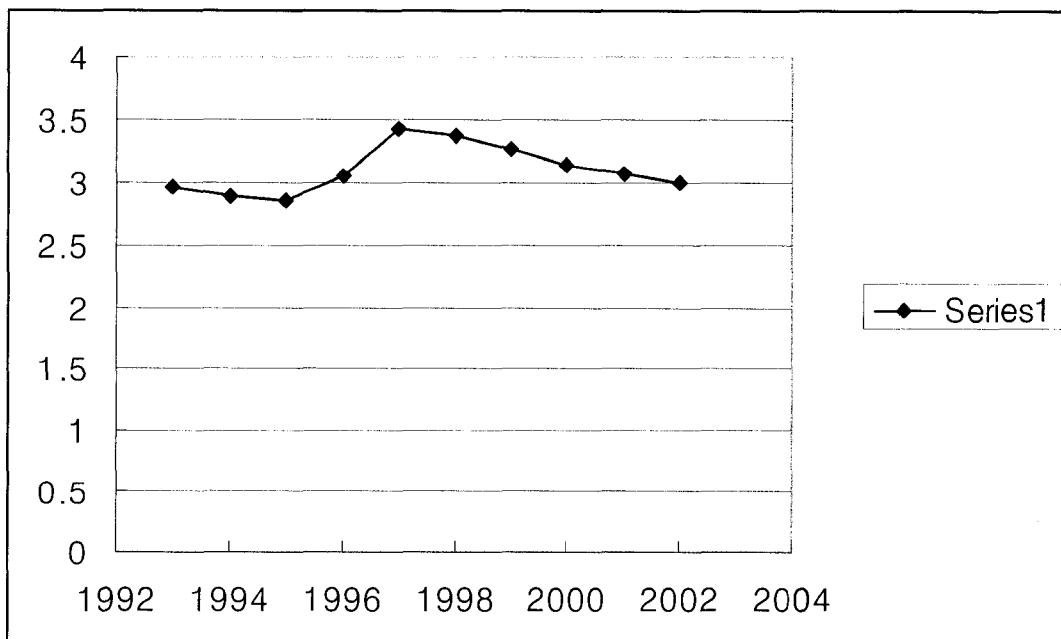
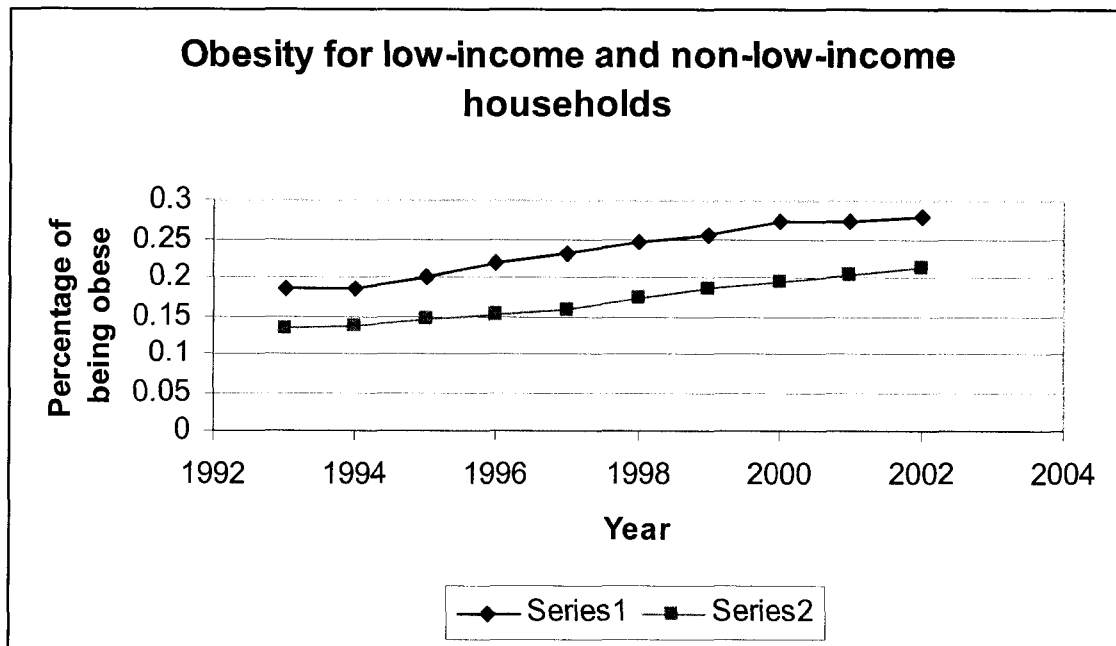


Figure 4 Obesity for Low-Income and Non-Low-Income Households



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Essay Two

The Effects of Fast Food Television Advertising on Obesity

1. Introduction

Americans spent \$415 billion in 2002 in total away-from-home food expenditures, which is defined as food expenses for consumption outside of the consumer's home.¹ Away-from-home expenditures increased by 23 percent between 1992 and 2002, even after inflation is taken into account. This fact strongly suggests that the eating habits of Americans have changed markedly in the direction of eating out over the past decade. The trend toward real away-from-home food expenditures with considered with inflation is more flat than nominal without inflation. Away-from-home food consumption can thus be linked with its expenditure. Indeed, the increase in away-from-home food expenditure implies a corresponding increase in away-from-home food consumption. Away-from-home food can be divided into full-service and fast food. Fast food has attracted particular attention in this content as the principal cause of a major public health problem, obesity. Fast food is defined as 'inexpensive food prepared and served quickly' in Webster's Dictionary. The ever increasing value of time has caused people to view eating out as a greater source of convenience and quickness. Moreover, fast food satisfies a certain need, or natural impulse, people have for taste. Since most fast foods are sweet and high in calories, the increase in consumption of fast food has caused an increase in obesity. This increase in fact food consumption seems to have several causes then; convenience, the physiological demand for sweet taste, low costs, and the ever increasing sizes of fast food portions. In addition, fast food companies have established a food

¹ This estimate is reported by the Economic Research Service (ERS) in the United States Department of Agriculture.

environment that promotes an “eat more” attitude through a number of new strategies.² Among these strategies advertising has played an increasingly substantial role in promoting this “eat more” attitude through encouraging constant dining-out. Advertising has a powerful affect on food choice and eventually on health, through obesity.

Obesity has rapidly emerged as one of the most chronicled diseases of the last two decades. In 1999, 61% of adults in the United States were overweight or obese. Body Mass Index (BMI) comprises the normal criterion for determining whether a person is overweight or obese. It is calculated by dividing a person’s weight in kilograms by his height in meters squared (kg/m^2). A person who has BMI of 30 or above is classified as obese; a BMI of between 25 and 29.9 qualifies as overweight. Obesity leads to a number of health consequences such as premature death, heart disease, type II diabetes, cancer, breathing problems, arthritis, and so on.³ These diseases are among the leading causes of death for Americans. Although one cause alone cannot explain the prevalence of obesity, it is certain that food consumption is a major contribution to it. Both the amount and the kinds of food people eat are important in this context. Even if people eat less but choose calorie-intensive food, they can still become corpulent. Lin et al. find that while Americans are consuming less fat at home, they are eating away from home more frequently, where foods are higher in fat and calories.⁴

Although many researchers have studied the connections between fast food advertising and obesity in children, there is relatively little literature about this connection in adults. Dietz and Gortmaker (1985), Anderson et al. (2003), and Burdette et al. (2003) find that there is a positive relationship between the hours of television

² Nestle, Marion. “Food Politics.” University of California Press, 2003.

³ The Surgeon General’s Report

⁴ Lin B-H, Guthrie J, Frazao E. Nutrient Contribution of Food Away From Home

watched and the incidence of obesity in children, though they supply no information for adults. Watching television and being exposed to fast food television advertising incites children to indulge unhealthy eating habits.

The objective of this paper is to investigate the influences of fast food television advertising on obesity. To find out the relationship two connections must be clarified. The first link is between fast food advertising and the consumption of fast food. Many researchers agree that advertising increases the consumption of advertised goods, though there are many different views on this subject.⁵ Becker and Murphy (1993) consider advertisements as complementary to the goods that have become the fixed preferences of consumers. In fact, watching advertisements on television produces its own kind of satisfaction which in turn increases the relative marginal utility of the advertised good. Therefore, this theory argues that fast food advertising increases the consumption of fast food. The second link is between the consumption of fast food and the increase of body mass index and the prevalence of obesity. The contribution of fast food consumption to obesity is more significant than other forms of food consumption because most fast foods are highly calorie-intensive. In demonstrating the empirical basis of these links I show that fast food advertising has a positive effect on the decision to buy fast food.

In the following section, I describe the data used. In Section 3 I explain the empirical strategy to examine the effects of advertising on body mass index and obesity. In Section 4 I present my empirical findings and in Section 5 my conclusion.

⁵ The economic analysis of advertising comprises a huge body of literature. It can be broken down into three categories: the persuasive view, the informative view, and the complementary view. The persuasive view claims that advertising affects demand by changing tastes and generating brand loyalty. The information view argues that advertising affects demand by conveying information. The complementary view states that advertising affects demand by playing a role as a complementary good for the advertised good. The complementary view differs from the persuasive view and the information view with regard to fixed preference. For more detail, refer to Bagwell's mimeo.

2. Data

In order to examine the causal relationship between fast food advertising and obesity, I use fast food advertising data obtained from Competitive Media Reporting (CMR), the leading provider of marketing communication information and advertising expenditure data in the United States. Fast food advertising data provide information on exposure time aired for fast food chains⁶ between 1996 and 1999. Exposure time variables are defined as the total number of fast food messages aired multiplied by the length of the message in seconds. The unit of observation for exposure variables is the Designated Market Area (DMA). It is defined as the counties which make up a city's television viewing area. In the United States geographic measurements are broken down in terms of population. Metropolitan Area is defined as a place with a minimum population of 50,000 by the U. S. Office of Management and Budget (OMB). The collective term "metropolitan area" includes Metropolitan Statistical Areas (MSAs), Primary Metropolitan Areas (PMSAs), and Consolidated Metropolitan Areas (CMSAs).⁷ DMA markets cover a larger area than PMSA markets. Table 1 shows comparisons of population and households by PMSA, CMSA, and DMA. Counties or cities which fall into the same designated market area have substantial populations with a high degree of

⁶ A&W Restaurants Inc, AFC Enterprises, Allied Domecq Plc, Arthur Treachers Inc, Carrols Corp, Chester Fried Chicken Restaurants, Chick-Fil-A Inc, Cici Enterprises Inc, Cke Restaurants Inc, Culver Franchising System Inc, Diageo Plc, Dominos Pizza Inc, Fatboys Franchise Systems Inc, Foodmaker Inc, Galardi Group, Hungry Howies Pizza & Subs Inc, Ich Corp, In-N-Out Burgers Inc, Inno-Pacific Holdings Inc, Krispy Kreme Doughnut Corp, Krystal Co, Leeann Chin, Little Caesars Enterprises Inc, Long John Silvers Inc, McDonalds Corp, Panda Express, Papa Ginos Inc, Papa Johns Intl Inc, Quality Dining Inc, Ranch 1, Rax Restaurants Inc, Showbiz Pizza Time Inc, Sizzler Intl Inc, Sonic Corp, Speedy Burgers Inc, TCBY Enterprises Inc, Triarc Cos Inc, Tricon Global Restaurants Inc, Wendys Intl Inc, Whataburger Inc, and White Castle System Inc.

⁷ While Primary Metropolitan Statistical Area (PMSA) is a MA with more than one million people, Consolidated Metropolitan Statistical Area (CMSA) consists of two or more major components, each of which is a PMSA.

economic and social integration geographically. Also, the residents within same designated market areas are subject to identical influences through television. DMA market and PMSA market are compared in terms of market size in Table 2. The DMA consists of 212, though only 75 are used in this paper. Table 3 enumerates the 75 designated market areas and the states they fall within.

Information on body mass index (BMI) used for respondent's health outcome is collected from the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a nation-wide, ongoing telephone survey for adults aged eighteen and older on a state-specific basis conducted by state and local agencies and administered by the Centers for Disease Control and Prevention (CDC) of the Department of Health and Human Services. Even though these surveys are designed to collect state-level data regarding a wide range of behavior that affects health, many states additionally provide information for regions within their borders. In order to examine the relationship between fast food advertising and body mass index, I pool cross sections and time series between 1996 and 1999 from BRFSS. I only consider observations which fall into designated market areas. All the observations outside selected DMAs are deleted.

The BRFSS provides self-reported data on weight and height. Based on this information I construct a body mass index and a dichotomous variable that equals 1 if the body mass index is equal to or greater than 30. In general, self-reported data make room for measurement errors since heavier people might underreport their weight. Table 4 provides descriptive statistics for the sample. The average of body mass index for the sample is 25.92. The percentage of obesity is 17. However, BMI and the percentage of obesity between 1988 and 1994 were 26.4 and 21.62 based on the National Health and

Nutrition Examination Survey III (NHANES III)⁸. In order to correct self-reporting errors Cawley (1999) uses the following procedures in his dissertation. His first step is to regress actual weight on reported weight and the square of reported weight. Height is treated in the same manner as weight. Then, the regressions for weight and height are estimated separately for their respective groups. The coefficients from the regressions are used to adjust height and weight. This methodology for correcting errors is not used in this study because the estimated coefficients have no significant effect on the results obtained in this paper, especially with regard to the signs of coefficients.

Table 4 exhibits definitions of demographic variables. The BRFSS provides information on the demographic variables of education, age, household income, ethnicity, gender, number of children, and marital status. Information on the number of children is particularly important in order to examine the results children have on the overall body mass index and the several level of obesity.

The fast food prices and food prices at home used in this study are obtained from ACCRA. It shows the cost of living index or relative prices for goods and services in participating areas. As ACCRA does not take into account inflation, it must be deflated by the consumer price index which is announced by the U. S. Bureau of Labor Statistics. Fast food and home food prices comprise state-level data. In determining the food price at home the following thirteen food items are used: steak, ground beef, bacon, frying chicken, tuna, whole milk, eggs, margarine, parmesan cheese, potatoes, bananas, lettuce,

⁸ The third National Health and Nutrition Examination Survey (NHANES III) was conducted between 1988 and 1994 using a sample of 33,994 people in order to obtain nationally representative information on health and nutrition in the United States. This survey includes actual weight and height measured in physical examinations as well as self-reported weight and height.

and bread. The items used to calculate fast food prices are hamburger, pizza, and 2-piece fried chicken. Each item has weight values which are constant over time.

3. Empirical Strategy

Assuming that I pool the cross-sections of individual, DMA, and state with the time-series data for each one, the basic model for estimating the parameters in the linear model is as follows:

$$(1) \quad Y_{id} = \alpha + Z_d\beta + P_s\delta + X_{id}\gamma + u_{id}$$

where d indexes the cluster or DMA and i indexes observations within DMA. Y includes exogenous variables which show the individual's health outcome, body mass index, and change within DMA. Z represents advertising data with total units in seconds and varies only at the DMA level. P stands for the state-level food price and can affect BMI of other respondents who live in the state of the featured respondent. X shows the vector of demographic variables and varies within DMA. Chou et al. (2002) find individual-specific effect whose mean is γ . The primary interest in this paper is to estimate β in order to show the effects of advertising in the DMA on body mass index. This is represented by the geographic effect or DMA effect. Here I consider two potential problems which might occur in the basic model. First, the geographic effect needs to be considered from the perspective of error terms. In the light of cultural, demographic and environmental characteristics, respondents who live in the same designated market area (DMA) might share common factors like environment and lifestyle. In the linear equation (1), u_{id} contains unobserved factors affecting dependent variable. If the geographic effect

is reflected, error terms suggest two errors: unobserved cluster effects and idiosyncratic errors.⁹

$$(2) \quad u_{id} = c_d + v_{id}$$

where c_d is cluster effect by area or geographically fixed effect and v_{id} is the idiosyncratic error. Cluster effect can catch the similarity of characteristics that respondents in the same area share. Then, equation (1) can be changed as follows:

$$(3) \quad Y_{id} = \alpha + Z_d\beta + P_s\delta + X_{id}\gamma + c_d + v_{id}$$

Second, time effect is included in the model. Different time periods might give rise to multiple regression equations with different slopes. In order to determine whether a linear model differs across two periods, the Chow test¹⁰ can be used. This is the F-test for structural change across time. The Chow test can detect such structural changes. If the null hypothesis is rejected, the time dummies must be constructed in order to catch time effects. Environment and lifestyles vary not only across areas but also across time.

$$(4) \quad Y_{idt} = \alpha + Z_{dt}\beta + P_{st}\delta + X_{idt}\gamma + c_d + a_t + v_{idt}$$

I use three different models to examine the effects of advertising on body mass index. To control for fixed and trending unmeasured factors that affect exposure time and obesity, DMA fixed effects and DMA-specific time trends are taken into account.

4. Empirical Results

⁹ Wooldridge, Jeffrey M. *Econometric Analysis of Cross Section and Panel Data*

¹⁰ First of all, estimate by performing pooled regressions allowing for different time intercepts which yields restricted residual of sum of squares (SSR_r). Second, run a regression for each time period. Third, compute

the F statistic, $\left[\frac{(SSR_r - SSR_{ur})}{SSR_{ur}} \right] \left[\frac{(n - T - Tk)}{(T - 1)k} \right]$. $SSR_{ur} = SSR_1 + SSR_2 + \dots + SSR_T$ and k is the

number of explanatory variables. The degree of freedom of the F test are $(T-1)k$ and $n-T-Tk$.

Table 3 provides a definition of the variables used and their mean and standard deviations. The variables are divided into four categories: health outcome, demographic, advertising, and the relative food price variable. Health outcome and demographic variables each have a sample size of 246,150 individual observations, whereas the sample size for relative food price is only 174 individual observations, since these data consist of state-level variables. Advertising data have 199 DMA-level observations.

The sample is broken down into three age groups: 18-45, 46-65, and 66-99. Table 5 shows the effects of total exposure time on body mass index for the age group 18-45 by gender. The sample sizes for female and male are 78,363 and 62,119, respectively. The first three columns present the results for females. Among females the effects are significant in the model controlling for DMA fixed effect and its magnitude is larger than the coefficient for men. Women are more likely to be exposed to advertising and to be affected by exposure time.

The coefficients of the relative price of home food compared with fast food are negative for body mass index in models (1) and (2). Indeed, this seems to follow logically from standard economic theory; a decrease in food prices allows food consumption and therefore body mass index to increase. However, there is no causal relationship between food price and body mass index for men. Results show that women have negative BMI coefficients with the exception of the model containing both DMA and time effect.

The coefficients for children have significant, positive effects on body mass index for both the female and male groups. This would seem to follow logically. If children ask their parents to buy high-caloric fast food which they have seen in advertisements their

parents are more likely to consume fast food as well. This in turn produces an increase in the BMI of parents. The effect of children on BMI is larger for women than for men.

Real income, education, race, and marital status are included as demographic variables. The results of these variables are consistent with what Chou et al. find in their study. For female coefficients demographic variables show significant effects on body mass index in all models. More educated women are less likely to experience an increase in BMI. For example, a woman with some college education has a BMI that is 36% lower than the one with only a high school degree in the model (2) controlling DMA fixed effect, and a college graduate's BMI is 106% lower than a woman with some college education. Income also produces different effects on BMI among women and men. While the real household income has a negative effect for women, it has a positive impact on BMI for men. In terms of ethnicity nonwhite women has greater negative impacts on health compared to white women. Time effects for women and men are significantly positive.

Table 6 presents the estimated effects of exogenous variables on body mass index for adults aged 46 to 65. Only model (2) with controlling for DMA effect for both women and men has a meaningful though small positive effect. Although the increase of BMI for women aged 46 to 65 can be explained by childrearing, men aged 46 to 65 do not experience a causal effect on BMI. Looking at this age group I can also see the effect education has on curbing body mass index.

The determinants of body mass index for whites and nonwhites are shown in Table 8. The effect of advertising on body mass index is very small in model (2) and is significant in models (1) and (3). The coefficients on education show the role of education

in reducing body mass index. Grossman (1972) demonstrates that a higher level of education increases the optimal health stock for a given level of health inputs. The education coefficients for nonwhite respondents are larger than the ones for white respondents. This suggests that nonwhites experience a greater reduction in BMI than whites.

Table 9 presents the different determinants of body mass index for people with and without children. The effects of advertising on BMI on a respondent with children are greater than the effects on a respondent without children in model (2). Real income has negative impacts for all models.

Table 10 shows the results of the estimated coefficients by gender. Controlling for demographic variables, geographic effect, and time effect, the impact of advertising on women's BMI is greater than on men's. There is no causal relationship between relative home food price and body mass index for men. Other coefficients have similar impacts to those shown in the other results. However, there is no causal effect for male respondents who have high school degrees and some college education.

Empirical estimates of obesity probability are shown in Tables 11 through 14. These equations are estimated by a linear probability model. In Table 11, the first three and second three columns presents the results of obesity demand function for ages 18-45 and 46-65 respectively. The last three columns estimate health demand function for ages 66-99. While model (1) indicates the basic model without controlling geographic or time factors, model (2) uses the model with designated market area (DMA) fixed effect. Lastly, model (3) is established by controlling time and DMA fixed effects. I find that advertising has a causal effect on the probability of obesity in model (2) for all age

groups, though its effect is small. The number of children a person has consistently significant, positive effects on obesity for all age groups. For ages 18-45 and 46-65 the addition of one more child in the household results in an increase in the percentage of the probability of obesity by 0.8 or 0.9%, with holding other variables constant. People aged 66 to 99 are affected less by the number of children they have compared to the other two age groups. This means that a person who has a child or children is more likely to be obese than a person who does not have a child. For the group aged 66-99 a relative home food price has a positive effect on the probability to be obese. One possible explanation of this is that old people may consume better quality food, even if prices are higher. Demographic variables include age, real household income, education, ethnicity, and marital status. Within the same age group the coefficients of demographic variables show almost the same effects in the three models. More education gives rise to a smaller chance of obesity. Income has a negative effect on obesity for all age groups.

The patterns of determinants for obesity by race are presented in Table 12. Positive advertising effects are found in model (1) and model (2) for whites, though the positive effect of advertising on obesity is estimated in model (2) only. Importantly, the coefficients of the number of children in nonwhite households are greater than those in white households. In other words, nonwhites have stronger relation to obesity with regard to children than whites. Age, real household income, education, gender, and marital status exhibit nearly identical effects on the probability of obesity. Table 13 and Table 14 estimate obesity demand function by children and gender, respectively. The results show the have same story.

5. Conclusion

There have been virtually no scholarly efforts to determine whether there is a causal relationship between advertising and obesity for adults. The purpose of this paper is to examine the effects of fast food television advertising on obesity. I hope to have demonstrated that increased exposure time to fast food advertising leads to an increase in body mass index and thus the probability of obesity, but not for all models. In addition, the number of children a person has also has a positive effect on obesity. These results suggest that television advertising leads to a greater consumption of fast food, increases the body mass index, and creates a higher risk for obesity. In addition, the number of children a person has also contributes to the prevalence of obesity since children are more likely to be exposed to fast food television advertising.

Table 1 Market Size Comparisons in Seattle-Bellevue-Everett (PMSA), Seattle-Tacoma-Bremerton (CMSA), and Seattle-Tacoma (DMA)

	Population	Households
PMSA	2,509,200	1,003,300
CMSA	3,698,500	1,452,700
DMA	4,403,600	1,729,600

Source: Environmental Systems Research Institute (ESRI), 2003

Table 2 Seattle-Tacoma DMA and Seattle-Bellevue-Everett PMSA Markets

Market Characteristics	DMA Total	DMA U.S. Rank	PMSA Total	PMSA U.S. Rank	% of DMA
Population	4,403,600	12	2,509,200	20	57%
Households	1,729,600	12	1,003,300	18	58%
Effective Buying Income	\$98,537,954,000	12	\$63,261,762,000	14	64%

Source: 2003 Survey of Buying Power, Sales & Marketing Management

Table 3 Designated Market Area (DMA) Codes and States

DMA Code and Name	CMR	BRFSS	ACCRA
500 Portland-Auburn	Maine, New Hampshire	New Hampshire	New Hampshire
501 New York	Connecticut, New Jersey, New York, Pennsylvania	Connecticut, New York, Pennsylvania	Connecticut, New York, Pennsylvania
504 Philadelphia	Delaware, New Jersey, Pennsylvania	Delaware, Pennsylvania	Delaware, Pennsylvania
505 Detroit	Michigan	Michigan	Michigan
506 Boston	Massachusetts, New Hampshire, Vermont	Massachusetts, New Hampshire, Vermont	Massachusetts, New Hampshire, Vermont
508 Pittsburgh	Maryland, Pennsylvania, West Virginia	Maryland, Pennsylvania, West Virginia	Maryland, Pennsylvania, West Virginia
510 Cleveland	Ohio	Ohio	Ohio
511 Washington DC	District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia	District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia	District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia
512 Baltimore	Maryland	Maryland	Maryland
513 Flint	Michigan	Michigan	Michigan
514 Buffalo	New York, Pennsylvania	New York, Pennsylvania	New York, Pennsylvania
515 Cincinnati	Indiana, Kentucky, Ohio	Indiana, Kentucky, Ohio	Indiana, Kentucky, Ohio
517 Charlotte	North Carolina, South Carolina	North Carolina, South Carolina	North Carolina, South Carolina
518 Greensboro	North Carolina, Virginia	North Carolina, Virginia	North Carolina, Virginia
521 Providence	Massachusetts, Rhode Island	Massachusetts, Rhode Island	Massachusetts, Rhode Island
524 Atlanta	Alabama, Georgia, North Carolina	Alabama, Georgia, North Carolina	Alabama, Georgia, North Carolina
527 Indianapolis	Indiana	Indiana	Indiana
528 Miami	Florida	Florida	Florida
529 Louisville	Indiana, Kentucky	Indiana, Kentucky	Indiana, Kentucky
532 Albany	Massachusetts, New York, Vermont	Massachusetts, New York, Vermont	Massachusetts, New York, Vermont
533 Hartford	Connecticut	Connecticut	Connecticut
534 Orlando	Florida	Florida	Florida

Table 3 Contd.
Designated Market Area (DMA) Codes and States

DMA Code and Name	CMR	BRFSS	ACCRA
535 Columbus	Ohio	Ohio	Ohio
538 Rochester	New York	New York	New York
539 Tampa	Florida	Florida	Florida
541 Lexington	Kentucky	Kentucky	Kentucky
542 Dayton	Indiana, Ohio	Indiana, Ohio	Indiana, Ohio
544 Norfolk	North Carolina, Virginia	North Carolina, Virginia	North Carolina, Virginia
547 Toledo	Michigan, Ohio	Michigan, Ohio	Michigan, Ohio
548 West Palm Beach	Florida	Florida	Florida
555 Syracuse	New York	New York	New York
556 Richmond	Virginia	Virginia	Virginia
557 Knoxville	Kentucky, Tennessee	Kentucky, Tennessee	Kentucky, Tennessee
560 Raleigh	North Carolina, Virginia	North Carolina, Virginia	North Carolina, Virginia
561 Jacksonville	Florida, Georgia	Florida, Georgia	Florida, Georgia
563 Grand Rapids	Michigan	Michigan	Michigan
564 Charleston	Kentucky, Ohio, West Virginia	Kentucky, Ohio, West Virginia	Kentucky, Ohio, West Virginia
566 Harrisburg	Pennsylvania	Pennsylvania	Pennsylvania
567 Greenville	Georgia, North Carolina, South Carolina	Georgia, North Carolina, South Carolina	Georgia, North Carolina, South Carolina
573 Roanoke	Virginia, West Virginia	Virginia, West Virginia	Virginia, West Virginia
577 Wilkes Barre	Pennsylvania	Pennsylvania	Pennsylvania
602 Chicago	Illinois, Indiana	Illinois, Indiana	Illinois, Indiana
609 St. Louis	Illinois, Missouri	Illinois, Missouri	Illinois, Missouri
613 Minneapolis	Minnesota, Wisconsin	Minnesota, Wisconsin	Minnesota, Wisconsin
616 Kansas City	Kansas, Missouri	Kansas, Missouri	Kansas, Missouri
617 Milwaukee	Wisconsin	Wisconsin	Wisconsin
618 Houston	Texas	Texas	Texas
622 New Orleans	Louisiana, Mississippi	Louisiana, Mississippi	Louisiana, Mississippi
623 Dallas	Texas	Texas	Texas
630 Birmingham	Alabama	Alabama	Alabama
635 Austin	Texas	Texas	Texas
640 Memphis	Arkansas, Mississippi, Tennessee	Arkansas, Mississippi, Tennessee	Arkansas, Mississippi, Tennessee
641 San Antonio	Texas	Texas	Texas
650 Oklahoma City	Oklahoma	Oklahoma	Oklahoma
652 Omaha	Iowa, Missouri, Nebraska	Iowa, Missouri, Nebraska	Iowa, Missouri, Nebraska

Table 3 Contd.
Designated Market Area (DMA) Codes and States

DMA Code and Name	CMR	BRFSS	ACCRA
658 Green Bay	Wisconsin	Wisconsin	Wisconsin
659 Nashville	Kentucky, Tennessee	Kentucky, Tennessee	Kentucky, Tennessee
671 Tulsa	Kansas, Oklahoma	Kansas, Oklahoma	Kansas, Oklahoma
678 Wichita	Kansas, Nebraska	Kansas, Nebraska	Kansas, Nebraska
679 Des Moines	Iowa, Missouri	Iowa	Iowa
686 Mobile	Alabama, Florida, Mississippi	Alabama, Florida, Mississippi	Alabama, Florida, Mississippi
693 Little Rock	Arkansas	Arkansas	Arkansas
751 Denver	Colorado, Nebraska, Nevada, Wyoming	Colorado, Nebraska, Nevada, Wyoming	Colorado, Nebraska, Nevada, Wyoming
753 Phoenix	Arizona	Arizona	Arizona
770 Salt Lake City	Idaho, Nevada, Utah, Wyoming	Idaho, Nevada, Utah, Wyoming	Idaho, Nevada, Utah, Wyoming
790 Albuquerque	Arizona, Colorado, New Mexico	Arizona, Colorado, New Mexico	Arizona, Colorado, New Mexico
803 Los Angeles	California	California	California
807 San Francisco	California	California	California
819 Seattle	Washington	Washington	Washington
820 Portland	Oregon, Washington	Oregon, Washington	Oregon, Washington
825 San Diego	California	California	California
839 Las Vegas	Nevada	Nevada	Nevada
862 Sacramento	California	California	California
866 Fresno	California	California	California
881 Spokane	Idaho, Montana, Oregon, Washington	Idaho, Montana, Oregon, Washington	Idaho, Montana, Oregon, Washington

Table 4 Variable Descriptions and Sample Characteristics

Variable	Definition	Mean	Standard Deviation
Weight Outcome			
BMI	Respondent's Body Mass Index (BMI = weight(kg)/Height ² (m ²))	25.92	5.075
Obese	One if respondent's BMI is equal to or greater than 30	0.17	0.376
Demographic Variables			
Age	Age of respondent	45.15	16.6
Real Household Income	Household income deflated by Consumer Price Index (in thousands)	27.84	19.69
High School Graduate	One if respondent completed high school (12 years)	0.307	0.461
Some College	One if respondent completed 13 – 15 years	0.285	0.451
College Graduate	One if respondent completed college (16 years or more)	0.304	0.46
Nonwhite	One if respondent is not white	0.199	0.399
Male	One if respondent is male	0.434	0.496
Married	One if respondent is married	0.533	0.499
Children	The number of children within a household	0.765	1.153
TV Time	The total number of fast food messages aired multiplied by the length of the message in seconds (in 1000 minutes)	636.77	213.2
Relative Price	The relative price of home food with fast food	1.545	0.116

Sample size is 246,150 for weight outcomes and demographic variables, 174 for relative food price with the state level data, and 199 for the DMA-specific advertising data.

Table 5 The Effects of Total Exposure Time on BMI by Aged 18 - 45

	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	0.0001** (1.52)	0.0006** (3.86)	0.0003 (0.19)	0.0002** (2.38)	0.0005** (3.79)	0.0001 (0.72)
Relative Home Food Price	-0.612** (-3.84)	-0.591* (-1.82)	-0.529 (-1.61)	0.141 (0.98)	0.059 (0.2)	-0.009 (-0.03)
Children	0.162** (9.93)	0.167** (10.22)	0.167** (10.2)	0.123** (6.11)	0.136** (6.71)	0.136** (6.76)
Real Income	-0.03** (-27.4)	-0.03** (-26.53)	-0.03** (-26.81)	0.0036** (3.76)	0.0039** (4.05)	0.0035** (3.67)
High School Graduate	-0.511** (-5.49)	-0.526** (-5.66)	-0.523** (-5.63)	0.075 (0.89)	0.072 (0.85)	0.072 (0.85)
Some College	-0.727** (-7.86)	-0.716** (-7.74)	-0.718** (-7.77)	0.036 (0.43)	0.063 (0.74)	0.062 (0.73)
College Graduate	-1.49** (-15.85)	-1.473** (-15.66)	-1.48** (-15.74)	-0.472** (-5.63)	-0.44** (-5.22)	-0.442** (-5.25)
Nonwhite	1.483** (29.99)	1.562** (30.52)	1.544** (30.17)	0.279** (6.3)	0.358** (7.81)	0.34** (7.43)
Married	0.433** (9.77)	0.426** (9.56)	0.438** (9.83)	0.963** (22.15)	0.94** (21.68)	0.95** (21.92)
DMA Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	78363	78363	78363	62119	62119	62119

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
2. All coefficients for state fixed effects and time effects are not reported.
3. * significant at 10 percent and ** significant at 5 percent.

Table 6 The Effects of Total Exposure Time on BMI by Aged 46 – 65

	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	-0.0001 (-0.76)	0.0006** (2.4)	-0.0003 (-0.11)	0.0001 (1.09)	0.0005** (2.43)	0.00007 (0.32)
Relative Home Food Price	-0.623** (-2.5)	0.072 (0.15)	0.092 (0.19)	-0.521** (-2.36)	0.657 (1.52)	0.532 (1.22)
Children	0.181** (4.36)	0.182** (4.38)	0.177** (4.23)	0.02 (0.61)	0.02 (0.61)	0.017 (0.51)
Real Income	-0.034** (-21.01)	-0.035** (-21.01)	-0.036** (-21.79)	0.001 (0.83)	0.002 (1.12)	0.001 (0.86)
High School Graduate	-1.003** (-8.75)	-1.014** (-8.81)	-1.027** (-8.94)	-0.166 (-1.55)	-0.194* (-1.81)	-0.199* (-1.86)
Some College	-1.126** (-9.49)	-1.081** (-9.04)	-1.1** (-9.2)	-0.227** (-2.08)	-0.213* (-1.94)	-0.225** (-2.05)
College Graduate	-1.858** (-15.17)	-1.858** (-14.87)	-1.829** (-14.8)	-0.897** (-8.2)	-0.864** (-7.85)	-0.877** (-7.96)
Nonwhite	1.548** (18.6)	1.574** (18.33)	1.554** (18.1)	0.082 (1.08)	0.154** (1.97)	0.137* (1.75)
Married	0.05 (0.77)	0.089 (1.37)	0.108* (1.67)	0.61** (10.32)	0.588** (9.9)	0.603** (10.13)
DMA Effect	No	Yes**	Yes**	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	38554	38554	38554	30559	30559	30559

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

2. All coefficients for state fixed effects and time effects are not reported.

3. * significant at 10 percent and ** significant at 5 percent.

Table 7 The Effects of Total Exposure Time on BMI by Aged 66 – 99

	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	-0.0001 (-0.91)	0.0005** (1.97)	-0.0003 (-0.96)	-0.00006 (-0.41)	0.0004 (1.55)	-0.000008 (-0.03)
Relative Home Food Price	0.153 (0.52)	0.722 (1.25)	0.8 (1.37)	0.7** (2.37)	0.754 (1.33)	0.736 (1.3)
Children	0.545** (4.2)	0.558** (4.33)	0.554** (4.29)	0.192 (1.29)	0.187 (1.23)	0.18 (1.19)
Real Income	-0.03** (-10.77)	-0.03** (-10.56)	-0.03** (-10.94)	-0.0005 (-0.23)	-0.0002 (-0.09)	-0.0007 (-0.33)
High School Graduate	-0.63** (-6.89)	-0.637** (-6.89)	-0.652** (-7.06)	-0.223** (-2.28)	-0.211** (-2.12)	-0.223** (-2.25)
Some College	-0.965** (-9.56)	-0.939** (-9.17)	-0.951** (-9.31)	-0.392** (-3.71)	-0.358** (-3.33)	-0.372** (-3.47)
College Graduate	-1.329** (-11.55)	-1.284** (-11.01)	-1.303** (-11.18)	-0.657** (-6.16)	-0.62** (-5.74)	-0.64** (-5.93)
Nonwhite	1.507** (13.33)	1.559** (13.33)	1.546** (13.24)	0.244** (2.14)	0.311** (2.66)	0.292** (2.5)
Married	0.568** (7.88)	0.577** (7.96)	0.591** (8.16)	0.479** (6.75)	0.484** (6.79)	0.489** (6.87)
DMA Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	22426	22426	22426	14129	14129	14129

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

2. All coefficients for state fixed effects and time effects are not reported.

3. * significant at 10 percent and ** significant at 5 percent.

Table 8 The Effects of Total Exposure Time on BMI by Race

	White			Nonwhite		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	7.85e-05 (1.47)	5.07-04** (5.42)	-7.33e-05 (-0.72)	6.50e-05 (0.65)	4.84e-04** (2.73)	-8.45e-05 (-0.43)
Relative Home Food Price	-0.245** (-2.54)	0.294 (1.56)	0.313* (1.66)	-0.521** (-2.8)	-0.179 (-0.39)	-0.363 (-0.78)
Children	0.05** (4.58)	0.053** (4.76)	0.052** (4.75)	0.328** (13.42)	0.333** (13.69)	0.332** (13.66)
Age	0.026** (38.71)	0.027** (39.36)	0.027** (39.31)	0.049** (28.43)	0.046** (26.69)	0.046** (26.70)
Real Income	-0.01** (-19.09)	-0.01** (-18.18)	-0.01** (-18.92)	-0.01** (-7.33)	-0.01** (-7.1)	-0.01** (-7.31)
High School Graduate	-0.24** (-5.0)	-0.194** (-4.05)	-0.203** (-4.23)	-0.299** (-3.74)	-0.374** (-4.66)	-0.38** (-4.74)
Some College	-0.366** (-7.52)	-0.289** (-5.91)	-0.302** (-6.18)	-0.501** (-6.07)	-0.562** (-6.79)	-0.568** (-6.85)
College Graduate	-0.949** (-19.44)	-0.865** (-17.62)	-0.883** (-17.98)	-1.421** (-16.14)	-1.46** (-16.54)	-1.486** (-16.64)
Male	1.496** (69.67)	1.503** (70.06)	1.505** (70.02)	0.056 (1.15)	0.132** (2.71)	0.129** (2.64)
Married	0.626** (25.32)	0.613** (24.66)	0.626** (25.18)	-0.044 (-0.81)	0.056 (1.03)	0.068 (1.25)
DMA Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	197200	197200	197200	48950	48950	48950

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

2. All coefficients for state fixed effects and time effects are not reported.

3. * significant at 10 percent and ** significant at 5 percent.

Table 9 The Effects of Total Exposure Time on BMI by Children

	No Child			Children		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	-5.39e-05 (-0.89)	4.63-04** (4.40)	-1.77e-04 (-1.55)	2.27e-04** (2.98)	5.85e-04** (4.35)	1.46e-04 (1.00)
Relative Home Food Price	-0.459** (-4.25)	0.008 (0.04)	-0.012 (-0.05)	-0.162* (-1.15)	0.038 (0.14)	0.058 (0.21)
Age	0.022** (31.19)	0.023** (31.6)	0.023** (31.57)	0.082** (43.59)	0.082** (43.73)	0.082** (43.62)
Real Income	-0.005** (-7.14)	-0.005** (-6.77)	-0.0055** (-7.47)	-0.02** (-26.3)	-0.02** (-25.43)	-0.02** (-25.76)
High School Graduate	-0.36** (-7.22)	-0.322** (-6.44)	-0.333** (-6.66)	-0.291** (-4.09)	-0.313** (-4.39)	-0.315** (-4.43)
Some College	-0.601** (-11.7)	-0.523** (-10.13)	-0.537** (-10.41)	-0.344** (-4.81)	-0.34** (-4.74)	-0.345** (-4.81)
College Graduate	-1.205** (-23.31)	-1.117** (-21.5)	-1.137** (-21.89)	-1.069** (-14.51)	-1.061** (-14.36)	-1.069** (-14.47)
Male	1.011** (39.87)	1.019** (40.25)	1.02** (40.32)	1.489** (46.84)	1.508** (47.44)	1.51** (47.5)
Nonwhite	0.877** (23.42)	0.938** (24.41)	0.917** (23.88)	1.214** (28.81)	1.311** (29.92)	1.293** (29.5)
Married	0.559** (20.34)	0.554** (20.09)	0.568** (20.6)	0.23** (5.73)	0.239** (5.93)	0.25** (6.2)
DMA Effect	No	Yes	Yes	No	Yes*	Yes**
Time Effect	No	No	Yes**	No	No	Yes**
Observations	149439	149439	149439	96711	96711	96711

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

2. All coefficients for state fixed effects and time effects are not reported.

3. * significant at 10 percent and ** significant at 5 percent.

Table 10 The Effects of Total Exposure Time on BMI by Gender

	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	3.51e-05 (0.51)	5.79-04** (4.84)	-8.64e-05 (-0.66)	1.27e-04** (2.05)	4.85e-04** (4.44)	3.48e-05 (0.29)
Relative Home Food Price	-0.528** (-4.29)	-0.155 (-0.63)	-0.11* (-0.44)	-0.124 (-0.21)	0.356 (1.56)	0.282 (1.23)
Children	0.095** (6.83)	0.098** (7.01)	0.097** (6.96)	0.124** (7.92)	0.132** (8.37)	0.132** (8.38)
Age	0.034** (36.67)	0.035** (38.03)	0.035** (38.03)	0.018** (19.89)	0.018** (20.16)	0.018** (20.09)
Real Income	0.027** (-31.78)	0.027** (-31.45)	0.027** (-31.98)	0.006** (-8.77)	0.007** (9.16)	0.006** (8.6)
High School Graduate	-0.55** (-9.57)	-0.52** (-9.03)	-0.528** (-9.18)	0.03 (0.54)	0.047 (0.85)	0.04 (0.72)
Some College	-0.74** (-12.57)	-0.676** (-11.45)	-0.689** (-11.67)	-0.016 (-0.29)	0.032 (0.57)	-0.023 (-0.41)
College Graduate	-1.472** (-24.23)	-1.401** (-22.96)	-1.421** (-23.3)	-0.578** (-10.39)	-0.52** (-9.34)	-0.531** (-9.53)
Nonwhite	1.64** (41.14)	1.696** (41.17)	1.676** (40.67)	0.289** (7.96)	0.37** (9.87)	0.351** (9.36)
Married	0.474** (14.54)	0.483** (14.75)	0.497** (15.19)	0.764** (24.31)	0.748** (23.79)	0.759** (24.13)
DMA Effect	No	Yes*	Yes**	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
Observations	139343	139343	139343	106807	106807	106807

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

2. All coefficients for state fixed effects and time effects are not reported.

3. * significant at 10 percent and ** significant at 5 percent.

Table 11 The Effects of Total Exposure Time on the Probability to be obese by Age

	Age 18 – 45			Age 46 – 65			Age 66 – 99		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	1.67e-05** (3.72)	3.06-05** (3.88)	2.44e-06 (0.29)	2.58e-06 (0.35)	2.51e-05* (1.94)	-5.28e-06 (-0.38)	-2.27e-06 (-0.26)	3.39e-05** (2.2)	-7.43e-06 (-0.44)
Relative Home Food Price	-0.016** (-1.96)	0.012 (0.74)	0.012 (0.71)	-0.052** (-3.90)	0.028 (1.06)	0.026 (0.99)	0.043** (2.57)	0.074** (2.24)	0.074** (2.21)
Children	0.008** (9.47)	0.009** (9.95)	0.009** (9.97)	0.009** (4.51)	0.009** (4.53)	0.009** (4.37)	0.031** (3.97)	0.031** (4.02)	0.031** (3.97)
Real Income	-0.001** (-19.08)	-0.001** (-17.88)	-0.001** (-18.22)	-0.001** (-14.32)	-0.001** (-14.28)	-0.001** (-14.56)	-0.001** (-8.08)	-0.001** (-7.86)	-0.001** (-8.2)
High School Graduate	-0.022** (-4.9)	-0.023** (-5.0)	-0.023** (-4.98)	-0.05** (-8.1)	-0.05** (-8.08)	-0.051** (-8.19)	-0.041** (-7.41)	-0.041** (-7.29)	-0.042** (-7.45)
Some College	-0.035** (-7.69)	-0.033** (-7.3)	-0.033** (-7.31)	-0.051** (-8.1)	-0.048** (-7.39)	-0.049** (-7.55)	-0.057** (-9.62)	-0.055** (-9.09)	-0.055** (-9.24)
College Graduate	-0.071** (-15.53)	-0.069** (-15.05)	-0.069** (-15.11)	-0.094** (-14.43)	-0.09** (-13.69)	-0.091** (-13.88)	-0.07** (-10.95)	-0.067** (-10.34)	-0.068** (-10.57)
Male	0.013** (6.71)	0.014** (7.33)	0.014** (7.38)	0.008** (2.63)	0.009** (2.83)	0.009** (2.88)	-0.028** (-6.83)	-0.027** (-6.67)	-0.027** (-6.65)
Nonwhite	0.047** (19.21)	0.052** (20.4)	0.051** (20.01)	0.052** (11.16)	0.055** (11.64)	0.054** (11.38)	0.069** (9.74)	0.069** (9.81)	0.068** (9.66)
Married	0.024** (11.17)	0.023** (10.65)	0.024** (10.92)	0.007* (1.95)	0.007** (2.07)	0.008** (2.38)	0.014** (3.41)	0.015** (3.5)	0.015** (3.65)
DMA Effect	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes	No	No	Yes**	No	No	Yes**
R-Squared	0.0162	0.02	0.0206	0.0163	0.022	0.0227	0.0168	0.0207	0.022
Observations	140,482	140,482	140,482	69113	69113	69113	36555	36555	36555

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

2. All coefficients for DMA fixed effects and time effects are not reported.

3. * significant at 10 percent and ** significant at 5 percent.

Table 12 The Effects of Total Exposure Time on the Probability to be obese by Race

	White			Nonwhite		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	1.08e-05** (2.7)	2.63e-05** (3.77)	-6.89e-04 (-0.91)	8.00e-06 (1.04)	3.31e-05** (2.54)	-4.35e-07 (-0.03)
Relative Home Food Price	-0.013* (-1.77)	0.038** (2.71)	0.037** (2.64)	-0.042** (3.02)	0.026 (0.73)	0.022 (0.62)
Children	0.002** (2.28)	0.002** (2.36)	0.002** (2.34)	0.017** (10.64)	0.017** (10.8)	0.017** (10.77)
Age	0.0007** (15.14)	0.0008** (15.72)	0.0008** (15.67)	0.002** (18.48)	0.002** (17.14)	0.002** (17.12)
Real Income	-0.0009** (-19.22)	-0.0008** (-18.33)	-0.0009** (-18.89)	-0.0007** (-6.2)	-0.0007** (-5.72)	-0.0007** (-5.87)
High School Graduate	-0.028** (-7.85)	-0.025** (-7.02)	-0.025** (-7.17)	-0.029** (-4.71)	-0.033** (-5.44)	-0.034** (-5.49)
Some College	-0.037** (-10.3)	-0.032** (-8.86)	-0.033** (-9.06)	-0.037** (-5.9)	-0.041** (-6.43)	-0.041** (-6.47)
College Graduate	-0.071** (-19.76)	-0.066** (-18.19)	-0.067** (-18.47)	-0.089** (-13.34)	-0.091** (-13.59)	-0.091** (-13.66)
Male	0.019** (11.2)	0.019** (11.52)	0.019** (11.59)	0.044** (11.85)	0.04** (10.67)	0.04** (10.72)
Married	0.029** (15.81)	0.029** (15.24)	0.029** (15.63)	0.009** (2.19)	-0.004 (-0.89)	-0.003 (-0.72)
DMA Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes	No	No	Yes
R-Squared	0.0108	0.0136	0.0145	0.0229	0.0315	0.0322
Observations	197200	197200	197200	48950	48950	48950

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.

2. All coefficients for DMA fixed effects and time effects are not reported.

3. * significant at 10 percent and ** significant at 5 percent.

Table 13 The Effects of Total Exposure Time on the Probability to be obese by Children

	No Child			Children		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	1.09e-06 (0.24)	2.64e-05** (3.34)	-1.05e-05 (1.22)	2.15e-05** (3.74)	3.21e-05** (3.18)	7.44e-06 (0.68)
Relative Home Food Price	-0.023** (-2.85)	-0.024 (-1.47)	-0.023 (-1.36)	-0.021 (-1.97)	0.025 (1.19)	0.025 (1.21)
Age	0.0006** (11.0)	0.0006** (11.39)	0.0006** (11.35)	0.004** (28.23)	0.004** (28.33)	0.004** (28.24)
Real Income	-0.0006** (-11.01)	-0.0006** (-10.58)	-0.0006** (-10.58)	-0.001** (-20.25)	-0.001** (-19.44)	-0.001** (-19.68)
High School Graduate	-0.035** (-9.17)	-0.032** (-8.53)	-0.033** (-8.69)	-0.027** (-5.3)	-0.028** (-5.51)	-0.028** (-5.53)
Some College	-0.048** (-12.51)	-0.043** (-11.16)	-0.044** (-11.38)	-0.033** (-6.35)	-0.032** (-6.16)	-0.032** (-6.21)
College Graduate	-0.084** (-21.46)	-0.078** (-19.94)	-0.079** (-20.24)	-0.076** (-14.15)	-0.075** (-13.93)	-0.075** (-14.01)
Male	-0.003 (-1.47)	-0.002 (-1.13)	-0.002 (-1.11)	0.017** (6.82)	0.018** (7.33)	0.018** (7.36)
Nonwhite	0.047** (16.81)	0.051** (17.61)	0.049** (17.18)	0.058** (18.51)	0.064** (19.58)	0.063** (19.29)
Married	0.026** (12.12)	0.025** (11.92)	0.026** (12.3)	0.008** (2.92)	0.009** (2.94)	0.009** (3.14)
DMA Cluster Effect	No	Yes	Yes	No	Yes*	Yes*
Time Effect	No	No	Yes**	No	No	Yes**
R-Squared	0.0123	0.0167	0.0178	0.0259	0.0259	0.0303
Observations	149439	149439	149439	96711	96711	96711

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
2. All coefficients for DMA fixed effects and time effects are not reported.
3. * significant at 10 percent and ** significant at 5 percent.

Table 14 The Effects of Total Exposure Time on the Probability to be obese by Gender

	Female			Male		
	(1)	(2)	(3)	(1)	(2)	(3)
TotExp	5.70e-06 (1.2)	2.69e-05** (3.25)	9.40e-06 (-1.05)	1.53e-06** (2.86)	3.39e-05** (3.59)	6.40e-06 (0.63)
Relative Home Food Price	-0.029** (-3.44)	0.012 (0.73)	0.015 (0.86)	-0.009 (-0.95)	0.045** (2.27)	0.04** (1.97)
Children	0.004** (4.69)	0.004** (4.71)	0.004** (4.66)	0.005** (4.48)	0.006** (4.95)	0.006** (4.95)
Age	0.001** (16.95)	0.001** (17.23)	0.001** (17.22)	0.0006** (9.07)	0.0007** (9.29)	0.0007** (9.23)
Real Income	-0.0015** (-26.8)	-0.0015** (-26.4)	-0.0015** (-26.83)	-0.00005 (-0.71)	-1.46e-06 (-0.02)	-0.00003 (-0.41)
High School Graduate	-0.046** (-11.2)	-0.044** (-10.75)	-0.045** (-10.87)	-0.009* (-1.93)	-0.008* (-1.65)	-0.008* (-1.74)
Some College	-0.055** (-13.27)	-0.051** (-12.31)	-0.052** (-12.48)	-0.017** (-3.66)	-0.013** (-2.8)	-0.013** (-2.92)
College Graduate	-0.09** (-21.2)	-0.085** (-20.08)	-0.087** (-20.34)	-0.059** (-12.83)	-0.055** (-11.91)	-0.056** (-12.05)
Nonwhite	0.078** (27.89)	0.081** (28.0)	0.079** (27.61)	0.021** (6.63)	0.027** (8.3)	0.025** (7.92)
Married	0.014** (6.19)	0.014** (6.3)	0.015** (6.65)	0.041** (15.56)	0.04** (15.05)	0.04** (15.29)
DMA Cluster Effect	No	Yes	Yes	No	Yes	Yes
Time Effect	No	No	Yes**	No	No	Yes**
R-Squared	0.0274	0.0315	0.0324	0.009	0.0124	0.013
Observations	139343	139343	139343	106807	106807	106807

1. Robust standard errors with adjustments for state clustering are taken into account because they assume that observations are independent across years and states but not within states in a given year. t-values based on robust standard errors are reported in parentheses.
2. All coefficients for DMA fixed effects and time effects are not reported.
3. * significant at 10 percent and ** significant at 5 percent.

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