The Effect of State Level Soda Tax on Adult Obesity

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ABSTRACT

Introduction

Rising obesity rates and lower state and local revenues have resulted in more state governments adopting taxes on soda over the last ten years. The intended effects of soda taxes are to reduce the amount of soda purchased and consumed. This research uses data from the Behavioral Risk Factor Surveillance System (BRFSS) and state-level soda tax rates above food taxes in order to ascertain whether soda taxes reduce individual body-mass index (BMI). BMI is calculated by using a person's height and weight and is a validated measure of body fat.

Methods

OLS, Logit, Multinomial Logit and quantile regressions with state fixed effects and controls for individual characteristics allow us to estimate and predict the effects of state soda taxes on obesity. The quantile regression was run at 25, 50, 75, and 95. The sample (n = 992,845) was limited to non-pregnant individuals aged 18 to 64 with a BMI of 15 to 40.

Results

The OLS results indicate that taxes have a small negative effect on BMI, however it is not statistically significant (βtax = -.01198, p = .352). The quantile regressions indicate there may be a trend of lower effect on BMI as a person's BMI increases, however, results were not statistically significant (Q 25 βtax = - .02201, p = .13; Q 95 βtax = .02237, p = .473). Several other variables were statistically significant predictors of BMI consistently across the models including exercise habits, health status and education. Race also plays a significant role in predicting BMI. African Americans have a body mass 1.55 higher than Whites and Asians have a body mass 1.89 less than Whites, according to the OLS model.

Discussion

Our research does not support the theory that soda taxes have a negative effect on body-mass index. Current soda tax rates range from two percent to 7.25 percent and it's possible these may not be high enough to affect BMI. Further research that addresses consumption and includes data on local soda taxes is warranted.

BACKGROUND

The Obesity Epidemic

Over the past 30 years, obesity rates for adults in the United States have increased steeply. This trend is consistent across racial/ethnic groups, educational attainment, and income groups (Ljungvall & Zimmerman, 2012, p. 119). The result is that more than one third of US adults are obese and the Centers for Disease Control (CDC) named obesity an "epidemic." Obesity is associated with other serious health conditions including coronary heart disease, Type II diabetes, cancer, high cholesterol, liver and gallbladder disease, sleep apnea, osteoarthritis, reproductive complications, and mental health conditions (Centers for Disease Control). It has been estimated that the medical costs of obesity equal 10 percent of all medical spending nationally ($147 million in 2008) (Fletcher, Frisvold, & Tefft, 2010, p. 968).

The Role of Soda

Sugar-sweetened beverages (SSBs), a group of beverages that includes soda sweetened with sugar, corn syrup or other caloric sweeteners and other carbonated and un-carbonated drinks, such as sports and energy drinks, play a large part in the obesity epidemic. Over the past 50 years, soft drink consumption has increased by 500 percent and sodas are the single -largest source of calories in the American diet (Fletcher, Frisvold, & Tefft, 2010, p. 968). The average American receives about seven percent of their total calories from soft drinks, but that number is much higher for people who consume soft drinks several times a day (Fletcher, Frisvold, & Tefft, 2010, p. 968). In 2008, the average household spent $142 on sugar-sweetened beverages. Those with lower income and lower education levels devote a higher proportion of their total spending to SSBs and receive a larger fraction of daily calories from those sources (McGranahan & Schanzenbach, 2011, p. 3).

One study concluded that SSBs "may be the single largest driver of the obesity epidemic… [and] the intake of sugared beverages is associated with increased body weight, poor nutrition, and displacement of more healthful beverages; increasing consumption increases risk for obesity and diabetes" (Brownell, et al., 2009, p. 1). Medical research has shown that sugar is an addictive food that leads to increased consumption of foods high in carbohydrates and fats, the main contributors to weight increase (Milkjovic, Nganje, & de Chastenet, 2008, p. 59).

Soda Taxation

In response to the growing evidence suggesting the detrimental impacts of SSB consumption, public agencies have looked for ways to decrease soda consumption. One such approach is taxing soda or sugar, a tactic that is considered by some to be a Pigouvian tax in that it attempts dissuade people from purchasing soda to minimize the negative externalities associated with soda consumption. The tax would help to correct for the overconsumption of sodas by using tax revenue to pay for programs that provide medical care to treat obesity-related issues and educate people about how to stay healthy. Additionally, soft drink revenues in the United States are about $70.1 billion every year, and taxing those profits provides government agencies with much-needed revenue that could potentially be used toward further obesity prevention activities.

The first tax on soda was implemented in 1920 in order to raise revenue. Justifications for recent soda taxes are varied and include raising revenue for the general fund, using revenue to for obesity prevention education, and deterring individuals from drinking soda in order to lower the rates of obesity. This last line of reasoning has also been used for raising taxes on cigarettes and alcohol and is known colloquially as a "sin tax." From 2009 to 2010, 17 states considered expanding taxes on SSBs and as of 2011, 23 states had enacted a sales tax on soda (McGranahan & Schanzenbach, 2011). Taxes vary drastically across and within states, by point of sale, and form of beverage. However, there are two basic approaches to soda taxes: sales taxes and excise taxes. Sales taxes are levied on the consumer at the cash register and excise taxes are levied on the distributors.

Critics of soda taxes have argued that targeting one source of caloric intake will not have an impact on health outcomes. However, one researcher found that "reducing energy intake by only 100 calories per day, which is fewer than one can of soda per day, could prevent weight gain in over 90 percent of the population" (Fletcher, Frisvold, & Tefft, 2010, p. 968). Another study found that a one percent increase in the price of sugary food would reduce the probability of a person of healthy weight becoming obese by 3.07 percent and increase the likelihood of being in the healthy body-mass index (BMI) category by 5.39 percent (Milkjovic, Nganje, & de Chastenet, 2008).

Despite the potential positive impacts of soda taxes, past research about other "sin taxes" have shown that behavioral responses to public policies can be unexpected and varied. For example, studies have shown that cigarette taxes have resulted in some smokers smoking cigarettes with higher tar and nicotine content (Evans & Farrelly, 1998). Smoking bans in bars have been shown to increase fatal traffic accidents as drivers travel further to find bars that allow smoking (Adams & Cotti, 2008), and the taxes lead to increased exposure of nonsmokers to tobacco smoke (Adda & Corgnaglia, 2010).

These lessons can be applied to soda tax policy. For example, a sales tax on soda would decrease the relative price per ounce of sugar beverages for larger servings and generic brands. Consumers may choose to switch to cheaper options rather than avoiding soda altogether. In addition, items purchased through the Federal Supplemental Nutrition Assistance Program (SNAP) are not subject to sales tax. As a result, sales taxes on soda do not reach the lowest income population that is consuming more of its calories through SSBs. An excise tax, on the other hand, is usually calculated based on volume of the product. Consumers may be incentivized to purchase brands with a higher sugar content under this scenario, undermining the public health benefits of the tax altogether.

We have chosen to examine state-level soda sales taxes because the tax is levied directly and visibly on the consumer and we believe that these taxes are the most likely to impact consumer behavior. Excise taxes, on the other hand, impact manufacturers and distributors and their effect on consumer behavior may be varied, delayed, and more difficult to measure. Soda consumption or sales would be excellent indicators of the effects of soda taxes on consumer behavior. However, consumption and sales data were not available. BMI is a downstream measure of the potential beneficial effects of a soda tax and is readily-available through the CDC's Behavioral Risk Factor Surveillance System. Therefore, we examine the effect of state-level soda taxes on obesity as measured by BMI.

DATA AND METHODS

Data Sources

To answer our research question we used data available online from a variety of sources including government agencies and a non-governmental research group.

Behavioral Risk Factor Surveillance System
(Centers for Disease Control and Prevention (CDC), 2008-2011)

The CDC's Behavioral Risk Factor Surveillance System (BRFSS) is the world's largest, on-going telephone health survey system, tracking health conditions and risk behaviors in the United States yearly since 1984. Currently, data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the US Virgin Islands, and Guam. This study uses data from all 50 states for 2008-2011.

Soda Tax Data (Bridging the Gap Program, University of Illinois at Chicago)

Bridging the Gap Research provides state-level tax data from 1997 to 2011. Sales tax information is captured for a variety of snack foods and sales locations, but this study will focus on the tax rate of soda sold in grocery stores above the rate of taxation on food items, a form of tax known as a "disfavored tax." This study uses tax data from 2008 to 2011.

State-level control data (United States Census Bureau, 2008-2011),
(United States Department of Labor, Bureau of Labor Statistics, 2008-2011)

State-level controls for unemployment and median income were obtained from the US Census Bureau and the US Department of Labor.

Variables

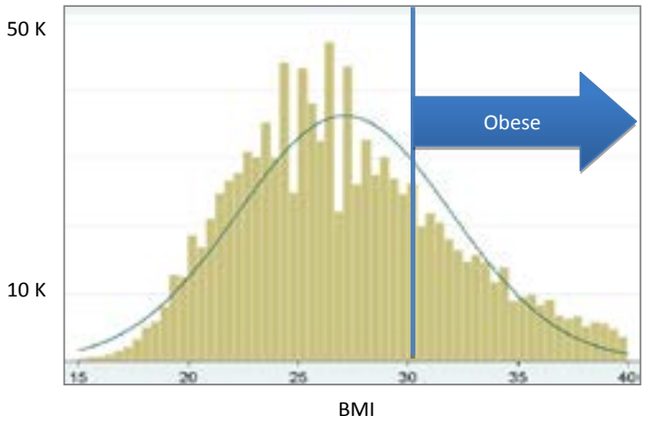
Outcome variable: Obesity

The BRFSS survey uses self-reported height and weight responses to calculate each respondent's BMI. Body Mass Index (BMI) is an established alternative for direct measures of body fat (Centers for Disease Control and Prevention, 2011). Although some research has shown that BMI varies in validity as a measure of body fat (Smalley, Knerr, Kendrick, Colliver, & Owen, 1990), other methods of measuring obesity are substantially more difficult and expensive. A BMI above 30 is considered obese and corresponds to about 35 pounds overweight for a 5'9" person (Table 1). A change of one BMI corresponds to a change in weight of one to 10 pounds.

Table 1 BMI and Weight Example

Height	Weight Range	BMI	Weight Status
5' 9"	124 lbs or less	Below 18.5	Underweight
	125 to 168 lbs	18.5 to 24.9	Normal
	169 to 202 lbs	25.0 to 29.9	Overweight
	203 lbs or more	30 or higher	Obese

Figure 1
Distribution of BMI in sample



Control Variables

The BRFSS provides extensive information about individuals that allow us to control for demographics such as gender, age, race, income, education level, and metropolitan status. We also controlled for personal habits such as frequency of physical activity, health status, and whether an individual was insured. We included median household income by state and year as a variable in the regression analysis to control for differential consumer buying power across states. This study spans the years of a major recession in the United States, 2008-2011. Therefore, we control for potential differential impacts of this recession by including state unemployment rates in the regression analysis.

Sample Population

For our research we limited our analysis to individual adults aged 18 to 64 who were not pregnant and for whom there existed height and weight variables. We truncated our data to include only those with BMI values 15 to 40 (a weight of 100 to 275 pounds for a 5'9" person) due to some concerns with data reliability. For example, weights ranged from 44 to 661 pounds and heights ranged from two to seven feet. We assumed that the most extreme outliers were measurement errors and that those that were not (the extremely obese or underweight) would not be influenced by a soda tax due to larger health issues. Even after the BMI sample is truncated, the distribution is right skewed (Figure 1).

The sample has a relatively equal number of observations in each year. Generally, the number of observations for each state mirrors the populations of those states. However, Washington, Massachusetts and Nebraska are oversampled while Texas and New York and underrepresented. In addition, women are overrepresented in the sample (59 percent). Nearly two thirds of the sample has been to college for at least a year and almost 80 percent of the sample is non-Hispanic white individuals. The second largest racial group is African Americans (8.2 percent) followed by Hispanics (seven percent). African Americans and Hispanics are under sampled, making up 12.9 and 15.1 percent of the general population, respectively (U.S. Census Bureau, Population Division, 2008).

Just over 30 percent of the sample reported making over $75,000 in the last year.

Health status variables also tell an interesting story about the sample. About 86 percent of the sample is insured and only 15 percent reported that they felt they were in "fair" or "poor" health. However, just 23 percent of the sample reported that they had participated in physical activities in the past month and the average BMI was just above 27 (overweight).

In 2008, 21 states had adopted a disfavored soda tax and the tax rate ranged from two to seven percent. By 2011, 23 states had adopted a soda tax ranging from 2.91 percent to 7.25 percent. BMI differs only slightly between states that have soda taxes and those that do not (Figure 2). Appendix A[1] provides an overview of obesity rates and soda tax rates by state.

Models

Our analysis is modeled after previous research that studies the impact of cigarette taxes on cigarette consumption (Fletcher, Frisvold, & Tefft, 2010). We used repeated cross-sections of the BRFSS data sets and controlled for individual demographics and socioeconomic characteristics. In addition, we used a fixed effects method to control for external factors (i.e. unobserved heterogeneity) such as state-level differences that are not measurable. We controlled for state-level differences to account for cultural and political factors that might influence obesity such as state-sponsored wellness programs or regional food habits. The time series aspect allows us to use the natural order of years to assess changes in soda tax policy over time. The basic OLS regression formula is as follows:

$$Y_{is}=\beta_1 X_{is}+\beta_2 T_{st}+\mu_s+\varepsilon_{is}$$

Where Y_{is} is the BMI outcome of individual i in state s. X_{is} is a set of individual and environmental characteristics in state s, T_s is the tax rate in state s, and μ_s represents the state fixed effects.

This same basic methodology was repeated using four different models in order to test the impact of soda taxes on individuals at different levels of BMI. The first model, a simple OLS regression, analyzes the impact of soda taxes, measured continuously, on BMI, also measured continuously. A logit model was also used to determine the effect of state soda taxes on the probability of an individual being obese (BMI>30). Third, we tested whether soda taxes differentially impacted obese, overweight, normal, and underweight individuals respectively using a multinomial logit. Lastly, we used a quantile regression to describe the effect of soda taxes at several places in the distribution of BMI. This last method provides a useful perspective because it examines the effect of tax separately among those who are normal or obese as opposed to the mean BMI, as is the case in OLS models (Ljungvall & Zimmerman, 2012). We ran quantile regressions at 25, 50, 75 and 95 levels.

In addition to the four models that test the relationship between soda taxes and obesity, we developed a separate regression to test the soundness of our model specification. We used a false experiment to test the effect of soda taxes on cigarette consumption. We hypothesized that a tax on soda would have no effect on smoking and if we found a significant effect on cigarette consumption it indicates that our model may be poorly constructed.

RESULTS

The effect of soda tax on BMI in all four models was very small and not significant and, in some cases, the relationship was actually positive (BMI increases as soda tax increases). The most promising results were derived from the quantile model. Results from the quantile model suggest that soda taxes may be more effective for individuals with a normal BMI, although the results are still insignificant (Figure 3).

On the other hand, several control variables were significantly related to BMI consistently throughout all models (Table 2). The largest relationship was between self-reported health status and BMI. Individuals who considered themselves to be in "poor health" had, on average, a BMI 2.5 points higher than individuals who reported being in "excellent health." While this finding is not particularly surprising, it provides evidence to support the relationship between health and BMI and the trustworthiness of the self-reported health status indicators. A one unit change in BMI is equivalent to a one to 10 pound weight gain or loss, meaning that "poor health" status is associated with a 2.5 to 25 pound increase in weight compared with those indicating "excellent health." Consistent with previous research, our findings also suggest that African Americans and other minorities (with the exception of Asians) are more likely to have a higher BMI than white individuals. Surprisingly, income does not have a large effect on BMI and the relationship does not appear to be linear. For a full list of results, see Appendix B.[2]

The false experiment on the effect of the tax on cigarette consumption also returned insignificant results, indicating that there were no major errors in our model specifications.

Table 2 Results*

Body Mass Index	OLS	Logit	Multinomial Logit**	Quantiles 25	50	75	95
State soda tax	-0.012 (.352)	0.002 (.768)	-0.004 (-0.45)	-0.022 (.13)	-0.020 (.222)	-0.012 (.583)	0.022 (.473)
Not exercising	0.57[t]	0.26[t]	0.321[t]	0.29[t]	0.65[t]	.97[t]	0.89[t]
"Poor health"	2.459[t]	1.247[t]	1.465[t]	1.226[t]	2.598[t]	4.017[t]	4.320[t]
African American	1.55[t]	0.504[t]	0.534[t]	1.48[t]	1.79[t]	1.80[t]	1.17[t]
Asian	-1.89[t]	-1.038[t]	-0.474[t]	-1.27[t]	-1.74[t]	-2.34[t]	-3.14[t]
Income $35-50K	0.507[t]	0.132[t]	0.259[t]	0.759[t]	0.506[t]	0.231[t]	-0.030[t]
Income over $75K	.34[t]	0.040[t]	0.233[t]	0.79[t]	0.37[t]	-0.11[t]	-.56[t]
Model fit (R^2 or pseudo R^2)	0.108	0.059	0.059	0.067	0.068	0.073	.065

*Reference groups: "Excellent health", non-Hispanic white, income <$15,000
**Obese (BMI>30) compared to normal (BMI between 18.5 and 25)
p values listed in parentheses
t indicates significance at <.001

DISCUSSION

Research Strengths

This large sample of the BRFSS sample allowed for a statistically powerful model. When paired with the BRFSS, the tax data from all 50 states provided results that, if significant, could have been fairly generalizable. The BRFSS also provided extensive personal information that allowed us to control for individual behavioral factors often not available with state-level soda consumption data. The OLS and Multinomial Logit models had the expected negative coefficients for soda tax and the control variables also had expected coefficient signs.

Research Limitations

There are a number of factors that might affect individual BMI for which we could not control including local taxes, excise taxes, and the time since implementation of the tax. The range of tax rates (2 to 7.25 percent) is not large and limited our ability to see the effects of various levels of soda tax on BMI. In addition, the tax rates were low and soda tends to be relatively inexpensive, providing little incentive for consumer behavior change. For example, a 7.2 percent tax on a soda that costs $1.50 would increase the price at the register by 10 cents to $1.60. It is also possible that our state fixed effects did not capture other localized public health campaigns, interventions to combat obesity at the local level, or factors that cause states to adopt soda taxes.

CONCLUSION

There are several potential reasons why our study shows no relationship between soda taxes and BMI. Previous research has shown mixed results when exploring similar topics. Using a multinomial logit model, one research group predicted that overweight and obese individuals will actually consume more sugar as the price increases, further increasing their BMI (Milkjovic, Nganje, & de Chastenet, 2008, p. 59). Another research project concluded that soda consumption is modestly responsive to price changes and that a price increase of 10 percent would reduce consumption between three percent and eight percent (McGranahan & Schanzenbach, 2011, p. 3). These mixed results are a reflection of the lack of information about the direct effects of soda taxes on soda consumption.

Consumers may respond to the taxes by simply purchasing soda that has more sugar content or calories per ounce or they may shift their consumption to items that are similarly unhealthy. It is also possible that due to corn subsidies and other market dynamics, soda remained cheaper than other beverages despite the soda taxes. The downstream effects of a soda tax are most likely dependent on whether the tax is intended to reduce consumption or generate revenue, the size of the tax, whether the revenue is used for health education, the amount of public knowledge of the tax, the length of time since the tax has been put into place, and the point at which the tax is applied in the distribution chain.

The results of this study suggest several possible policy implications:

Increase the size of the sales tax

As mentioned above, this research is limited by the small range of soda tax values that states currently use. It is possible that increasing soda taxes above seven percent could result in lower BMI, but further research will need to be conducted to explore the price

elasticity of soda. Given the addictive nature of sugar, future research should focus on the impact of soda taxes on soda consumption for individuals who are already overweight or obese.

Increase awareness and discussion of soda taxes

Simple marketing to increase public awareness of the soda tax may be sufficient to influence consumer behavior separate from the tax rate itself. Future studies should investigate the impact of public discourse on consumer perceptions of the health effects of soda consumption.

Use an excise tax

Because excise taxes are structured as a fixed cost per ounce of sugar, they may provide more of an incentive for consumers to buy less. In addition, excise taxes would be passed to the customer through the distributor and would be seen when the customer is making a purchase whereas sales taxes are only seen at the register. Future research should be aimed at determining whether excise taxes and sales taxes differ in their effect on BMI and consumption.

Increase Obesity Prevention Efforts

Some evidence produced in our research and previous research suggests that soda taxes may have differential impacts on people depending on their current health status. Individuals with a normal BMI (between 18.5 and 25) may reap the most benefits from the soda tax in terms of lowering their future consumption. However, the impact on individuals that are already overweight and obese is less convincing. These results suggest that soda taxes may be an important tool for preventing future obesity problems, but will not help to solve the existing epidemic. Soda taxes should be used in concert with other policies such as health education in order to reach those who are not as affected by the tax or who are at risk for obesity, including children and youth, to prevent future weight issues.

Thus, more research on the effect of soda on soda consumption is needed to determine whether taxes are having the intended effect and additional health interventions are necessary to address the obesity epidemic.

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BIBLIOGRAPHY

University of Limericks Sociology. (2012, April 23). Fixed and random effects models. Retrieved 10 26, 2012, from http://teaching.sociology.ul.ie/DCW/confront/node45.html

Adams, S., & Cotti, C. (2008). Drunk driving after the passage of smoking bans in bars. Journal of Public Economics.

Adda, J., & Corgnaglia, F. (2010). The Effect of Bans and Taxes on Passive Smoking. American Economic Journal: Applied Economics, 1-32.

Bridging the Gap Program, University of Illinois at Chicago. (n.d.). State Sales Taxes on Regular, Sugar-Sweetened Soda and Snacks, 2008-2011. Bridging the Gap.

Brownell, K. D., Farley, T., Willett, W., Popkin, B. M., Chaloupka, F. J., Thompson, J. W., & Ludwig, D. S. (2009). The Public Health and Economic Benefits of Taxing Sugar-Sweetened Beverages. New England Journal of Medicine, 361(16), 1599-1605.

Centers for Disease Control and Prevention (CDC). (2008-2011). Behavioral Risk Factor Surveillance System Survey Data. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Atlanta, Georgia.

Centers for Disease Control and Prevention. (2011, September 13). Healthy Weight - it's not a diet, it's a lifestyle! Retrieved 4 2012, December , from CDC Home: http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html

Centers for Disease Control. (n.d.). Chronic Disease Prevention and Health Promotion. Retrieved from http://www.cdc.gov/chronicdisease/resources/publications/AAG/obesity.htm

Evans, W., & Farrelly, M. (1998). The compensating behavior of smokers: taxes, tar, and nicotine. The Rand Journal of Economics, 578-595.

Fletcher, J. M., Frisvold, D. E., & Tefft, N. (2010). The effects of soft drink taxes on child and adolescent consumption and weight outcomes. Journal of Public Economics, 94, 967-974.

Ljungvall, A., & Zimmerman, F. (2012). Bigger bodies: Long-term trends and disparities in obesity and body-mass index among U.S. adults, 1960-2008. Social Science and Medicine, 75, 109-119.

McGranahan, L., & Schanzenbach, D. W. (2011, March). Who would be affected by soda taxes? Federal Reserve Bank Essays on Issues(284).

Milkjovic, D., Nganje, W., & de Chastenet, H. (2008). Economic factors affecting the increase in obesity in the United States: Differential response to price. Food Policy, 33, 48-60.

Smalley, K., Knerr, A., Kendrick, Z., Colliver, J., & Owen, O. (1990). Reassessment of Body Mass Indices. The American Journal of Clinical Nutrition, 405-8.

U.S. Census Bureau, Population Division. (2008). Table 4. Projections of the Population by Sex, Race, and Hispanic Origin for the United States: 2010 to 2050.

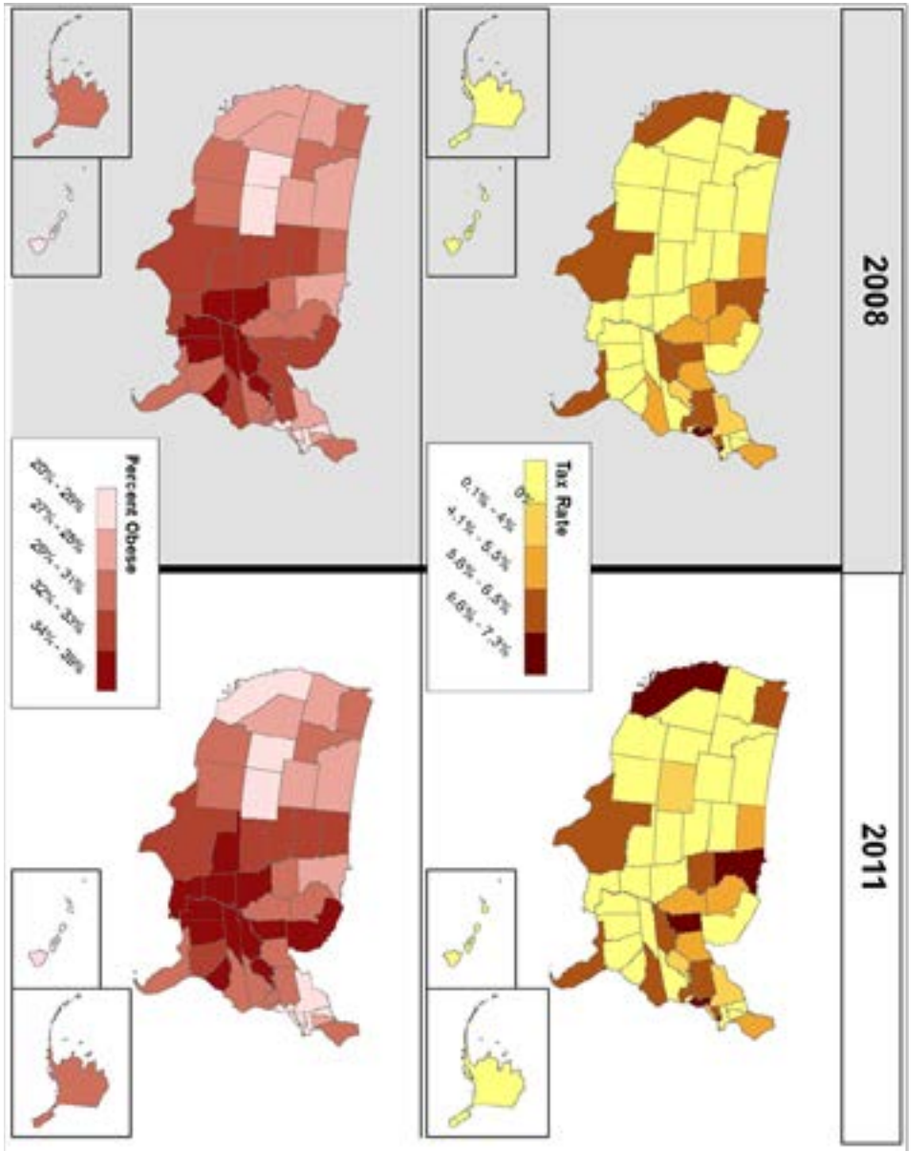
United States Census Bureau. (2008-2011). American Community Survey: Median Income in past 12 Months.

United States Department of Labor, Bureau of Labor Statistics. (2008-2011, February 29). Unemployment Rates for States Annual Average Rankings Year: 2008-2011. (B. o. Statistics, Producer) Retrieved October 2012, from http://www.bls.gov/lau/lastrk10.htm

END NOTES

1, 2. All appendices are available at the end of this article online. Go to the publisher's Web site and use the search engine to locate the article at <https://depts.washington.edu/esreview/>

Appendix A



Appendix B: Regression Results

Reference Variables	
Dummy Variable	Reference Group Description
Education	As compared to those who never attended school, grades 1-8, or grades 9-11
Exercise	As compared to those who exercised in the past month
Health Status	As compared with those who indicated they have "excellent health."
Income	As compared with annual household income of less than $15,000
Health Insurance	As compared with those who have health insurance
Metropolitan Area	As compared with those in the center of a MSA or an MSA that has no center city
Race	As compared to non-Hispanic whites

OLS Results

BMI	Model 1	Model 2
Tax	-0.007*** (0.002)	-0.012 (0.013)
Year		-0.001 (0.006)
High School or GED		0.141*** (0.020)
1-3 years of College		0.239*** (0.021)
College graduate		-0.286*** (0.021)
No Exercise		0.574*** (0.012)
Female		-1.167*** (0.0095)
Very good health		1.529*** (0.013)
Good health		2.653*** (0.014)
Fair health		3.049*** (.0186)
Poor health		2.459*** (.026)
Less than $20,000 household income		0.177*** (0.021)
$20,000 - $35,000 household income		0.338*** (0.023)
$35,000 - $50,000 household income		0.507*** (0.022)

$50,000 - $75,000 household income		0.550*** (0.021)
Household income of $75,000 or more		0.343*** (0.021)
Refused to disclose income		-0.376*** (0.023)
No health insurance		-0.386*** (0.014)
Inside county containing center city of MSA		0.103*** (0.013)
Inside suburban county of MSA		0.202*** (0.016)
Not in an MSA		0.293*** (0.013)
Black or African American, non-Hispanic		1.551*** (0.018)
Asian, non-Hispanic		-1.892***
(0.035)		
Native Hawaiian, Pacific islander, American Indian, Alaska Native, Other, non-Hispanic		0.743*** (0.031)
Multiracial, non-Hispanic		0.414*** (0.035)
Hispanic		0.712*** (0.020)
Age		0.034*** (0.000)
Median income		0.000 (0.000)
Unemployment rate		0.024*** (0.005)
Constant		26.130* (12.014)
Adjusted R2	.0000	.109
N	1,058,093	992,845
* p<0.05, ** p<0.01, *** p<0.001 Standard Errors in parentheses		

Logit Results

BMI	β	Standard Error β	eβ (Odds Ratio)
Tax	0.002	0.007	1.002
Year	-0.001	0.003	0.999
High School or GED	0.034***	0.010	1.035
1-3 years of College	0.083***	0.010	1.087
College graduate	-0.134***	0.010	0.874
No Exercise	0.262***	0.006	1.299
Female	-0.163***	0.005	0.850
Very good health	0.744***	0.008	2.104
Good health	1.240***	0.008	3.455
Fair health	1.414***	0.010	4.112
Poor health	1.247***	0.013	3.481
Less than $20,000 household income	0.039***	0.010	1.040
$20,000 - $35,000 household income	0.081***	0.011	1.084
$35,000 - $50,000 household income	0.132***	0.010	1.141
$50,000 - $75,000 household income	0.137***	0.010	1.147
Household income of $75,000 or more	0.040***	0.010	1.041
Refused to disclose income	-0.183***	0.011	0.832
No health insurance	-0.136***	0.007	0.873
Inside county containing center city of MSA	0.029***	0.007	1.029
Inside suburban county of MSA	0.061***	0.008	1.063
Not in an MSA	0.097***	0.006	1.102
Black or African American, non-Hispanic	0.505***	0.009	1.656
Asian, non-Hispanic	-1.039***	0.025	0.354
NH, PI, AI, AN, Other, non-Hispanic	0.247***	0.015	1.280
Multiracial, non-Hispanic	0.160***	0.017	1.174
Hispanic	0.149***	0.010	1.161
Age	0.007***	0.000	1.007
Median income	0.000	0.000	1.000
Unemployment rate	0.009	0.002	1.010
Constant	-1.007	6.131	0.365
Pseudo R2	0.060		
N	992845		
* p<0.05, ** p<0.01, *** p<0.001			

Multinomial Logit Results

	BMI 15-18.5	BMI 25-30	BMI 30-40
Tax	-0.013	-0.011	-0.004
	(-0.024)	(-0.007)	(-0.008)
Year	0.031	-0.015***	-0.008*
	(-0.011)	(-0.003)	(-0.004)
High School or GED	-0.106**	0.040***	0.054***
	(-0.034)	(-0.011)	(-0.012)
1-3 years of College	-0.129***	0.045***	0.105***
	(-0.035)	(-0.012)	(-0.012)
College graduate	-0.217***	-0.137***	-0.213***
	(-0.036)	(-0.012)	(-0.012)
No Exercise	0.370***	0.091***	0.321***
	(-0.020)	(-0.006)	(-0.007)
Female	0.529***	-0.872***	-0.651***
	(-0.022)	(-0.005)	(-0.006)
Very good health	-0.063**	0.473***	0.971***
	(-0.024)	(-0.006)	(-0.008)
Good health	0.189***	0.653***	1.575***
	(-0.026)	(-0.007)	(-0.009)
Fair health	0.586***	0.602***	1.730***
	(-0.032)	(-0.010)	(-0.011)
Poor health	0.978***	0.399***	1.465***
	(-0.038)	(-0.015)	(-0.015)
Less than $20,000 household income	-0.144***	0.097***	0.087***
	(-0.032)	(-0.012)	(-0.012)
$20,000 - $35,000 household income	-0.327***	0.170***	0.167***
	(-0.038)	(-0.013)	(-0.013)
$35,000 - $50,000 household income	-0.447***	0.245***	0.259***
	(-0.037)	(-0.012)	(-0.012)
$50,000 - $75,000 household income	-0.525***	0.283***	0.284***
	(-0.037)	(-0.012)	(-0.012)
Household income of $75,000 or more	-0.611***	0.233***	0.156***
	(-0.035)	(-0.011)	(-0.012)
Refused to disclose income	-0.155***	-0.030*	-0.200***
	(-0.035)	(-0.012)	(-0.013)
No health insurance	0.007***	-0.110***	-0.200***
	(-0.024)	(-0.008)	(-0.008)
Inside county containing center city of MSA	-0.055	0.046***	0.053***
	(-0.024)	(-0.007)	(-0.008)
Inside suburban county of MSA	-0.067*	0.088***	0.109***
	(-0.030)	(-0.009)	(-0.010)
Not in an MSA	-0.130*	0.103***	0.152***
	(-0.024)	(-0.007)	(-0.007)
Black or African American, non-Hispanic	-0.326***	0.534***	0.804***
	(-0.039)	(-0.011)	(-0.011)
Asian, non-Hispanic	0.260***	-0.474***	-1.248***
	(-0.046)	(-0.017)	(-0.026)
NH, PI, AI, AN, Other, non-Hispanic	-0.236***	0.263***	0.389***
	(-0.062)	(-0.017)	(-0.018)
Multiracial, non-Hispanic	-0.024	0.128***	0.232***
	(-0.061)	(-0.019)	(-0.021)
Hispanic	-0.542***	0.423***	0.374***
	(-0.041)	(-0.011)	(-0.012)
Age	-0.020***	0.019***	0.017***
	(-0.001)	(0.000)	(0.000)
Median income	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Unemployment rate	-0.017	0.008	0.013***
	(-0.009)	(-0.003)	(-0.003)
Constant	-63.591**	29.641***	14.801*
	(-22.726)	(-6.414)	(-7.120)
Pseudo R2	0.060		
N	992845		
* p<0.05, ** p<0.01, *** p<0.001			
Standard Errors in parentheses			
Comparison Group is normal weight (BMI 18.5-25)			

Quantile Results

BMI	25	50	75	95
Tax	-0.022 (0.015)	-0.020 (0.017)	-0.012 (0.021)	0.022 (0.031)
Year	-0.015* (0.007)	-0.006 (0.008)	0.008 (0.010)	0.021 (0.015)
High School or GED	0.151*** (0.023)	0.128*** (0.026)	0.139*** (0.034)	0.091*** (0.050)
1-3 years of College	0.203*** (0.024)	0.227*** (0.027)	0.254*** (0.034)	0.199*** (0.051)
College graduate	-0.245*** (0.024)	-0.369*** (0.028)	-0.447*** (0.035)	-0.387*** (0.052)
No Exercise	0.298*** (0.013)	0.655*** (0.015)	0.971*** (0.019)	0.897*** (0.028)
Female	-1.835*** (0.011)	-1.493*** (0.012)	-0.899*** (0.015)	-0.105*** (0.023)
Very good health	1.050*** (0.014)	1.517*** (0.016)	2.028*** (0.021)	2.442*** (0.031)
Good health	1.791*** (0.015)	2.713*** (0.018)	3.677*** (0.022)	3.969*** (0.033)
Fair health	1.931*** (0.021)	3.227*** (0.024)	4.437*** (0.031)	4.534*** (0.045)
Poor health	1.226*** (0.029)	2.598*** (0.033)	4.017*** (0.043)	4.320*** (0.063)
Less than $20,000 household income	0.305*** (0.023)	0.196*** (0.027)	0.032 (0.035)	-0.089 (0.051)
$20,000 - $35,000 household income	0.521*** (0.026)	0.336*** (0.030)	0.124** (0.038)	-0.086 (0.055)
$35,000 - $50,000 household income	0.759*** (0.024)	0.506*** (0.028)	0.231*** (0.035)	-0.030 (0.052)
$50,000 - $75,000 household income	0.852*** (0.024)	0.567*** (0.027)	0.202*** (0.035)	-0.111** (0.052)
Household income of $75,000 or more	0.796*** (0.023)	0.37368*** (0.027)	-0.115** (0.034)	-0.568*** (0.050)
Refused to disclose income	0.017 (0.026)	-0.38642*** (0.030)	-0.765*** (0.038)	-0.853*** (0.056)
No health insurance	-0.397*** (0.016)	-0.441*** (0.018)	-0.438*** (0.024)	-0.255*** (0.035)
Inside county containing center city of MSA	0.140*** (0.015)	0.126*** (0.017)	0.116*** (0.022)	0.006 (0.032)
Inside suburban county of MSA	0.221*** (0.018)	0.246*** (0.021)	0.199*** (0.026)	0.143*** (0.039)
Not in an MSA	0.308*** (0.014)	0.305*** (0.016)	0.318*** (0.021)	0.219*** (0.031)
Black or African American, non-Hispanic	1.480*** (0.020546)	1.793*** (0.023)	1.806*** (0.030)	1.177*** (0.044)
Asian, non-Hispanic	-1.277*** (0.039)	-1.740*** (0.045)	-2.345*** (0.057)	-3.142*** (0.084)
NH, PI, AI, AN, Other, non-Hispanic	0.693*** (0.035)	0.854*** (0.041)	0.877*** (0.051)	0.564*** (0.075)
Multiracial, non-Hispanic	0.313*** (0.040)	0.467*** (0.046)	0.594*** (0.058)	0.386*** (0.086)
Hispanic	0.998*** (0.023)	0.797*** (0.026)	0.480*** (0.033)	0.149** (0.048)
Age	0.046*** (0.000)	0.040*** (0.001)	0.026*** (0.001)	0.001 (0.001)
Median income	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Unemployment rate	0.024*** (0.005)	0.029*** (0.006)	0.029*** (0.008)	0.014 (0.011)
Constant	50.545*** (13.5525)	35.825* (15.468)	10.022 (19.766)	-9.706 (29.130)
Pseudo R2	0.0645	0.0683	.0734	.0654
N	992845			
* p<0.05, ** p<0.01, *** p<0.001				
Standard Errors in parentheses				