6-2013

The Role of Relative BMI Across Racial and Ethnic Groups: Impacts on Happiness Within the United States

Colin Knox
Union College - Schenectady, NY

The Role of Relative BMI Across Racial and Ethnic Groups: Impacts on Happiness Within the United States

BY

Colin Knox

****

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

Union College

June, 2013

Abstract

KNOX, COLIN The Role of Relative BMI Across Racial and Ethnic Groups:
Impacts on Happiness Within the United States
Department of Economics June 2013

Over the last generation, rising Body Mass Index (BMI) among Americans has had significant health and psychological impacts. My thesis uses data from over 1 million surveys from the Behavioral Risk Factor Surveillance System to examine the role of BMI in determining individual happiness. I specifically consider whether being surrounded by others who are overweight reduces the psychological cost of being overweight. Controlling for demographic factors, I create reference groups based on an individual's state, sex, race and age. My thesis intends to show that individuals with a BMI higher than their reference group will be less happy.

In particular, I examine whether the effect of relative BMI differs for individuals based on their racial, ethnic and gender identity. I am interested in whether an individual's BMI affects them differently depending on the BMI of their reference group. I compare the role of relative BMI across racial and ethnic groups while taking into account impacts based on gender. I find that different racial and gender groups are more likely to make social comparisons based on relative BMI, specifically, White men experience the greatest decrease in happiness as their relative BMI increases.

Table of Contents

Introduction

With over 72 million American adults being obese, obesity has become a focal point for many economists over the last several years. There are many areas in which economists tackle the idea of obesity. Some discuss obesity relative to happiness and income, whereas others estimate the associated costs.[1] In my paper, I examine the relationship between Body Mass Index (BMI) and happiness while controlling for a variety of other variables. I would like to see the impact of an individual's Body Mass Index on happiness based on the average BMI of that individual's peers. I am also interested in analyzing how different racial groups respond to changes in their BMI and the BMI of those around them. Other variables that other economists have controlled for in similar papers include: age, age squared, income, marital status, and employment status.

Many have looked at obesity and its impact through a variety of different measures, including mortality rates and the rising cost of public healthcare.[2] By analyzing the relationship between happiness and BMI, this paper allows me to properly examine the psychological costs of a high BMI. It successfully catches many of the psychological factors that more objective measures fail to capture for each racial and ethnic group in the sample. For example, the psychological cost of being obese in a relatively skinny group would have a greater negative impact on an individual's self-esteem or self-value.

---

[1] The Medical Care Costs of Obesity: An Instrumental Variable Approach. Cawley and Meyerhoefer (2012)
[2] Cawley and Meyerhoefer (2012)

In recent history, it is acknowledged that both women and men suffer from eating disorders such as anorexia, binge eating or bulimia. This inspired the creation of my paper for a variety of reasons. According to the National Association of Anorexia Nervosa and Associated Disorders, ten to fifteen percent of anorexic individuals are men. I am interested in looking at the relationship between relative BMI and happiness for men and women across different racial and ethnic groups. The evidence of eating disorders in men further strengthen the argument that the psychological costs of a high BMI can be as great as the health and social costs for both sexes. This also brought about the question, who is more likely to be impacted by a higher relative BMI, men or women?

This paper is different than many other economic papers due to the inclusion of relative BMI and happiness for several different racial and ethnic groups while including the respondents' sex. No economist has undertaken explaining the relationship between BMI and happiness for different races, sexes and ethnic groups simultaneously. This paper will use data from the Behavioral Risk Factor Surveillance System, a nationally representative survey conducted by the Center for Disease Control.

I test multiple hypotheses regarding the relationship between BMI and happiness. Through the creation of my regressions, I intend to show that social comparisons matter when it comes to weight. In addition to caring about their own BMI, individuals across different racial, ethnic and gender groups care about their BMI relative to their peers.

Literature Review

There have been numerous papers that discuss obesity and happiness. In this section of my paper, I outline some of the most important and influential papers written in this field. The description of the articles in this portion of my paper will help motivate the questions being asked in my paper. The other articles will also make the differences between my paper and many other papers regarding obesity and happiness more apparent. Many economists have looked at obesity in a variety of ways. Much of the literature discussed in this section deals with obesity and happiness, more specifically, in Europe. Some of the papers analyze relative happiness and the Body Mass Index of peers. The other literature in this section is focused on race and relative utility. This helped motivate the question of BMI relative to one's own race and life satisfaction.

This section also discusses some papers that highlight the annual medical costs, social and psychological costs of obesity. One of the most important articles discussed in this section discusses the idea of accurate reporting of subjective well-being. Many happiness, life satisfaction and well-being regressions are impacted by inaccurate measures of reported well-being.

Bhattacharya and Sood (2011) discuss some of the costs of obesity and the designated responsibility of paying those costs. The authors discuss this issue as a reflection of the increasing number of obese Americans. Over the last forty years, obesity has nearly tripled from 13.4% to 35.1% among adults. They discuss many of the health costs related to obesity, including diabetes, heart disease and decreased life expectancy. The impacts of obesity at a young age greatly decrease one's life

expectancy, whereas being moderately overweight only has a slight impact on life expectancy. One of the most interesting things discussed in this article was the personal cost of obesity. Bhattacharya and Sood highlight how one could expect to pay several hundred thousand dollars over a lifetime due to obesity. The expected cost for an obese 50 year-old in medical expenses is $15,000 and a reduction in life expectancy by about 1.65 years.

Bhattacharya and Sood go on to highlight many of the external costs related to obesity. They emphasize the Pigovian case for intervention. Bhattacharya and Sood believe public policy arguments in support of government intervention must be non-Pigovian. They argue that the cost imposed by the obese on the non-obese is less than most would argue. For example, due to recent increases in obesity, biomedical researchers have focused their research efforts on the diseases associated with obesity. Private markets reward this responsiveness with profits for pharmaceutical firms, while the National Institutes of Health reward this with grant funding to universities and medical schools. The obese subsidize the thin in several different ways. For example, obese people die at an earlier age and do not claim as much in Social Security benefits. A person's chance of becoming obese increases if he or she has a friend or family member who becomes obese, which is another negative cost related to obesity.

Bhattacharya and Sood's paper was very influential in helping motivate some of the ideas discussed in my paper. A significant determinant of subjective well-being, among other things, is income. As Bhattacharya and Sood highlight, an obese individual could expect to pay thousands of dollars in additional medical bills,

disability and are at greater risk for decreased life expectancy. Bhattacharya and Sood's discussion of medical expenses and life expectancy among the obese led me to consider the impact of these factors on one's subjective well-being. Although Bhattacharya and Sood do not discuss subjective well-being in their paper, it led me to examine the correlation between a change in income (in my paper, natural log of income), and a decrease in happiness.

Herbst and Tekin (2009) tackle the issue of childcare subsidies' impacts on childhood health and well-being in their paper. They employ OLS and fixed effects methods to explore BMI and measures of obesity. The article uses quantile regressions to address the issue of subsidy receipt having heterogeneous effects on children's weight at different points in the BMI distribution. Their motivation to research this topic comes from alarming obesity rates among children. Since the 1970's, obesity among children ages two to five grew from five to twelve percent. Obesity during one's childhood increases the likelihood that the individual develops health problems, such as high blood pressure and diabetes in early adulthood. Childhood obesity can even be connected with long-term psychological and labor market outcomes including poor self-esteem and even lower wages. The main purpose of this paper is to examine the impact of subsidy receipt in the year before kindergarten on measures of children's weight. The data used in the analysis came from the Early Childhood Longitudinal Study, Kindergarten, a sample of 21,260 children.

Herbst and Tekin find that childcare subsidy receipt is associated with increases in BMI and increased likelihood of being overweight and obese. They

found that BMI gains due to subsidized care are extremely different depending on where children are located in the BMI distribution. Those in the upper end of the distribution experience BMI gains that are larger than the gains among children at the lower end.

One of the most interesting points discussed in Herbst and Tekin's paper was the development of long term health problems, including long-term psychological and labor market outcomes, such as low self-esteem and a decrease in wages. Childhood obesity could lead to a significant decrease in life satisfaction as an adult. I included this paper because of its discussion of low self-esteem and lower wages as an adult. Childhood obesity can likely impact the happiness they experience as adults.

Similar to Bhattacharya and Sood, Cawley and Meyerhoefer (2012) use the method of instrumental variables to estimate the impact of obesity on medical costs to address the endogeneity of weight and reduce the bias from reporting error in weight. The instrument used is the weight of a biological relative. In a pooled sample, they found that an additional unit of BMI is associated with $49 higher in annual expenditures. Obesity, relative to having a BMI less than thirty, leads to an additional $3,000 in annual medical expenditures. They believe that much of the previous literature written discussing the medical costs associated with obesity grossly underestimates the additional annual medical costs. This leads to underestimates of the economic rationale for government intervention in an attempt to reduce obesity due to obesity related externalities on the rest of the population.

Cawley and Meyerhoefer's paper is closely related to mine due to the use of the weight of a biological relative used as an instrument. They build off the idea that it is easy to be obese in an obese society. They highlight the fact that it is much more common for individuals with heavy family members to be overweight. Unlike many other papers, they believe the cost of obesity has been grossly underestimated and poses a significant externality on the rest of the population. The social cost of having a high BMI decreases as the BMI of others increases.

Borghesi and Vercelli's *Happiness and Health Two Paradoxes* (2012) focuses on the interaction between subjective indexes of happiness and objective indexes of health. They discuss some of the main determinants of subjective happiness and highlight the determinants of objective health. In subjective terms of happiness, absolute income and income aspirations play important roles, but those are decreasing in significance. The roles of relative income and other social factors have a significant impact on subjective measures of happiness. "As a matter of fact, unhappiness increases if the relative personal income of the individual diminishes relatively to the (average) per capita income of a reference group and vice versa." The two main social factors are unemployment and education. As many economists have highlighted in the past, unemployment reduces well-being. Higher degrees of education are correlated with a greater subjective happiness. The authors argue that education increases the amount of enjoyable goods. For example, the experiencing of cultural goods: literature, music, theatre, etc.

The role of absolute income has an impact on the health of a town or even a state. As the per capita income of a community increases, the average health of that

community also increases. Borghesi and Vercelli find that the health of the poor has a higher income elasticity than that of the rich. There is a direct relationship between average per capita income and life expectancy in relatively poor countries, whereas in rich countries, this relationship tends to disappear. There is a close relationship between inequality and mortality rates. People compare themselves to their own reference group and are subject to suffering from chronic stress when the comparison is unfavorable. This can have a significantly negative impact on an individual's long-term health. They confirm that health is a significant determinant of subjective happiness. Borghesi and Vercelli also find that policies created to invest in environmental and social capital are likely to improve health and happiness.

Borghesi and Vercelli successfully highlight the close relationship between objective measures of health and subjective measures of happiness. They helped motivate some of the objective measures of health discussed in my paper including: BMI and the average BMI of one's reference group. Unlike many other papers, Borghesi and Vercelli dive into the framework behind the subjective measures of well-being.

Mandal and Chern (2011) highlight how personal and environmental characteristics influence weight determination using BMI as functions of lifestyle components and other external factors. They highlight how the annual medical burden of obesity was $147 billion in 2008 and is expected to keep increasing heading into the future. The data used in Mandal and Chern's paper is from the Behavioral Risk Factor Surveillance System. They use a multilevel framework where

they incorporate the influence of state level factors on individual level characteristics through the construction of random intercept hierarchical models in an attempt to explain the rising rates of obesity in the U.S.

Mandal and Chern find that increased urban residency is correlated with lower prevalence of obesity. They argue that this could be a result of increased levels of awareness on nutrition, health and exercising. They control for macroeconomic conditions by including unemployment rates and food stamp benefits per participant. Neither of these factors are found to be associated with being overweight or obese. Both short and long-term unemployment are found to be associated with higher levels of obesity. Out of labor market individuals are less likely to be overweight or obese than employed individuals. Higher income is associated with higher levels of obesity and being overweight for men, whereas, for woman, the opposite holds. As Philipson (2001) argues, they believe that marital status plays a role in determining weight. If lower weight contributes to being more physically attractive, then, those seeking marriage are more cognizant of their body weight. Mandal and Chern find that divorced and separated women have lower instances of obesity, whereas, separated, divorced and widowed men are more
likely to be obese.

Sparks and Bollinger (2011) discuss the disproportionate rates of obesity burdening disadvantaged groups. They use data from the Behavioral Risk Factor Surveillance System in 2008. One of their most significant findings is that women have eleven percent lower odds of being obese compared to men after controlling for sociodemographic, behavioral and health characteristics. Their bivariate tests

highlighted significant differences in the obesity rates between men and women, more specifically, twenty-seven percent of men and twenty-five percent of women are obese. The measure they used for obesity is a Body Mass Index over thirty. They do not find that obesity rates are higher among veterans compared to non-veterans. They find that male veterans have seven percent higher odds of being obese compared to non-veteran males.

Sparks and Bollinger find that there was a strong and positive correlation between the number of chronic health conditions an individual experiences and the odds of being obese. People with multiple health chronic health conditions have a much better chance of being obese than individuals not experiencing chronic health conditions. The cross-sectional data used in their paper makes it difficult to determine if the chronic health issues arise due to obesity or if the chronic health issues led to obesity. They argue that regular meetings with a physician or other medical professional could give information about weight management, diets and exercise.

Sparks and Bollinger's paper is useful due to its analysis of disadvantaged people and their obesity rates. Although their findings contradict much of the current economic literature regarding obesity and disadvantaged people, the ideas behind their paper prove to be extremely useful. Sparks and Bollinger's paper led me to include independent variables, such as income, in my paper. They use veterans as their disadvantaged socioeconomic group due to tendencies in the general population and their poorer health. Income and employment attempt to measure for socioeconomically disadvantaged people in my paper.

Dragone and Savorelli (2012) depict the increasing concern of the policy maker regarding the eating behavior and the spread of obesity. They discuss how many people consistently diet, despite being underweight, leading to various adverse effects. They create arguments considering how a given ideal body weight affects consumption behavior, body weight and health. Many government proposals regarding healthier consumption patterns and body weight have a variety of consequences. With the current tendency towards obesity and the ideal body weight being low, many policies attempting to improve welfare lead to people becoming more overweight.

Utility is dependent on food consumption and body weight. If an individual's weight is greater or smaller than his or her healthy weight, they experience reductions in their overall health. Many individuals experience disutility when their body weight does not conform to the socially accepted ideal weight. If one's weight does not coincide with the healthy weight or society's ideal weight, there tends to be a trade-off between the health and social consequences of one's eating habits.

Dragone and Savorelli's paper presents a unique argument regarding the social pressures of consumption. To be overweight is not socially desirable, leading people to augment their diets in a variety of unhealthy ways. The discussion of experienced utility based on relative societal body weight norms is very unique, helping motivate the idea of relative BMI in my paper.

Zhou's (2012) paper attempts to combine a happiness evaluation method with the day reconstruction method to form a new happiness survey procedure. Many happiness surveys ask participants to provide information on their subjective

well-being, life satisfaction or happiness. Zhou argues that participants tend to overweigh certain experiences that are often salient or recent and assign little or no weight to the duration of the experience, leading to inaccurate reporting. Studies have shown that reported life satisfaction can be impacted by irrelevant events, such as the weather or even outcomes of sporting events.

To combat many of the inconsistencies with subjective well-being surveys, Zhou develops a framework for measuring happiness. The framework attempts to obtain individual subjective well-being and an appropriate way to evaluate national well-being based on data for a national well-being account. In his framework for determining subjective well-being, participants will be asked to divide their previous day's events into a specific series. Then, they are required to recall the details of the episodes. The participants would then be asked to measure the intensity of happiness of all the episodes listed in the survey. The survey asks participants to report the net affect of each episode directly. The survey asks participants to report the time duration of each episode and estimate the intensity of happiness that he or she experienced. From this response, the overall happiness of the participants will be calculated.

Zhou's paper is extremely important when discussing happiness regressions. Unlike many economic papers, he dives into the issues encountered when measuring subjective well-being. This is something every economist must take into account when using data from the Behavioral Risk Factor Surveillance System. Happiness, life satisfaction or subjective well-being regressions are often reflective

of a myriad of the participants' experiences, often with different weight for each experience.

Davis and Wu's (2012) paper discusses social comparisons on life satisfaction among different racial and ethnic groups within the United States. Davis and Wu interpret the positive impact of group income of Black life satisfaction in terms of racial solidarity due to the experience of slavery, racial discrimination, and the collective action in the Black civil rights movement. They use happiness regressions to test two main hypotheses. The social salience hypothesis for racial solidarity indicates that racial solidarity is stronger and more present when people are reminded of their distinctiveness when relating to others of a different race. They highlight differences in race specific comparison income effects and use subjective well-being to test theories of Black solidarity.

For Whites, Hispanics and Asians, they find that higher group income levels are associated with lower levels of personal life satisfaction, whereas, life satisfaction is increasing as group income increases for Blacks. Davis and Wu receive their data from the Behavioral Risk Factor Surveillance System. They find strong support for the idea that an individual's racial or ethnic group matters in determining a reference group in which he or she can engage in social comparisons.

This paper plays an important role in helping motivate the ideas discussed in my paper, as well as setting it apart from other papers discussing obesity and happiness. As previously highlighted, Davis and Wu discuss the issue of life satisfaction in different racial groups. They provide the framework for finding an appropriate peer group and base of reference. They motivated one of the most

important themes discussed in my paper, the inclusion of a reference group. No economists have tackled the idea of race, happiness and BMI. The framework provided by Davis and Wu's paper will help highlight the race specific comparison BMI effects and use happiness to test theories of BMI's impact on different racial groups in the United States.

Blanchflower, Oswald and Landeghem (2009) are some of the first to analyze the relationship between utility and relative weight. They attempt to document international patterns in well-being, dieting and people's perception of their weight. The article discusses how much of social status can come from being slimmer than "the herd", among other factors.

The data is cross-sectional Eurobarometer data gathered from 29 countries. The BMI of participants was calculated by their reported height and weight. Blanchfower, Oswald and Landeghem find that over one third of Europe's population view themselves as overweight. For any level of BMI, people that are more highly educated are more likely to see themselves as overweight. Similar to many other papers regarding obesity, women are more likely to believe they are overweight. For women, overweight perceptions depend on their own BMI and upon BMI relative to their peers. The perception of an individual's BMI is based significantly on his or her surrounding peers, greatly impacting their life satisfaction based upon their BMI. There are many similarities between BMI and dieting decisions. There is often a negative effect from one's own BMI on their dieting decisions. This is a very significant factor in many articles discussing obesity and

happiness. The question that is often discussed is: do people eat more because they are unhappy or are they unhappy due to larger caloric intake levels?

Blanchflower, Oswald and Landeghem's paper is extremely useful in helping generate some of the most important topics discussed in my paper. In particular, they discuss the idea of being slimmer than "the herd". This is a very important topic discussed in my paper and one of the greatest motivators for analyzing people's happiness based on the average BMI of their reference group. By doing this, one will be able to accurately see how one's BMI relative to his or her fellow citizens impacts their perception of their relative BMI and happiness.

Oswald and Powdthavee (2007) examine some important ideas raised in Avner Offer's book (2006) regarding weight, affluence and happiness. They believe that well-being depends on a person's relative income, weight and ranked position. Oswald and Powdthavee state, "By definition, that (well-being) cannot rise for everyone in a group as a group's members all go from having just one Ford in the driveway to having three Lexuses spilling out across the pavement."

One thing that Oswald and Powdthavee do differently than many other economists have done when it comes to analyzing obesity is comparing happiness to relative weight. They argue that, it is easier to be fat in a fat society and the utility of an individual will depend on relative weight. There are many reasons for one to invest in a healthy weight. If one's neighbor gains weight, he then rationalizes gaining a little weight because he now can be heavier and still compete. They provide simple evidence that happiness and mental health are worse among heavier people in Britain and Germany. The article also highlights how one's perception of

whether they are over-weight depends on their education and income just as much as actual weight.

Oswald and Powdthavee's paper plays an interesting role in helping generate the idea for my paper. As they argue, there are many different reasons to be obese. They were some of the first economists to tackle the idea of relative obesity. It helps discuss the issue of relative obesity being that it is much easier to be heavy when surrounded by heavy people. One of the most important things that Oswald and Powdthavee's paper discusses is ranked position. That is one's position relative to their peers, more specifically, their personal perception of their ranked position. This helped motivate the examination of one's happiness based on the average BMI of their reference group in my paper.

Katsaiti (2009) highlights how happiness is one of life's most fundamental goals. Economic research has identified several key determinants of happiness including age, employment status, health condition, marital status, education level, income and disability. Katsaiti goes on to depict how the relationship between happiness and obesity does not address the issue of endogeneity that could be a result of dual causality and omitted variable bias. One can easily think that higher or lower weight would influence personal happiness through self-esteem and impact on personal attractiveness with respect to social norms. As a result, Katsaiti conducts the Hausman test of endogeneity.

Katsaiti finds many differences between the three countries analyzed in her paper. In Germany, she finds that obesity has a negative and significant impact on overall life satisfaction. Each unit increase in Body Mass Index (BMI) reduces

happiness by 1/3 unit on a scale of 1 to 10. She finds that married people tend to be happier than single, divorced or separated people. Things such as political party membership in Germany increase well-being as much as a 1-unit reduction in BMI. As expected, greater income had a positive impact on happiness. The analysis of German participants shows that non-obese individuals are a half a unit happier than obese people, on a scale of 1-10. UK had many similarities with Germany in terms of BMI having a negative impact on individual happiness. The magnitude was the greatest difference in the two. For British participants, one unit increase in BMI reduces well-being by 0.01 units while for Germans the corresponding effect is 0.24. Katsaiti finds that physical disability (being confined to a wheelchair or other physical limitations) reduces well-being by nearly a whole unit and is highly significant. Australia is very similar when it comes to obesity's role in impacting happiness. One difference that Katsaiti found in Australia was that women are happier than men on average. As Katsaiti highlights, obesity is very important when it comes to determining an individual's happiness for several reasons. She discusses how obesity can lead to an individual experiencing lower levels of self-esteem.

This paper is interesting and was one of the more important papers in determining the direction of my paper. Katsaiti employs many useful methods to help generate happiness regressions that will prove useful in my paper. Katsaiti tackles the issue of endogeneity by conducting the Hausman test of endogeneity. Katsaiti uses many of the variables that could be included in my regressions including: marital status, education level, income, presence of a disability and Body Mass Index. She uses height as an instrument because the independent BMI variable

is created using the participant's height. Katsaiti does this testing to see if height only impacts that dependent variable through BMI.

The papers discussed in this section help motivate some of the important ideas discussed in my paper including: subjective well-being, BMI, race, income, marital status and others. They provide a strong framework for the measure of subjective well-being as well as help differentiate my paper from other papers discussing the impacts of obesity and happiness.

Empirical Structure

Methodology

Many of the previous papers written discussing the relationship between obesity and happiness have not sufficiently addressed the problem of endogeneity. This problem could result from dual causality because one may argue that higher or lower weight could potentially impact one's personal levels of satisfaction through changes in self-esteem as well as change their personal attractiveness with respect to others in his or her own reference group.[3] This could also introduce the problem of reverse causality. As Katsaiti (2009) highlights, many people gain weight due to depression issues stemming from self-esteem and self-valuation problems because they are not feeling well. As a result, endogeneity must be taken into account in the equation.

To measure the impact of an individual's reference group BMI on his or her own happiness, I estimate the regression:

$$Happiness_{its} = \alpha + \beta X_{it} + \gamma BMI_{it} + \gamma_2 BMI_{st} + \varepsilon_{it}$$

where *i* indexes the individuals, *t* indexes the year and *s* is the individual's state of residence. X_{it} is equal to the age, age^2, gender, income, marital status and employment status. I use state dummy variables to control for omitted variable bias. State, Age, gender and race specific measures of BMI are inserted into the equation

[3] Obesity and Happiness
Katsaiti, Marina-Selini; 2009, pp. 32 pages, University of Connecticut, Department of Economics, Working papers: 2009-44

to measure the effects of one's reference group BMI on one's own satisfaction. The dependent variable is a one's happiness.

I will estimate the equations:

1. $Happiness = \alpha_1 + \beta_1 X + \gamma_1 Z + \varepsilon_1$ where X = constants and BMI = Z = endogenous

2. $BMI = \alpha_2 + \beta_2 X + \gamma_2 W + \varepsilon_2$ where W = height

I will reduce the equation by substituting the equation for BMI for the Z variable in equation number 1.

$$Happiness = \alpha_1 + \beta_1 X + \gamma_1(\alpha_2 + \beta_2 X + \gamma_2 W + \varepsilon_2) + \varepsilon_1$$

$$Happiness = (\alpha_1 + \gamma_1\alpha_2) + (\beta_1 + \gamma_1\beta_2)X + \gamma_1\gamma_2 W + \gamma_1\varepsilon_1 + \varepsilon_2$$

→ $\hat{\gamma}_1\hat{\gamma}_2$

Running BMI on Height → $\hat{\gamma}_2$

$$\hat{\gamma}_1 = \hat{\gamma}_1\hat{\gamma}_2 / \hat{\gamma}_2$$

$$E(W\varepsilon_1) = 0$$

In this equation, X is a matrix of control variables used to examine the relationship between obesity and happiness. The happiness variable indicates the self reported life satisfaction of the individual participants. Z is the reported BMI of the individual. The BMI variable is constructed using the individual's height, allowing me to regress BMI on height. After creating an equation showing the relationship between height and BMI (equation 2), I can then substitute that equation into equation 1, replacing the Z variable with equation 2. By doing this, I

have created an equation that creates a happiness regression where the independent variable is height instead of reported BMI.

In my paper, similar to Katsaiti and Marina-Selini (2009), I will use an instrumental variable. Evidence that endogeneity is present is shown if the null hypothesis that the difference in coefficients is not systematic with the Ordinary Least Square (OLS) and the instrumental variable is rejected.

The instrument that will be used in my paper is an individual's height. One's BMI is closely correlated with the instrument of height because height is used when creating one's BMI. Height is an important instrument because it has the ability to play the role of a statistical instrument. This paper tests height as an instrument because Katsaiti believes that it will only affect happiness through its correlation with BMI, and no other independent variable. Thus, it is imperative that the results of the F-statistic be statistically significant. This will indicate the strength of the instrument used.

Data

The data for this paper comes from the Behavioral Risk Factor Surveillance System (BRFSS), the largest telephone health survey system focused on tracking health conditions and risk behaviors in the United States. Data collection started in 1984 and currently, data is collected monthly from all fifty states, the District of Columbia, Puerto Rico, U.S. Virgin Islands and Guam. Some of the main uses for the

BRFSS include identifying emerging health problems, establishing and tracking health objectives and developing public health policies or programs.[4]

The data used in this paper is from the years 2007 to 2010. There are more than 450,000 Americans surveyed each year in the BRFSS. This allows for over 1,700,000 observations to be used in this paper. This paper surveys adults between the ages of 18-65. I am interested in the BMI of all age groups, including young adults, thus explaining the inclusion of 18-year-olds in the data set. The members will be of five different age groups: 18-25, 26-35, 36-45, 46-55 and 56-65. These age groups will allow for strong reference groups for the respondent because age plays a large role in determining an appropriate reference group.[5] In my paper, a total of five age groups, two genders and five racial groups will be used.

The dependent variable used in the equations will be happiness. The respondents generate an answer for a measure of their overall life satisfaction. The 4 possible answers are: very satisfied, satisfied, dissatisfied and very dissatisfied. To help create a regression, the possible answers will be put on a scale of 1-4; 1 being very satisfied and 4 being very dissatisfied. To rescale the empirical model, I will create the life satisfaction variable of Happiness:

5 – (respondent's response) = *Happiness*

Body Mass Index (BMI) will be used as one of the independent variables, in addition to sex, race, age, age squared, marital status, employment status, the

---

[4] Behavioral Risk Factor Surveillance System: Turning Information Into Public Health
http://www.cdc.gov/brfss/about.htm

[5] Davis, Lewis, and Stephen Wu. "Social Comparisons and Life Satisfaction across Racial and Ethnic Groups: The Effects of Status, Information and Solidarity." (2012): n. pag. Web. (Pg 9)

natural log of income and the natural log of average income . Body Mass Index is divided into four categories in the BRFSS: underweight, normal weight, overweight and obese. Less than two percent of respondents fall into the underweight category. I create the natural log of BMI variable based on state, sex, race group and age group. By using the natural log of BMI variable, I am able to identify how a one percent increase in an individual's own BMI affects his or her happiness. I create the average BMI variable by using the natural log of average BMI based on state, sex, race group and age group. Through creating the natural log of average BMI variable, I am able to see how a one percent increase in the average BMI of that individual's reference group impacts his or her happiness.

When constructing the independent variables, I create the natural log of income variable and the natural log of average income variable in the same fashion used to create the BMI variables. Again, by doing this, I am able to identify the relationship between a one percent increase in an individual's income and that person's happiness. It shows how increases in the income of an individual's reference group impacts his or her happiness.

The race variable is broken up into the categories: 1 for White, 2 for Black or African American, 3 for Hispanic, 4 for Asian, 5 for Native Hawaiian of Other Pacific Islander. The categories for sex are: 1 for male and 2 for female. Employment status is broken up into the following categories: 1 for employed, 2 for self employed, 3 for out of work for more than a year, 4 for out of work for less than a year, 5 for a homemaker, 6 for a student, 7 for retired, 8 for unable to work and 9 for refused. The categories for the marital status variable are: 1 for married, 2 for divorced, 3 for

widowed, 4 for separated, 5 for never married, 6 for being a member of an unmarried couple.

I include the demographic variables age and age squared in my regressions. I include age because, as many other authors have previously shown, it usually has a inverse relationship with happiness. Age squared is included in my regressions because typically happiness decreases until individuals reach a certain age (about forty-five), where happiness starts to increase again.

The creation of an appropriate reference group is something that helps differentiate my paper from other similar papers. By creating reference groups, based on state, sex, race group and age group, I am able to determine how relative BMI impacts the happiness of individuals. It is important to create proper reference groups because people are more likely to compare themselves to others in the same reference group. For example, a twenty-year-old Black male would not compare his BMI to that of a fifty-year-old Asian woman. By creating proper reference groups, I will be able to see how a Black man, or any other race or sex, is impacted by a change in the BMI of other Black men.

Regression Analysis

Section 1. Natural log of BMI

In this portion of my thesis, I test multiple hypotheses regarding the relationship between happiness and BMI. Running regressions, with the addition of different independent variables in each table, tests the hypotheses. I initially regress happiness for males and females on employment status, marital status, age, age squared, the natural log of income, and the natural log of BMI. To expand on the impact of BMI on happiness, I add the variables: the natural log of average BMI and the natural log of average income in later regressions. I also include different states to help control for state fixed effects.

First, consider the results for the full, cross-racial, male subsample, displayed in column one of Table1. I regress happiness for males on employment status, marital status, age, age squared, the natural log of income, and the natural log of BMI. I control for race so I can measure how each race is impacted by each independent variable. For the employment status independent variable, the "employed full time" category has been omitted. The coefficients on the other categories are the effects of that category relative to the omitted category (employed full time). For the whole sample, being self-employed positively impacts happiness and is statistically significant at the one percent level. Being unemployed for more than a year has a large negative affect on the whole sample with a coefficient of -0.248. The happiness of the self-employed is more similar to that of the employed than that of the unemployed. Thus, being unemployed has a much

larger impact on happiness than being self-employed. Being unemployed for less than one year has a negative impact on happiness as well. The negative effect on happiness is nearly three quarters as large as the negative change in happiness associated with being unemployed for more than a year. For the whole sample, being a homemaker has a negative impact on happiness that is about one quarter as large as being out of work for less than one year. Being a student has a positive coefficient of 0.0779. This is more than double the positive impact on happiness than being self-employed. Similarly, being retired has a positive impact on happiness of 0.0562 units. For the whole sample, being unable to work has the greatest negative coefficient associated with it. Being unable to work reduces happiness by nearly 1.3 times as much as being out of work for more than a year.

For the whole sample, being divorced, widowed, or never married have nearly the same negative effect on happiness. All of the variables have very similar coefficients, all being statistically significant. Being separated has a negative coefficient on happiness that is nearly fifty percent greater than being divorced, widowed, or never married. Being a member of an unmarried couple has the smallest negative coefficient, with a value of -0.129.

As expected, the coefficient associated with age is negative for the whole sample. But, the coefficient for age squared is positive. The shape of the age-happiness relationship is parabolic. Happiness typically decreases until the age of forty-five, when it starts increasing again. Again, as many papers in the past have led us to expect, the variable associated with the natural log of income is positive. The coefficient for the natural log of income variable is .140. As an individual's income

increases by ten percent, his happiness increases by 0.0140 units. Thus, an increase in income by one percent has an aeffect that is slightly more than three quarters the absolute value of being unemployed for less than a year.

Next, we compare the effects of BMI on happiness across different racial subsamples. The results in columns two through six in Table 1 indicate that the relationship between BMI and happiness varies significantly across races. For example, the coefficient for the natural log of BMI for White men is -0.0619 and is statistically significant at the one percent level. Both Black and Hispanic men are negatively impacted by increases in the natural log of BMI. Black men experience a -0.0142 unit change in happiness. Whereas, a one percent increase in the BMI of Hispanic men has a negative impact about one third the magnitude of the coefficient associated with White men. The happiness of Asian and Native men is not significantly impacted by changes in BMI.

In Table 1, I found that the effects of BMI on happiness are felt across different racial subsamples of men. White men were negatively affected the most by an increase in their own BMI. Certain racial groups, such as Blacks and Hispanics, are impacted to a lesser extent by changes in their BMI.

Table 2 includes the same variables as Table 1, but contains the results for the full, cross-racial, female subsample, displayed in column one. The coefficient associated with the natural log of BMI for the whole sample of men is -0.0445. The coefficient associated with the whole sample for women is roughly half as large as the coefficient for men. This indicates that a one percent increase in a female's BMI

decreases her happiness by half as much as it impacts that of the corresponding males.

Columns two through six of Table 2 indicate that BMI is negatively associated with happiness for White, Hispanic and Native women, and the magnitude of these effects is highly similar for these groups. In contrast, BMI is marginally significant or not significant for Black and Asian women.

To illustrate the significant differences in the effects of BMI on happiness across genders, I compare the men and women of each race to highlight the contrast. The negative impact on happiness associated with a one percent change in BMI is nearly three times as large for White men than for White women. Similarly, but to a slightly lesser extent, the negative coefficient associated with Black men is nearly twice as large as that for Black women. Hispanic women and Hispanic men experience a similar decrease in happiness with corresponding coefficients being -0.0218 and -0.0206. Native women are negatively affected by BMI, whereas a one percent change in BMI does not impact Native men. The happiness of Asian women and men is not impacted by a one percent increase in their BMI.

As I hypothesized, changes in BMI would have different impacts on the happiness of both men and women of different races. Tables 1 and 2 illustrate that White men experienced the largest decrease in happiness with a one percent increase in their BMI and Native women had the second largest negative coefficient, being roughly half as large as that the coefficient for White men. An increase in BMI has a negative aeffect on nearly all categories of men and women, albeit to a different extent for each category. By adding the variables controlling for sex, I was

able to compare how men and women of different races were impacted by changes in BMI, most being statistically significant results. Tables 1 and 2 successfully illustrated the inverse relationship between BMI and happiness for different racial and gender groups.

Section 2. Adding the Natural Log of Average BMI

I am testing the hypothesis that social comparisons matter when it comes to BMI. In Tables 3 and 4, I include the same variables as in 1 and 2, with the addition of the natural log of average BMI variable. By adding this variable, I am able to see how a one percent increase in the BMI of one's reference group increases his or her happiness. If the coefficient for the natural log of average BMI is significant, this means that individuals care about their BMI relative to their peers. If the coefficient is insignificant, the respondents only care about their own weight. If the coefficients for the natural log of BMI and natural log of average BMI variables are both significant and of similar magnitude, then the individuals care only about their relative BMI. As I have outlined in previous sections of my paper, I expect that an increase in the BMI of one's reference group will have a positive impact on the correspondent's happiness. Table 3 shows the regression results for men and Table 4 shows the results for women.

First, consider the results in column one of Table 3, which reports the results for the cross-racial, male subsample. The coefficient associated with the natural log of BMI variable is negative for the whole sample. The size of the coefficient is -0.0478. For the natural log of average BMI for the whole sample of men is nearly

the same magnitude, with an opposite sign, of the coefficient associated with the natural log of BMI variable. This is indicative of a hedonic treadmill, illustrating that, for the whole sample, a man's happiness is not impacted by a positive change in his BMI as long as, on average, all other men experience that same change in BMI.

White, Black, and Hispanic men are all negatively affected by a positive change in BMI. Similar to the results shown in Table 1, White men in Table 3 have the largest negative coefficient for the natural log of BMI variable. It is nearly three times larger than the coefficient for Hispanic men. Black men experience the smallest negative change in happiness with a decrease of -0.00172 units in happiness with a ten percent increase in their BMI. Asian and Native men are not impacted by a change in their BMI.

As we saw with the natural log of BMI variable, only a portion of the racial groups experience a change in happiness when the BMI of their reference group increase. White and Black men experience nearly the same positive change in happiness when the BMI of their reference group increases. For White men, the value for the average BMI variable is roughly forty percent as large as the size of the own BMI variable. For Black men, the positive value associated with the average BMI variable is greater than that associated with the own BMI variable. This indicates that Black men are more positively impacted by an increase in the BMI of other Black men than negatively impacted by an increase in their own BMI. Hispanic, Asian and Native men are not impacted by a change in the BMI of their reference group.

Next, consider the BMI variables in column one of Table 4, which show how happiness is impacted by changes in BMI for the full, cross-racial, female subsample. Again, as in Tables 1 and 2, the coefficient for the natural log of BMI variable for women is smaller than that for the whole sample of men. The coefficient for the whole sample of men is nearly twice as large as the coefficient for women. The coefficient for the natural log of average BMI for women is less than half the size of the coefficient for the whole sample of men. This indicates that women experience a much smaller decrease in happiness as their BMI increases by a percent.

Each female racial category, columns two through six, is affected to a different extent by an increase in their own BMI and an increase in the BMI of their reference group. Native women experience the largest decrease in happiness with a one percent increase in their own BMI. Asian and White women experience a similar decrease in happiness with the coefficients for their own BMI variable being -0.0212 and -0.0266. Black women experience the smallest decrease in happiness with a one percent increase in their BMI. The coefficient associated for Black women is roughly one quarter the size of the coefficient for Native women.

In Table 4, Black women experience the largest increase in happiness as the BMI of other Black women increases. The values for Black women and Native women are similar and roughly three times larger than the coefficient for White women. This shows that their happiness increases by nearly three times as much as White women when the BMI of other Black and Hispanic women increases by a percent.

For individual BMI across genders, White men experience a negative change in happiness that is nearly 2.5 times larger than that of White women. Similarly, Black men experience a greater decrease in happiness with an increase in their BMI than Black women. The coefficient for the natural log of BMI for Black men is roughly twice as large as the coefficient for Black women. Hispanic men and women experience the same decrease in happiness with a one percent increase in their BMI. The coefficient associated with the natural log of BMI for Hispanic men and women in -0.0212. Native women experience a negative change in happiness as their BMI increases, whereas Native men do not feel any change in happiness with an increase in BMI. Asian women and men are not impacted by a change in their BMI.

The coefficient for the natural log of average BMI for White men is much larger than the coefficient for White women. This follows a similar pattern as individual BMI. Thus, White men are much happier when the BMI of other White men increases by a percent. The coefficients for the natural log of average BMI for Black women and Black men are nearly the same. The value for the female coefficient is 0.0243 and the value for males is 0.0234. As the BMI of their reference group increases, Black women and men experience the roughly the same positive change in happiness.

Tables 3 and 4 illustrate that not only are each race affected differently by changes in their own BMI, as well as, the BMI of others within their reference group; but different sexes are affected to very different extents by changes in BMI. Again, White males experience the largest negative change in happiness as their own BMI increases. They also experience the largest positive change in happiness as the BMI

of other white men increases by a percent. But, Black women and men experience a similar change in happiness when the BMI of their reference group increases by a percent. These regressions further support my initial hypothesis that different races and sexes will be affected to different extents by changes in their own BMI and relative BMI. In addition, Tables 3 and 4 support my hypothesis that social comparisons matter when it comes to weight. As we saw, the coefficient for the natural log of average BMI was significant, indicating that individuals care about their BMI relative to their peers.

Section 3. Adding the Natural Log of Average Income

The variables used in Table 5 and 6 are the same variables used in Tables 3 and 4, with the addition of the natural log of average income. Through the addition of this variable, I will be able to see how a one percent increase in the income of one's reference group affects his or her happiness. The natural log of average income variable is added because it corrects for a potential bias in my previous regressions. Through the inclusion of this additional variable, it assures that the natural log of average income is not correlated with any other variable, which could potentially lead to a bias in the coefficient of another independent variable. If the coefficient for the natural log of average income is significant, it means that individuals care about their income relative to their peers. If it is insignificant, then they only care about their own income. If the natural log of income and natural log of average income variables are significant and similar in magnitude, then individuals only care about their relative income. I expect that a one percent

increase in the income of one's reference group will have a negative affect on that individual's happiness.

For the cross-racial, male subsample, reported in column one of Table 5, the natural log of income has a positive coefficient of 0.153. The natural log of average income has a coefficient of -0.149. These two coefficients are nearly identical in absolute value. The values of these coefficients are indicative of a hedonic treadmill. This indicates that a man's happiness is stays the same if his income increases by a percent and the income of all other men also increases by a percent.

The natural log of BMI for all men has a negative coefficient of -0.0488, indicating a decrease in happiness with an increase in BMI. It is nearly five times larger than the value associated with the natural log of average BMI for the whole sample. This indicates an increase in an individual's BMI has a negative impact on happiness that is roughly five times the positive effect associated with an increase in the BMI of other men.

Again, as in all previous tables, White men have the largest negative coefficient associated with the natural log of BMI variable. The coefficient for White men is -0.0636. This is over three times larger than the coefficient for Hispanic men and nearly four times larger than the coefficient for Black men. Only White and Black men have statistically significant coefficients for the natural log of average BMI. The values for White and Black men are roughly the same. The natural log of average BMI for Black men is very close in value for the natural log of BMI, again, indicating a hedonic treadmill.

Next, we must consider column one Table 6, where the natural log of income for the full, cross-racial, female subsample has a positive value of 0.148. This is nearly as large as the coefficient for the natural log of income for men, indicating that a one percent increase in income for women has roughly the same positive effect that the same increase has on men. The natural log of average income for women is about two-thirds as large as the coefficient for the natural log of income. Unlike the men in Table 5, for women in Table 6, there is no hedonic treadmill related to the natural log of income and natural log of average income variables. The natural log of average income for women is about two-thirds as large as the coefficient for men. This shows that the social cost related to an increase in men's reference group is greater than for women.

The natural log of BMI for the whole sample of women has a negative value associated with it. As in previous regressions, the coefficient for all women is about half the value of that for men, showing that a one percent increase in women's BMI has the same affect as a 0.5 percent increase in men's BMI. For the natural log of average BMI variable, the coefficient for women is nearly as large as that for men. This shows that a one percent increase in the BMI of all other women has the same effect on the happiness of women that a one percent increase in the BMI of all men has on other men.

We must now consider the impact of BMI on happiness across different racial subsamples of women in columns two through six of Table 6. The natural log of BMI has the greatest coefficient (-0.0356) for Native women. White women have a coefficient that is three-quarters the value of that for Native women. Black and

Hispanic women have the smallest values for the natural log of BMI variable. The only two races that have statistically significant values for the natural log of average BMI are Black and Native women, both of which are nearly the same in value. This shows that a one percent increase in the BMI of their reference group has roughly the same impact on Black and Native women. The coefficient is not statistically significant for any other groups.

For each group of women, separated by race, the coefficients for the natural log of income are positive and statistically significant. White women have the largest coefficient with a value of 0.156. Black women have the smallest value for the natural log of income with a coefficient of 0.107. The values for Native and Hispanic women are about four-fifths the size of the value for White women. Asian women have the second largest value for the natural log of income with a coefficient of 0.142. For the natural log of average income variable, each race has a negative statistically significant value associated with it. Hispanic and Native women have the largest negative value associated with the natural log of average income variable. The coefficient for White women is eighty percent as large as the coefficient for Hispanic and Native women. Black and Asian women have the smallest value associated with the natural log of average income variable, being about half and one-third the size of that for Hispanic and Native women.

To further support my hypothesis, I compare genders within each racial subsample. For White men and women, the value for the natural log of income is roughly the same size and is the largest of their respective group. This shows that White men and women are the most positively impacted by a one percent increase

in their income. The values for both sexes of Asian and Native categories have the same size coefficient for the natural log of income variable. The value for Black men is slightly larger than that of Black women. The coefficients for Asian men and women are less than ten percent different, indicating a very similar change in happiness with a one percent increase in income.

For the natural log of average income, both sexes for all racial categories have statistically significant coefficients, except for Asian men and women. Unlike the values associated with the natural log of income, the values for each race for men and women for average income are somewhat different. This indicates that for each race, men and women respond differently to a ten percent increase in the income of their reference group. For example, the value for White men is -0.151 and the value for White women is -0.115. All the values have a negative coefficient associated with them, but the coefficients are of different magnitudes.

The natural log of BMI for each racial category is very different for men and women, except for Hispanic men and women. The values for Hispanic men and women are nearly identical, indicating that a one percent increase in the BMI of Hispanic men and women has the same negative affect on their happiness. The coefficient for White men is over twice as great as the value for White women. For Black men, the coefficient for the natural log of BMI is about 1.5 times larger than the coefficient for Black women. Native women are negatively impacted by an increase in their own BMI, whereas, Native men are not impacted by a change in their BMI. Asian men and women are not affected by a change in their BMI. Black men and women are the only race that has a statistically significant coefficient for

the natural log of average BMI variable for both sexes. The coefficient for women is larger, indicating that Black women are more positively impacted by an increase in the BMI of other women than Black men.

Tables 5 and 6 have successfully highlighted that different races are affected to different extents by BMI and income. Clearly, both BMI and average BMI are important for an individual's happiness. If the BMI of one's reference group increases, that individual will experience a positive change in happiness. Being skinny relative to one's reference group provides an increase in happiness for that individual. In addition, the inclusion of the natural log of average income variable shows that social comparisons matter when it comes to income. Individuals, across different racial and gender groups, care about their income relative to their peers.

Section 4. Addition of State Fixed Effects

The next group of regressions is different from the last because it contains the different states, allowing me to control for state fixed effects. It is important to include state fixed effects because they control for time invariant, state specific omitted variables that could be correlated with happiness and average BMI. If they are in fact correlated, the omission of these variables will result in biased estimates of the effects of the coefficient on average BMI. That is, suppose Louisiana is both fat and happy, due to the excellent deep fried southern cuisine. This is an omitted state level variable that will bias my estimates. It would appear that higher BMI is good, but in reality, it is the deep fried southern cuisine. Other than the addition of the individual states, the regressions shown in Tables 7 and 8 contain the same

independent variables as Tables 5 and 6. The natural log of BMI for the cross-racial, male subsample (column one in Table 7) has a negative coefficient. This indicates that men are -0.0475 units less happy with a one percent increase in their BMI. Unlike in the previous regressions, the natural log of average BMI for the whole sample of men does not have a statistically significant coefficient. This indicates that men, across state lines, do not become happier when the BMI of their reference group increases by a percent.

Similar to results in previous regressions, the natural log of income has a statistically significant positive coefficient. The coefficient for the natural log of income is slightly larger in magnitude than the coefficient for the natural log of average income. This shows that the social cost associated with the income of one's reference group increasing by a percent is less than the increase in happiness felt when an individual's income grows by a percent.

For each racial subsample of men, White men, as in all previous regressions, have the highest coefficient for the natural log of BMI variable. It is over three times larger than the next largest coefficient, which is the coefficient for Hispanic men. This shows that a one percent increase in the BMI of White men has the same effect on happiness as an increase of over three percent for Hispanic men. Black men have the smallest statistically significant value for the natural log of BMI variable. Asian and Native men are not impacted by an increase in their own BMI.

The only group of men that is impacted by a change in the BMI of their reference group is White men. White men experience a 0.00166 unit increase in happiness as the BMI of their reference group increases by ten percent. This value is

nearly four times smaller than the variable for the natural log of BMI for White men. White men are impacted much more by an increase in their own BMI than the BMI of their reference group.

The natural log of income for each racial subsample of men is positive and statistically significant. White men have the largest coefficient for this variable, with it being 0.161. Hispanic men have the smallest coefficient for this variable, as it is about two-thirds the size of the value for White men. Native, Asian and Black men all have coefficients that are about the same in size, showing that these three races feel the same increase in happiness with a one percent increase in their income.

The natural log of average income variable is statistically significant for each race, except for Asian men. As in the natural log of income variable, the White men have the highest coefficient for the natural log of average income. This indicates that White men experience the largest decrease in happiness with a one percent increase in the income of other White men. The coefficient for White men is about three times larger than the coefficients for Black, Hispanic and Native men. A three percent increase in the average income of Black, Hispanic and Native men would have about the same impact on their happiness as a one percent increase in the average income of White men would have on other White men.

Next, we consider the full, cross-racial, female subsample in column one of Table 8 where the coefficients for the natural log of BMI and the natural log of average BMI are both statistically significant. The natural log of BMI for the cross-racial, female subsample has a coefficient of -0.0246. The coefficient for the natural log of average BMI is roughly one-third the size of the coefficient for the natural log

of BMI. This shows that a one percent increase in one's own BMI is equivalent to a three percent increase in the BMI of that person's reference group. As in all previous regressions, the coefficient for the natural log of BMI for men is much larger than that of women. In these regressions, the coefficient for men is roughly twice the size of the coefficient for women. These variables show that men are much more susceptible to decreases in happiness with an increase in their BMI than women.

For the whole sample of women, the natural log of income variable has a coefficient of 0.149. The coefficient for the natural log of average income is about half the size of the coefficient for individual income. This shows that women are much happier with an increase in their own income instead of a decrease in the income of their reference group. To be more specific, for women to feel the same increase in happiness, either the individual has to experience a one percent increase in her own income, or all women have to experience a two percent decrease in their income. The coefficient for the natural log of income is roughly the same for men and women, indicating that an increase in their income of one percent has the same affect on their happiness. But, the natural log of average income variable for men has a much larger coefficient than that for women, being about 1.5 times larger. Men experience a much larger decrease in happiness if the income of other men increases, whereas women still feel a decrease in happiness, but to a much smaller extent.

The natural log of BMI for Native women has the largest among all female racial groups. The value of the aforementioned coefficient is -0.0357. The next largest coefficient is for White women, with a value of -0.265. Black women feel the

smallest change in their happiness with a one percent increase in their BMI. Relative to all Black women, Hispanic women feel twice the decrease in happiness with a one percent increase in BMI.

The only individual races that are impacted by the BMI of their reference group are White and Native women. As expected, the value for Native women is the largest coefficient. The coefficient for White women is less than half the size of the coefficient for Native women. This means that for White women to experience the same increase in happiness as Native women, the BMI of their reference group must increase by twice as much as Native women. Black, Hispanic and Asian women do not feel a change in happiness if the BMI of their reference groups increase.

The natural log of income variable for all races of women is statistically significant and positive. White women feel the largest increase in happiness with a one percent increase in their income. Black women experience the smallest increase in happiness with a one percent increase in their income, as the coefficient for Black women is about two-thirds the size of the coefficient of White women. Hispanic and Native women experience roughly the same increase in happiness with a one percent increase in their income. The coefficient for Asian women is slightly smaller than that of White women.

The natural log of average income for each racial group of women is statistically significant, except for Asian women, as they are not impacted by a change in the income of other Asian women. White women experience the largest decrease in happiness when the income of their reference group increases by a percent. Black and Native women experience a decrease in happiness that is about

half as large as the decrease felt by White women when the income of their reference group increases by a percent. Hispanic women feel the smallest decrease in happiness, with a coefficient of -0.060, when the income of other Hispanic women increases by a percent.

In addition, I compare men and women of each racial subsample to show how each gender makes social comparisons based on BMI. For two of the race groups, the coefficient for the natural log of BMI is much larger for men than for women. The coefficient for White men is nearly three times larger than for White women and the coefficient for Black men is about 1.5 times larger than for Black women. Hispanic men and women feel the same decrease in happiness with a one percent increase in their BMI. Native women feel a decrease in happiness with a positive change in their BMI, while Native men feel no change in happiness with a change in their BMI. Neither Asian women nor men are impacted by an increase in their BMI.

Similar to the coefficients for the natural log of BMI, the average BMI variable for White men has a larger coefficient than for women. To be more specific, it is about 1.5 times larger than the coefficient for women. This means that White men experience an increase in happiness that is 1.5 times larger than women when the BMI of their reference group increases by a percent. Native women feel a positive change in happiness when the BMI of their reference group increases by a percent, but Native men feel no change in their happiness with a change in the average BMI of their reference group. No other races are impacted by a change in the BMI of their reference groups.

For both sexes, the coefficient of the natural log of income variable for the White group is larger than for any other group. White men still feel a larger increase in happiness than White women with a one percent increase in their income. Similarly, Black men feel a larger increase in happiness than Black women with a one percent increase in their income. Both sexes for the Asian and Native groups experience a very similar change in happiness with a one percent increase in their income. The coefficient for Hispanic women is larger than the coefficient for Hispanic men, showing that Hispanic women are impacted to a greater extent by a change in their income.

Each gender in the same racial subsample is impacted by a change in the average income of their reference group. Both White men and women have the largest coefficients associated with the natural log of average income variable. But, the coefficient for White men is larger than that for White women, indicating that White men experience a larger decrease in happiness with an increase in the average income of their reference group. For both sexes, both the Native and Black groups experience a very similar decrease in happiness with a one percent increase in the average income of their reference group. Hispanic men experience a negative change in happiness with a one percent increase in the income of their reference group that is roughly 1.5 times greater than the change in happiness felt by Hispanic women with the same change in income. Asian men and women are not impacted by changes in the income of their reference groups.

As Tables 7 and 8 have shown, the happiness of each racial group and gender is impacted to a much different extent by changes in their own BMI, the BMI of their

reference group, their own income, and the income of their reference group. For the most part, White men were impacted the most by changes in all these categories. This is indicative that White men are more likely than any other race or sex to make social comparisons based on BMI or income. That being said, I have outlined how many other groups are significantly impacted by their own BMI and the BMI of their reference groups. The social cost of being heavier than one's reference group is different, but very significant for most races. The inclusion of a fixed effects model has a drawback, which is the cross-state variation in my variables is used to estimate the state fixed effects. There is less variation left over to estimate the other coefficients, meaning larger standard errors and less precise coefficient estimates.

Section 5. IV Regression Analysis

In this section of my paper, I use an instrumental variable in an attempt to address the problem of endogeneity. The instrumental variable used in the next set of regressions is the natural log of height. I use the natural log of height because height is used when creating the BMI variable. More specifically, the equation is:

$$BMI = [Weight/(Inches^2)]x703$$

I use the instrumental variable of the natural log of height because, in my original regressions, I use the natural log of BMI. Through the following regressions, I am attempting to explain how height affects happiness only through its effect on BMI. Height is used as an instrument because it is one that is correlated with the independent variable, but not with the error term.

As expected, the natural log of BMI for the all race category for men in Table 9 has a negative coefficient. The coefficient for the natural log of BMI, when instrumenting for height, is -0.676. This is nearly five times larger than any coefficient for the natural log of BMI in the previous OLS regressions. Also, the coefficient for White men is extremely large, with a value of -1.691, indicating a 0.1691 unit decrease in happiness with a ten percent increase in BMI. The coefficients are much too large to be considered accurate. Also, the coefficients for the Black, Hispanic, Asian and Native groups are not statistically significant.

Similarly, Table 10 uses the instrumental variable of the natural log of height for females. Again, the coefficients are too large to be considered accurate. The coefficient for the natural log of BMI for the whole sample is -0.366, which is over ten times larger than any coefficient in the OLS regressions found for females. The only coefficient that is statistically significant for an individual race category is for White females, and again, it is over fifteen times larger than any coefficient for any of the coefficients in the OLS regressions in the previous section of this paper.

These results lead me to believe that height affects happiness through channels other than its effect on BMI. There is correlation between height and the error term in my equations. Having height as an instrument in the instrumental variable approach may lead to misleading results. Katsaiti used height as an instrument in her paper and I have reason to believe that it is an invalid instrument. The coefficients for the natural log of BMI are grossly overestimated in both tables. This is a direct result of BMI being correlated with the error term.

The instrument of height may be invalid for several different reasons. Taller people have higher incomes on average[6]. As my paper has already shown in the OLS regressions, higher income is correlated with higher levels of happiness. Also, height is correlated with the error term, meaning that it impacts happiness through channels other than BMI. For example, a short individual may be unable to ride a roller coaster at an amusement park with a certain height requirement and experience a decrease in happiness as a result of this. This is an example of how height is impacting happiness through a channel other than BMI and it is accounted for in the error term.

Through these regressions, I have shown that Katsaiti was wrong when using height as an instrument because it is correlated with the error term for a multitude of reasons. As a result, the coefficients for BMI in tables 9 and 10 are overestimated, which could potentially lead to inaccurate interpretation.

[6] Rashad, Inas. "Height, Health, and Income in the US, 1984-2005." Economics & Human Biology 6.1 (2008): 108-26. Web.

Conclusion

In my thesis, I have highlighted how BMI and relative BMI have significant impacts on happiness. Through my regressions I have shown that being surrounded by others with a lower BMI increases the psychological cost of being overweight. I received the most accurate regression results by controlling for demographic factors including: sex, state, age, marital status, and employment status. By using data from the Behavioral Risk Factor Surveillance System, I was able to assemble a data set of over 1.4 million observations. The aspect of my paper that sets it apart from all other economics papers is the inclusion of reference groups. By creating reference groups based on state, sex, age group, and race group, I was able to see how an individual's BMI, relative to the appropriate reference group, affects his or her happiness. Also, the creation of proper reference groups allowed me to compare the role of relative BMI across racial and ethnic groups while taking into account the impacts based on gender.

One problem encountered with the data set was the number of White men and women compared to the number of other racial and ethnic groups. White people accounted for roughly 1.1 million data points. Black, Hispanic, Asian, and Native people only accounted for about 300,000 data points. To get the most accurate regression results for future tests, the Center for Disease Control would have to have an equal number of respondents for each racial group.

With each additional regression, it became increasingly evident that different racial and gender groups are more likely to make social comparisons based on relative BMI. In my first set of regressions (Table 1 and 2), White men and Native

women experienced the largest decrease in happiness with a one percent increase in their own BMI. In Tables 3 and 4, I added the natural log of average BMI allowing to me to analyze how a one percent increase in the BMI of one's reference group affects his or her happiness. Not only were White men impacted the most by changes in the BMI of their reference group, but other racial subsamples, specifically, Black and Hispanic men, were affected to a lesser extent by a one percent increase in the BMI of their reference group. Table 8 also shows how White and Native women were happier when the average BMI of other women in their reference group increased by a percent, whereas, Black, Hispanic and Asian women were not impacted by an increase in the BMI of their reference groups. In all regressions, White men experience the greatest decrease in happiness as their relative BMI increases. My regressions supported my original hypothesis that social comparisons matter when it comes to BMI.

By using the instrumental variable of height, I was able to show that it was not a legitimate instrument, as Katsaiti had originally suggested. The coefficients for the natural log of BMI were much too large, being over ten times larger than any other value in the OLS regressions. This suggests that the height is correlated with the error term leading to an overestimation of the natural log of BMI in the regressions. Height could be correlated with the error term for a variety of reasons. As I suggested earlier, a short individual may be unable to ride certain roller coasters at an amusement park due to a height requirement, leading to a decrease in happiness. This decrease in happiness would be accounted for in the error term.

My initial hypothesis was correct when I suggested that different racial and gender groups are more likely to make comparisons based on Relative BMI. Specifically, White men experience the greatest decrease in happiness as their relative BMI increases. In conclusion, my regressions support my initial hypothesis that changes in BMI would have different impacts on the happiness of different racial, ethnic, and gender groups.

Table 1; Male Happiness Based on lnbmi, lninc, and Race

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
Periods	Yes	Yes	Yes	Yes	Yes	Yes
Male	Yes	Yes	Yes	Yes	Yes	Yes
Self-Employed	0.0308***	0.0333***	0.00942	0.0280**	0.0540***	0.0232
	(12.10)	(12.27)	(0.706)	(2.507)	(2.899)	(1.230)
Out of Work For more than A year	-0.248***	-0.260***	-0.228***	-0.224***	-0.0807**	-0.223***
	(-43.51)	(-39.28)	(-12.97)	(-11.34)	(-2.213)	(-7.182)
Out of Work For less than A year	-0.181***	-0.195***	-0.163***	-0.145***	-0.100***	-0.120***
	(-37.47)	(-34.92)	(-10.28)	(-9.349)	(-3.015)	(-4.496)
A Homemaker	-0.0477***	-0.0631***	-0.0108	-0.0545	0.0226	0.0476
	(-3.214)	(-3.743)	(-0.169)	(-1.252)	(0.213)	(0.601)
A student	0.0779***	0.0891***	0.0452*	0.0601***	0.101***	0.0200
	(10.45)	(10.17)	(1.759)	(2.643)	(2.977)	(0.475)
Retired	0.0562***	0.0640***	0.0333**	-0.00134	0.0568***	0.000936
	(20.69)	(21.96)	(2.909)	(-0.105)	(2.592)	(0.0451)
Unable to Work	-0.320***	-0.346***	-0.183***	-0.281***	-0.324***	-0.367***
	(-83.64)	(-79.11)	(-14.89)	(-20.77)	(-7.575)	(-17.45)
Did Not Answ	-0.0117	-0.0138	0.0156	0.0242	-0.391**	0.00939
	(-0.561)	(-0.579)	(0.239)	(0.325)	(-2.353)	(0.0847)
Divorced	-0.190***	-0.192***	-0.109***	-0.183***	-0.119***	-0.175***
	(-75.19)	(-69.40)	(-11.35)	(-16.69)	(-5.060)	(-10.52)
Widowed	-0.187***	-0.197***	-0.0799**	-0.139***	-0.0324	-0.185***
	(-51.91)	(-50.80)	(-5.442)	(-7.806)	(-0.937)	(-6.997)
Seperated	-0.262***	-0.325***	-0.157***	-0.177***	-0.176***	-0.199***
	(-41.85)	(-41.91)	(-10.29)	(-9.160)	(-3.039)	(-5.882)
Never Marrie	-0.191***	-0.198***	-0.124***	-0.176***	-0.157***	-0.140***
	(-71.12)	(-65.55)	(-13.14)	(-16.95)	(-9.603)	(-7.950)
Member of an Unmarried Couple	-0.129***	-0.140***	-0.146***	-0.114***	-0.1000**	-0.0915***
	(-23.86)	(-22.46)	(-6.570)	(-7.905)	(-2.086)	(-3.112)
Refused	-0.139***	-0.147***	0.00448	-0.224***	0.120	-0.176**
	(-6.811)	(-6.335)	(0.0681)	(-2.738)	(0.813)	(-1.964)
age	-0.00774**	-0.00798***	-0.00455*	-0.00857**	-0.00119	-0.00679***

	(-25.25)	(-23.54)	(-3.685)	(-6.968)	(-0.590)	(-3.380)
agesqr	8.27e-05**	8.53e-05***	6.36e-05*	9.54e-05**	9.68e-06	8.16e-05***
	(28.42)	(26.77)	(5.200)	(7.619)	(0.472)	(4.089)
lninc	0.140***	0.156***	0.120***	0.0859***	0.131***	0.112***
	(118.0)	(115.1)	(26.52)	(20.70)	(16.53)	(14.63)
lnbmi	-0.0445***	-0.0619***	-0.0142*	-0.0206***	-0.00255	-0.0124
	(-16.78)	(-19.44)	(-1.685)	(-2.792)	(-0.201)	(-0.827)
Constant	2.267***	2.149***	2.240***	2.806***	2.008***	2.396***
	(130.0)	(106.8)	(34.80)	(48.60)	(18.09)	(21.69)
Observations	546,655	455,191	34,816	33,700	10,434	12,514
R-squared	0.124	0.134	0.088	0.076	0.070	0.117

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2; Female Happiness Based on lnbmi, lninc, and Race

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
Period	Yes	Yes	Yes	Yes	Yes	Yes
Female	Yes	Yes	Yes	Yes	Yes	Yes
Self-employe	0.0360***	0.0362***	0.0169	0.0399***	0.0419**	0.0137
	(13.18)	(12.35)	(1.356)	(3.522)	(2.196)	(0.622)
Out of Work For more tha A year	-0.229***	-0.255***	-0.195***	-0.153***	-0.145***	-0.260***
	(-50.04)	(-46.26)	(-16.16)	(-10.74)	(-4.632)	(-9.477)
Out of Work For less than A year	-0.199***	-0.226***	-0.151***	-0.135***	-0.0916***	-0.183***
	(-45.60)	(-43.24)	(-12.82)	(-9.778)	(-3.035)	(-7.145)
A Homemake	0.0293***	0.0306***	0.000619	0.00100	0.0244	-0.0188
	(12.96)	(12.33)	(0.0542)	(0.133)	(1.624)	(-1.045)
A Student	0.0244***	0.0392***	0.0259*	-0.0314*	0.0547*	-0.0287
	(4.497)	(5.943)	(1.751)	(-1.909)	(1.909)	(-0.959)
Retired	0.0448***	0.0483***	0.0210**	0.0320***	0.0557***	-0.0525***
	(20.41)	(20.43)	(2.552)	(3.105)	(3.028)	(-2.730)
Unable to work	-0.326***	-0.363***	-0.202***	-0.283***	-0.291***	-0.381***
	(-112.8)	(-108.0)	(-25.06)	(-27.30)	(-7.984)	(-21.57)
Refused	-0.0470***	-0.0528***	-0.0551	0.0711	-0.150	-0.198*
	(-2.828)	(-2.768)	(-1.085)	(1.255)	(-1.272)	(-1.946)
Divorced	-0.154***	-0.157***	-0.0956***	-0.127***	-0.0874***	-0.125***
	(-76.16)	(-69.71)	(-13.76)	(-16.10)	(-5.064)	(-8.396)
Widowed	-0.120***	-0.126***	-0.0469***	-0.0874***	-0.0533***	-0.130***
	(-52.97)	(-51.24)	(-5.632)	(-8.804)	(-2.839)	(-7.198)
Separated	-0.229***	-0.301***	-0.123***	-0.159***	-0.251***	-0.180***
	(-51.60)	(-51.68)	(-11.96)	(-13.74)	(-6.036)	(-6.590)
Never Married	-0.138***	-0.153***	-0.0878***	-0.109***	-0.0814***	-0.121***
	(-57.48)	(-52.66)	(-13.21)	(-12.80)	(-5.102)	(-7.309)
Member of An Unmarried	-0.104***	-0.103***	-0.118***	-0.0947***	-0.0510	-0.116***

Couple						
	(-22.84)	(-19.69)	(-6.580)	(-7.453)	(-1.307)	(-4.394)
Refused	-0.113***	-0.116***	-0.0671	-0.146**	-0.0618	-0.0695
	(-7.091)	(-6.233)	(-1.576)	(-2.299)	(-0.476)	(-0.846)
age	-0.00684***	-0.00784***	-0.00521**	-0.00795***	-0.00164	-0.0118***
	(-28.21)	(-28.75)	(-6.464)	(-8.254)	(-0.951)	(-6.837)
agesqr	8.09e-05***	8.89e-05***	8.70e-05**	9.50e-05***	3.29e-05*	0.000143***
	(35.07)	(34.68)	(10.65)	(9.703)	(1.893)	(8.237)
lninc	0.137***	0.150***	0.102***	0.110***	0.140***	0.111***
	(146.0)	(137.0)	(33.24)	(33.66)	(21.92)	(16.66)
lnbmi	-0.0231***	-0.0264***	-0.00778*	-0.0218***	-0.00317	-0.0298***
	(-18.50)	(-18.84)	(-1.937)	(-4.656)	(-0.320)	(-3.385)
Constant	2.200***	2.103***	2.376***	2.507***	1.903***	2.585***
	(172.7)	(142.9)	(57.95)	(55.97)	(21.44)	(28.88)
Observations	837,453	674,802	75,987	55,958	13,957	16,749
R-squared	0.114	0.123	0.070	0.080	0.069	0.112

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3; Male Happiness Based on lnbmi, lnavbmi, lninc, and Race

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
lninc	0.140***	0.156***	0.121***	0.0859***	0.132***	0.112***
	(118.5)	(115.1)	(26.61)	(20.71)	(16.56)	(14.63)
lnbmi	-0.0478***	-0.0625***	-0.0172**	-0.0212***	0.00154	-0.00896
	(-17.92)	(-19.60)	(-2.014)	(-2.847)	(0.116)	(-0.579)
lnavbmi	0.0410***	0.0246***	0.0234**	0.00424	-0.0122	-0.0120
	(11.37)	(3.701)	(2.507)	(0.596)	(-1.084)	(-0.905)
Constant	2.117***	2.061***	2.155***	2.789***	2.036***	2.429***
	(96.75)	(66.55)	(29.57)	(43.59)	(17.88)	(20.88)
Observations	546,655	455,191	34,816	33,700	10,434	12,514
R-squared	0.124	0.134	0.088	0.076	0.070	0.117

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(also includes: periods, sex, employment status, marital status, age and age squared)

Table 4; Female Happiness Based on lnbmi, lnavbmi, lninc, and Race

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
lninc	0.137***	0.150***	0.102***	0.110***	0.140***	0.111***
	(146.2)	(137.0)	(33.36)	(33.66)	(21.92)	(16.69)
lnbmi	-0.0240***	-0.0266***	-0.00930**	-0.0212***	-0.00400	-0.0350***
	(-19.14)	(-18.96)	(-2.306)	(-4.494)	(-0.393)	(-3.882)
lnavbmi	0.0185***	0.00898**	0.0243***	-0.00470	0.00303	0.0223***
	(7.891)	(2.558)	(3.724)	(-0.881)	(0.365)	(2.687)
Constant	2.124***	2.066***	2.270***	2.524***	1.893***	2.510***
	(133.0)	(100.1)	(45.36)	(51.38)	(20.33)	(26.80)
Observations	837,453	674,802	75,987	55,958	13,957	16,749
R-squared	0.114	0.123	0.071	0.080	0.069	0.112

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(also includes: periods, sex, employment status, marital status, age and age squared)

Table 5; Male Happiness Based on lnbmi, lnavbmi, lninc, lnavinc, and Race

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
lnbmi	-0.0488***	-0.0636***	-0.0167**	-0.0192***	0.00148	-0.00936
	(-18.35)	(-19.98)	(-1.960)	(-2.585)	(0.112)	(-0.605)
lnavbmi	0.00998***	0.0152**	0.0162*	0.000834	-0.0118	-0.0147
	(2.708)	(2.293)	(1.717)	(0.117)	(-1.049)	(-1.110)
lninc	0.153***	0.162***	0.126***	0.102***	0.132***	0.122***
	(124.8)	(117.5)	(27.17)	(23.66)	(16.10)	(15.40)
lnavinc	-0.149***	-0.151***	-0.0938***	-0.179***	-0.00862	-0.124***
	(-39.13)	(-23.78)	(-5.469)	(-12.91)	(-0.292)	(-4.904)
Constant	3.678***	3.657***	3.094***	4.404***	2.121***	3.599***
	(80.86)	(49.49)	(16.58)	(31.36)	(6.749)	(13.56)

Observations	546,655	455,191	34,816	33,700	10,434	12,514
R-squared	0.126	0.135	0.089	0.081	0.070	0.119

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(also includes: periods, sex, employment status, marital status, age and age squared)

Table 6; Female Happiness Based on lnbmi, lnavbmi, lninc, lnavinc, and Race

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
lnbmi	-0.0252***	-0.0270***	-0.00947**	-0.0190***	-0.00416	-0.0356***
	(-20.07)	(-19.24)	(-2.348)	(-4.031)	(-0.409)	(-3.948)
lnavbmi	0.00856***	0.000123	0.0182***	-0.00368	0.00273	0.0192**
	(3.635)	(0.0348)	(2.770)	(-0.691)	(0.328)	(2.304)
lninc	0.148***	0.156***	0.107***	0.122***	0.142***	0.121***
	(151.2)	(139.8)	(34.11)	(36.27)	(21.80)	(17.76)
lnavinc	-0.0995***	-0.115***	-0.0769***	-0.142***	-0.0471*	-0.142***
	(-38.37)	(-27.21)	(-7.088)	(-14.14)	(-1.817)	(-6.549)
Constant	3.105***	3.271***	3.020***	3.778***	2.375***	3.853***
	(103.0)	(66.97)	(25.79)	(37.28)	(8.441)	(17.10)
Observations	837,453	674,802	75,987	55,958	13,957	16,749
R-squared	0.116	0.124	0.071	0.084	0.069	0.115

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(also includes: periods, sex, employment status, marital status, age and age squared)

Table 7; Male Happiness Based on lnbmi, lnavbmi, lninc, lnavinc, and Race (State Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
lnbmi	-0.0475***	-0.0620***	-0.0161*	-0.0182**	0.000418	-0.00845
	(-17.87)	(-19.49)	(-1.897)	(-2.457)	(0.0316)	(-0.546)
lnavbmi	0.00190	0.0166**	0.00318	0.000260	-0.0180	-0.0105
	(0.498)	(2.325)	(0.326)	(0.0327)	(-1.521)	(-0.761)
lninc	0.154***	0.161***	0.128***	0.105***	0.131***	0.123***
	(124.9)	(116.5)	(27.66)	(24.09)	(15.94)	(15.61)
lnavinc	-0.138***	-0.254***	-0.0834***	-0.0906***	-0.0389	-0.0799**
	(-29.81)	(-24.78)	(-2.641)	(-3.652)	(-0.973)	(-2.083)
Constant	3.612***	4.794***	3.041***	3.510***	2.453***	3.064***

	(66.09)	(42.30)	(9.282)	(13.48)	(5.529)	(7.558)
Observations	546,655	455,191	34,816	33,700	10,434	12,514
R-squared	0.128	0.137	0.095	0.086	0.079	0.127

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(also includes: periods, sex, employment status, marital status, age and age squared)

Table 8; Female Happiness Based on lnbmi, lnavbmi, lninc, lnavinc, and Race (State Fixed Effects)

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
lnbmi	-0.0246***	-0.0265***	-0.00920**	-0.0181***	-0.00475	-0.0357***
	(-19.66)	(-18.88)	(-2.283)	(-3.845)	(-0.466)	(-3.967)
lnavbmi	0.00854***	0.0105**	0.00287	-0.00163	-0.00119	0.0250***
	(3.249)	(2.393)	(0.408)	(-0.264)	(-0.136)	(2.910)
lninc	0.149***	0.156***	0.109***	0.125***	0.141***	0.123***
	(151.7)	(139.0)	(34.58)	(36.87)	(21.54)	(18.03)
lnavinc	-0.0834***	-0.141***	-0.0880***	-0.0600***	-0.0441	-0.0787**
	(-27.50)	(-25.24)	(-4.316)	(-3.269)	(-1.310)	(-2.535)
Constant	2.958***	3.525***	3.215***	2.920***	2.556***	3.102***
	(84.41)	(57.34)	(15.52)	(15.50)	(6.862)	(9.586)
Observations	837,453	674,802	75,987	55,958	13,957	16,749
R-squared	0.117	0.126	0.075	0.087	0.074	0.120

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(also includes: periods, sex, employment status, marital status, age and age squared)

Table 9; IV Male Happiness Based on lnbmi and Race

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
lnbmi	-0.676***	-1.691***	0.137	-0.0559	-2.421	0.740
	(-8.495)	(-7.349)	(0.757)	(-1.323)	(-1.213)	(0.632)
lnavbmi	0.100***	0.177***	-0.00716	0.00567	0.576	-0.173
	(8.297)	(7.271)	(-0.246)	(0.632)	(1.189)	(-0.699)
lninc	0.145***	0.142***	0.126***	0.101***	0.0724	0.134***
	(88.51)	(43.16)	(27.06)	(22.62)	(1.391)	(6.323)
lnavinc	-0.159***	-0.201***	-0.0969***	-0.177***	-0.0877	-0.118***
	(-38.00)	(-18.80)	(-5.504)	(-12.72)	(-0.986)	(-4.019)

Constant	5.520***	8.948***	2.714***	4.501***	9.444	1.532
	(23.16)	(11.87)	(5.586)	(25.27)	(1.557)	(0.473)
Observations	546,655	455,191	34,816	33,700	10,434	12,514
R-squared	0.037		0.081	0.080		

z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(also includes: periods, sex, employment status, marital status, age and age squared)

Table 10; IV Female Happiness Based on lnbmi and Race

	(1)	(2)	(3)	(4)	(5)	(6)
	All	White	Black	Hisp	Asian	Native
VARIABLES	happy	happy	happy	happy	happy	happy
lnbmi	-0.366***	-0.527***	-0.0133	-0.0289	-0.160	-0.336
	(-12.00)	(-10.75)	(-0.148)	(-1.028)	(-0.656)	(-1.137)
lnavbmi	0.0640***	0.0674***	0.0189	-0.00217	0.0312	0.0783
	(11.57)	(8.835)	(1.172)	(-0.319)	(0.689)	(1.333)
lninc	0.130***	0.127***	0.107***	0.122***	0.138***	0.112***
	(70.15)	(41.49)	(27.27)	(33.57)	(14.54)	(10.01)
lnavinc	-0.116***	-0.130***	-0.0770***	-0.141***	-0.0506*	-0.149***
	(-37.57)	(-26.89)	(-7.033)	(-13.81)	(-1.896)	(-6.372)
Constant	4.311***	5.019***	3.032***	3.801***	2.839***	4.764***
	(38.39)	(27.99)	(10.17)	(31.45)	(3.647)	(5.151)
Observations	837,453	674,802	75,987	55,958	13,957	16,749
R-squared	0.038		0.071	0.084	0.054	0.055

z-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

(also includes: periods, sex, employment status, marital status, age and age squared)

References

Who Pays for Obesity?
Bhattacharya, Jay; Sood, Neeraj; Journal of Economic Perspectives, Winter 2011, v. 25, iss. 1, pp. 139-58

Imitative Obesity and Relative Utility. Blanchflower, Oswald, and Landeghem, 2009. Journal of the European Economic Association, MIT Press, vol. 7, pages 528-538.

Borghesi, Simone, and Alessandro Vercelli. "Happiness and Health: Two Paradoxes." Journal of Economic Surveys 26.2 (2012): 203-33. Web.

The Medical Care Costs of Obesity: An Instrumental Variables Approach
Cawley, John; Meyerhoefer, Chad; Journal of Health Economics, January 2012, v. 31, iss. 1, pp. 219-30

Davis, Lewis, and Stephen Wu. "Social Comparisons and Life Satisfaction across Racial and Ethnic Groups: The Effects of Status, Information and Solidarity." (2012): n. page. Web.

Dragone, Davide, and Luca Savorelli. "Thinness and Obesity: A Model of Food Consumption, Health Concerns, and Social Pressure." Journal of Health Economics 31.1 (2012): 243-56. Web.

Child Care Subsidies and Childhood Obesity
Herbst, Chris M.; Tekin, Erdal; 2009, National Bureau of Economic Research, Inc, NBER Working Papers: 15007

Obesity and Happiness
Katsaiti, Marina-Selini; 2009, pp. 32 pages, University of Connecticut, Department of Economics, Working papers: 2009-44

Mandal, and Chern. A Multilevel Approach to Model Obesity and Overweight in the U.S.: International Journal of Applied Economics 8 (2011):

Offer, Avner. *The Challenge of Affluence: Self-control and Well-being in the United States and Britain since 1950*. Oxford: Oxford UP, 2006. Print.

Obesity, Unhappiness, and the Challenge of Affluence: Theory and Evidence Oswald, Andrew J.; Powdthavee, Nattavudh; 2007, pp. 21 pages, University of Warwick, Department of Economics, The Warwick Economics Research Paper Series (TWERPS)

Rashad, Inas. "Height, Health, and Income in the US, 1984-2005." Economics & Human Biology 6.1 (2008): 108-26. Web.

Sparks, Johnelle P., and Mary Bollinger. "A Demographic Profile of Obesity in the Adult and Veteran US Populations in 2008." Population Research and Policy Review 30.2 (2011): n. pag. Web.

Zhou, Haiou. "A New Framework of Happiness Survey and Evaluation of National Wellbeing." Social Indicators Research 108.3 (2012): 491-507. Web.