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# A Study on Obesity and its Relationship to Socioeconomic Background and Current Earnings

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# A Study on Obesity and its Relationship to Socioeconomic Background and Current Earnings

## **Abstract**

With larger meal portions and fewer natural food production methods, many suggest that people find it difficult to maintain a healthy diet. Nevertheless, certain individuals have been able to maintain a high-quality nutritional status and avoid this unhealthy condition. What are the reasons for these differences between individuals in weight outcomes? Moreover, how does this unhealthy weight outcome affect an individual's current economic situation? In this study, I will examine the effects of socioeconomic background on obesity and test whether an individual's weight has an impact on their present salary or wage levels.

# A Study on Obesity and its Relationship to Socioeconomic Background and Current Earnings

*Ian Cohen*

## **I. Introduction<sup>2</sup>**

“In 1999-2000, nearly 65 percent of U.S. adults were either overweight or obese. Obesity accounts for \$117 billion a year in direct and indirect economic costs, it is associated with 300,000 deaths each year, and it will soon overtake tobacco as the leading cause of preventable deaths” (Mancino, Lin, and Ballenger, 2004 p. 1). Clearly, obesity is a large problem in America. With larger meal portions and fewer natural food production methods, many suggest that people find it difficult to maintain a healthy diet. Nevertheless, certain individuals have been able to maintain a high-quality nutritional status and avoid this unhealthy condition. What are the reasons for these differences between individuals in weight outcomes? Moreover, how does this unhealthy weight outcome affect an individual’s current economic situation? In this study, I will examine the effects of socioeconomic background on obesity and test whether an individual’s weight has an impact on their present salary or wage levels.

The effect of obesity on economic outcomes is an area lacking significant economic research. Most literature on the topic studies the correlation between health factors and nutritional status on labor results, such as wage rates, in developing countries. Additionally, contemporary literature suggests that weight can play a large

role in determining an individual’s income level within the American job market. Thus, many economists insist that investments in good health, *ceteris paribus*, can increase a person’s human capital in regards to labor results. Within my study, I will utilize human capital theory to help develop a model to predict the effect of poor weight outcomes upon economic status in the form of current salaries or wages.

Before formulating such a model, I will describe the socioeconomic characteristics, if any, that determine obesity. To do this, I will observe the socioeconomic status of the individual’s household during childhood. Essentially, it is possible that the socioeconomic characteristics of the parent can have a profound influence on an individual’s eating habits and, therefore, weight outcomes. Again, human capital theory applies directly to this potential correlation between parental socioeconomic status and an individual’s weight condition. It is expected that parental education and level of income can help to determine the behavior of the child towards investment in a healthy body weight. Through this process, I create a model to determine if the background socioeconomic components of the parental units lead to the formation of the individual’s weight status.

The following sections discuss the previous literature on the link between socioeconomic background and obesity as well as the relationship with obesity and current income. I will draw on the human capital theory to explain both of these correlations. Then, I describe the data set and empirical model used to test my hypotheses, and I present the results and analyze

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<sup>2</sup> *Ian Cohen is a senior economics major and political science minor from Lake Zurich, Illinois. He wrote “A Study on Obesity and Its Relationship to Socioeconomic Background and Current Earnings” for his Senior Project class.*

the findings as they relate to the research subject of socioeconomic background, obesity, and current earnings. Finally, I attempt to discuss any policy implications and future research that may emerge from my results.

## **II. Theory and Review of the Literature**

Gary Becker's human capital theory is a framework that helps to clarify the effect of weight status on labor market outcomes for the individual. Human capital is the education, job experience/training, and the health status that workers invest in to increase their productivity and skills to be "rented out" to employers (Ehrenberg and Smith, 2005 p. 275). With its mention of health status, a healthy weight condition is a type of human capital investment. According to Robert Pindyck and Daniel Rubinfeld (2004 p. 562), "When an investment decision is made, the investor commits to a current outlay of expenses in return for a stream of expected future benefits." These costs for a healthy weight may include purchases of food with good nutritional characteristics and appropriate time given to fitness. As an investment, the individual sacrifices time and other resources to acquire a future healthy weight to become more productive and, thus, earn higher wages.

Besides the human capital inputs an individual acquires for increased earnings, the parental socioeconomic characteristics may present the person with crucial human capital investments towards weight control. Parents of higher socioeconomic status should be able to maximize utility subject to a higher money income constraint and provide better health inputs for their children. In many ways, health is a human capital investment derived from parental traits that can bring about additional benefits for the child. Thus, human capital in the form of a healthy weight outcome for the individual also depends on the socioeconomic traits of others. Ronald Ehrenberg and Robert Smith (2005 p. 277) state that, "Parental resources and

guidance...help to influence...general health and life expectancy..." considerations of the child. The lifestyle and economic situation of an individual's family at childhood helps to form the basis of his or her attitudes and behavior towards obesity. As such, the human capital accumulation of the parents, which can be represented by their socioeconomic standing and education, can directly influence the future weight status of the individual.

The findings from previous literature suggest many interesting correlations between the socioeconomic factors I will use in my study and poor dietary conditions, such as obesity. Again, because this type of empirical research is not as well recorded in the economic literature, I consider the results of other fields such as health and physical science to address my research problem. First, numerous studies consider the impact of income on multiple levels of dietary characteristics. Karen Morgan (1986) finds through her research of various authors that income has a significant impact on food expenditure. However, its effect on nutritional status, though significant, is not as strongly supported due to the different types of proxies used for the dependent variable. Subsequently, Lisa Mancino, Biing-Hwan Lin, and Nicole Ballenger (2004 p. 10), in a study observing the effect of individual attitudes on obesity, find that, "income had the strongest positive marginal impact on diet quality."

Another explanatory variable, educational attainment, presents interesting findings. Carleton Davis (1982 p. 1022) determines that, "the general education level of the homemaker was found to have a positively significant impact on food expenditures as well as nutritional status." Furthermore, Mancino, Lin, and Ballenger (2004 p. 10) state from their results that, "Men and women with a college education eat a higher quality diet." By applying these results to human capital investments, I can develop hypotheses to explain how parent's educational attainment influences their children's future obesity

measure.

Alongside these empirical tests on socioeconomic background and future obesity/weight, there are further studies that document the correlation between weight outcomes and current wages or salaries. In a study to determine the impact of male obesity on earnings, Robert McLean and Marilyn Moon (1980) utilize the National Longitudinal Survey of Youth (NLSY) to find that obese individuals achieve a 33-cent premium in hourly wages for being overweight. These results contradict with contemporary theories of human capital inputs and income. However, the exclusion of mature women and their dichotomous weight variables place limitations on their findings. From a similar obesity-earnings analysis by gender, Charles Baum and William Ford (2004) find that obesity decreases male wages by 3.2 percent and female wages by 5.8 percent. This is an interesting result because it suggests that although obesity has a negative impact on earnings it is twice as great for women than for men. Finally, John Cawley (2004) studies the effect of obesity on wages amongst different gender and racial groups and finds that white females alone experience a decline in wages from higher weight outcomes. In his conclusion, he states that for white women, “OLS estimates indicate that a difference in weight of... [roughly 65 pounds] is associated with a difference in wages of 9 percent” (p. 468). Although this paper focuses more on the effect of gender and racial obesity on earnings, it provides evidence that weight outcomes are significant when it comes to an individual’s perceived productivity and current earnings.

All of these studies examine either the impact of socioeconomic background upon present obesity or the correlation between this obesity status and current earnings. The correlated link between socioeconomic background and current earnings is an area lacking sufficient economic research. For this reason, my model builds on the previous literature by jointly analyzing these relationships

using the most recent longitudinal data.

From the human capital theory and previous literature, this research paper submits the following hypotheses for empirical analysis:

1. A favorable socioeconomic background will result in a less obese and a more healthy weight outcome for the individual.
2. If an individual is obese, then he or she will experience a decrease in productivity and earn lower current wages or salaries.

### **III. Data**

The data for this research comes from the recent edition of the National Longitudinal Survey of Youth, or NLSY (Bureau of Labor Statistics). This dataset records information gathered from 12,676 individuals surveyed annually from 1979 to 2002, with the last few years recorded on an every other year basis. My sample will consist of a representative group of 6,111 individuals. In the year 1979, these respondents fall into an age range of 14-21 years. Many of these young adults were still partially dependent on their parent’s income. At these ages, the NLSY provides information on the respondent’s family demographic and socioeconomic background. Subsequently, individuals are between 20-27 years of age in 1985. I use this year as a proxy for the respondent’s career attainment. Although some people may still be in college or seeking further graduate education, the year 1985 adequately represents these individuals’ primary interaction with the career labor market. In 2002, the respondents reach middle age within a range of 37-44 years old. This year reflects current labor market conditions for the individual due to promotion, job change, and/or unemployment. By documenting responses to all types of questions in these years, I will be able to examine the socioeconomic changes to the individual over the course of their lives.

Within the NLSY data extraction, I limit the sample identification code to those in the representative sample. In this way, I avoid

the over sampling of minority groups and individuals in the military to streamline the data for ordinary least squares (OLS) analysis. Additionally, this sample allows for respondent dropouts that may occur due to death or non-participation throughout the survey years. The system labels these “missing values” with a -5 and eliminates the respective respondent as to not skew statistical results. As such, my sample size will decrease over time depending on the number of individuals that do not participate or answer certain questions. Nevertheless, the number of observations in this study are great enough to overcome this “missing values” deficiency. Finally, the NLSY takes the form of a questionnaire, in which it asks questions directly to the individual to obtain its extensive database. Because the NLSY takes this format, it opens itself up to some bias from respondent estimations and dishonesty in the reporting of information. Although bias exists due to the questionnaire format of the NLSY, most respondents make a faithful effort and attempt to provide an accurate figure. For these reasons, the NLSY is the most appropriate dataset for my research.

The obesity measure for this study is the Body Mass Index (BMI). It characterizes a normal weight given an individual’s height. This dataset includes information on each person’s height and weight. Because a person’s height does not change much after adolescence, the NLSY’s most recent question of the respondent’s height in inches came in 1985 when 14-year-old individuals in 1979 would be 20 years old. On the other hand, the NLSY records the self-reported weight of the respondent in 1981, 1982, 1985, 1986, 1988, 1989, 1990, 1992, 1993, 1994, 1996, 1998, 2000, and 2002. For the purposes of this study, I utilize the respondent weight in pounds documented in 1985 and 2002 to formulate two models attempting to predict total earnings in the respective year. To calculate BMI, I take the ratio of weight (converted to kilograms) to height squared (converted to

meters). Following World Health Organization weight classifications, BMIs between 18.5 and 25 reflect a healthy weight, BMIs between 25 and 30 reflect an overweight respondent, and BMIs over 30 reflect an obese respondent (Mancino, Lin, and Ballenger, 2004). In Model 1, BMI is the dependent variable. By excluding BMI less than 18.5, I am able to express a rise in BMI as a negative weight change for the individual. Next, I create an explanatory “dummy variable” for obesity for both 1985 and 2002 in Model 2. The variable is “1” for individuals with BMIs more than 30, while “0” for all other BMIs. Additionally, I formulate a second dummy variable for the unhealthy weight outcome of being underweight. The variable is “1” for individuals with BMIs less than 18.5 and “0” for all other BMIs. Each of these measures properly categorizes disparities in weight outcomes for my empirical models.

Additionally, the NLSY database includes information on total respondent U.S. dollar income from wages and salary in the past calendar year. For the study, I acquire this variable for 1985 and 2002 by approximating earnings figures reported in the 1986 and in the past calendar year of 2001, respectively. Unlike some previous studies, I examine total yearly income from earnings apart from hourly earnings. Nonetheless, this distinction will not throw off my results. The variable still includes the potential for obese workers to have difficulty working full-time by displaying a decrease in total earnings income from missed or part-time work. However, this variable reports individuals with zero earnings. During the year, these individuals are not employed and do not earn wages or salaries. I exclude respondents with zero earnings so as to eliminate unemployment from the model and focus entirely on working individuals. In order to precisely assess my model, I also convert all monetary figures into 2002 dollars. As is the case, I take the 2002 Consumer Price Index (CPI) over the 1985 CPI base year and multiply this ratio by 1985

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total earnings to attain 1985 figures in 2002 dollars. To obtain this measure, interviewers ask respondents to self-report their current wages or salaries. Despite the possibility of false reports and mere estimates of this figure, these wages or salaries are the best approximation of current earnings. I will apply these U.S. dollar measurements in 1985 and 2002 as the dependent variables in model 2 and the ultimate result of human capital accumulation in the form of a healthy weight outcome. Moreover, the NLSY offers two important familial socioeconomic background variables for my research. First, the dataset includes a measurement of parental socioeconomic status in the form of total net family income in 1979. This figure takes the income earned from the respondent's family while between the age of 14 and 20. The dollar amounts in the NLSY range from \$0 to \$50,000 or more annually per family. Due to the effect of inflation in the 1970s, I once more use the annual CPI to transform 1979 total family incomes into 2002 dollars. Besides limiting the effects of inflation, this alteration allows for results that are more comparable across years. Second, the dataset supplies a variable denoting

the respondent mother's educational attainment. For this variable, the interviewer notes the highest grade completed by the respondent's mother in a range from 0 to 20. In the dataset,

Table 1-Descriptive Statistics

Variable	Definition	
<b>Dependent Variables</b>		
Body Mass Index (BMI)	BMI=Weight [kg]/(Height [m]) <sup>2</sup> [1]	
Total Income -Wages and Salaries (WAGE)	Income from wages and salaries during the past calendar year. [2]	
<b>Main Explanatory Variables</b>		
Mother's Education (MOMED)	# of years of education. [1]	(-)
Total Net Family Income (FAMINC)	Total Income earned from family in U.S. dollars. [1]	(-)
Obese (OBESE)	Obese=1: If BMI>30 [2]	
Underweight (UNDERWEIGHT)	Underweight=1: If BMI<18.5 [2]	
<b>Secondary Explanatory Variables</b>		
Area of Residence at 14-Urban/Rural (RES)	Urban=1 Rural=0 [1]	(-)
Female (GENDER)	Female=1 Male=0 [1/2]	(-)
Black/Hispanic (RACE)	Black: 1=Black; 0=Other Hispanic: 1=Hispanic; 0=Other [1/2]	(+ [1]/-[2])
Highest Grade Completed (EDUC)	# in years of individual's education [2]	(+)
Occupation at Current/Recent Job (OCPT)	1-if OCPT from 1-580 0-if OCPT from 581-984 [2]	(-)
Area of Residence-Urban/Rural (URBAN)	Urban=1 Rural=0 [2]	(+)
Region of Residence (REGION)	East: 1=East; 0=Other Midwest: 1=Midwest; 0=Other West: 1=West; 0=Other [2]	(+) (-) (-)

- [#]: The model in which the variable is found.

-- (NAME)-The abbreviated NAME for each variable 0 indicates no education, while 20 indicates eight years of college or more.

-EX. (EDUC) = Highest Grade Completed

The mother's education is utilized because she usually makes food decisions for the family and largely influences its food spending patterns. Generally, these two explanatory variables are the main components of Model 1 used to predict respondent's present body mass index. For the definitions of the variables in my models, refer to

Table 1.

**IV. Empirical Model**

For my empirical model, I will use two ordinary least squares (OLS) regressions as follows:

MODEL #1

$$BMI = \beta_1 + \beta_2 FAMINC + \beta_3 MOMED + \beta_4 GENDER + \beta_5 RACE + \beta_6 RES + u_t$$

MODEL #2

$$WAGE_{it} = \beta_1 + \beta_2 OBESE_{it} + \beta_3 UNDERWEIGHT_{it} + \beta_4 EDUC_{it} + \beta_5 OCPT_{it} + \beta_6 GENDER_{it} + \beta_7 RACE_{it} + \beta_8 URBAN_{it} + \beta_9 REGION_{it} + u_t$$

Where i represents the individual respondent and t represents a given year [1985 or 2002].

I will seek to explain the above variables in more detail in this section. In model 1, the dependent variable is Body Mass Index (BMI) with explanatory variables of total net family income (FAMINC), mother’s education (MOMED), gender (GENDER), race (RACE), and residence (RES). The final three variables are used as controls in the first model.

First, gender (GENDER) is a dummy variable with 0 as male and 1 as female. As the literature examines gender, the findings suggest that women maintain better dietary standards than men. Men have faster metabolisms than women at youth and are not told to control their caloric intake as often as women (Mancino, Lin, and Ballenger, 2004). Consequently, men are more likely to eat unhealthy, fatty foods and struggle to obtain healthy weight outcomes. As such, being a woman should have a negative effect on BMI. Next, race (RACE) is broken down into 3 choices: hispanic, black, and non-black, non-hispanic. For my model, I create two “dummy variables”. The first variable has a “1” for black individuals and “0” for the two other categories. The second variable has a “1” for Hispanic respondents and “0” for the two other categories. It is suggested that both Hispanic

and black respondents, because of their minority status and discrimination in the labor market, find it difficult to afford the healthy options offered to Caucasian consumers. Thus, minorities can develop unhealthy eating patterns that can cause a variation in BMI.

Finally, the NLSY measures residence (RES) with 1 as town or city, 2 as country-not farm, and 3 as farm or ranch. Once more, I generate a dummy variable entitled URBAN. The variable is “1” for town or city and “0” for the other two selections, which represent rural areas. The access to food and the types of food offered in different areas of residence can play an integral role in the level of individual obesity. The congestion of a municipality often implies foods of poor nutritional content, while rural regions seem to offer fresher and healthier items (Adrian and Daniel 1976). As such, these controls will allow me to examine the sole effects of total family net income (FAMINC) and mother’s educational attainment (MOMED) on the individual’s BMI.

With regards to Model 2, I attempt to study the correlation between the dependent variable total income from wages and salaries in 1985 and 2002 (WAGES) with obesity (OBESE), highest grade completed by respondent (EDUC), occupation (OCPT), gender (GENDER), race (RACE), degree of urbanization (URBAN), and region (REGION). The key variable of study in this model is the dummy variable of OBESE, indicating whether an individual has an unhealthy weight outcome measure. All the other variables represent additional human capital or demographic elements that determine current earnings. Thus, I attempt to control for these factors in order to determine the sole human capital effect of obesity on wage levels.

In both years, there are important human capital variables to consider which may cause a variation in total earnings. These include the education (EDUC) and experience (OCPT) of the respondent. First, I obtain the respondent’s educational attainment measure



through the highest grade completed on May 1st of the survey year (EDUC). An increase in an individual's level of education results in an increase in the individual's human capital accumulation (Ehrenberg and Smith, 2005). This makes the respondent appear more productive and earn higher wages or salaries than less educated persons. Furthermore, the respondent's occupation (OCPT) is an element that an individual reports directly to the questionnaire. Then, the questionnaire proceeds to categorize the occupation into a type of career. The NLSY lists 984 types of occupations with professional/management careers between 1 and 580 and service/laborer careers between 581 and 984. As it takes more experience to become a business leader or acquire a management position, holding these types of jobs would seem to require a large amount of human capital. Thus, these occupations will pay out higher earnings than the service/laborer sectors. Because of this fact, I create a dummy variable in both years with "1" standing for jobs from 1 to 575 and "0" for jobs from 575 onward.

Besides economic factors, other demographic and respondent characteristics can cause a variation in current earnings for wage or salaries. Principally, gender (GENDER) takes the value of 0 for male and 1 for female. Despite attempted improvements for women in the workplace, women still earn significantly less than men and are barred from the highest paying occupations. Therefore, it is expected that being a women compared to a man significantly decreases the respondent's current amount of earnings. Similar to Model 1, race (RACE) consists of black and hispanic dummy variables. Again, being a member of a minority group can limit one's entry into some of the highest paying careers either because of discrimination or pressure to conform to a particular industry.

Finally, the degree of urbanization (URBAN) measures 0 for rural and 1 for urban, while region (REGION) places a 1 for northeast, 2 for north central, 3 for south, and 4 for west.

Furthermore, I divide region into dummy variables for EAST, MIDWEST, and WEST. I exclude SOUTH as to make it the region of study in my research. Often, highly urbanized areas such as large cities and towns have very different labor markets when compared to rural areas. Although urban centers have competitive and constricting labor markets, they are also the business centers that contain the highest paying jobs. Likewise, the region where the respondent lives can determine the extent of the labor market. There is a larger percentage of the population in the North than in the South. Because of the large population, I expect to see an increase in labor demanded to keep up with the needs of the larger number of consumers in these regions. Thus, these jobs in the North

Table 2 - Summary Statistics

Variables	Mean	Standard Deviation
<b>Dependent Variables</b>		
Body Mass Index (BMI)	27.7 (2002)	5.88 (2002)
Total Income-Wages & Salaries (WAGE)	14,600 (1985) 36,400 (2002)	14,300 (1985) 42,200 (2002)

- [Letter]: Variable Name  
 -EX. [O] =Obesity  
 -- (YEAR): Period of study.

should offer higher wages or salaries than in the South. All these variables are important to my research and help me to develop an organized and efficient research design to study weight outcomes as a human capital input. See Table 2 for summary statistics of the variables in my models.

## V. Results

This research on the correlations between family socioeconomic factors, obesity, and earnings generates mixed results. In Model 1A, I regress Body Mass Index (BMI) against FAMINC and MOMED. Both variables have the correct sign and are highly significant at the one percent level. Furthermore, the variable coefficient helps to predict each variable's impact on 2002 Body Mass Index. For instance,

Table 2 - Summary Statistics

Variables	Mean	Stdev.
<b>Main Explanatory Variables</b>		
Mother's Education (MOMED)	11.5 (1979)	2.76 (1979)
Total Net Family Income (FAMINC)	53,400 (1979)	34,700 (1979)
Obese (OBESE)	.0676 [O] .0427 [U] (1985)	.251 [O] .202 [U] (1985)
Underweight (UNDERWEIGHT)	.2098 [O] .0082 [U] (2002)	.407 [O] .090 [U] (2002)
<b>Secondary Explanatory Variables</b>		
Area of Residence at 14- Urban/Rural (RES)	0.77 (1979)	0.423 (1979)
Female (GENDER)	0.51	0.5
Black/Hispanic (RACE)	.12 [B] .07 [H]	.328 [B] .260 [H]
Highest Grade Completed (EDUC)	12.72 (1985) 13.46 (2002)	2.14 (1985) 2.53 (2002)
Occupation at Current / Recent Job (OCPT)	0.38 (1985) 0.3 (2002)	0.486 (1985) 0.459 (2002)
Area of Residence - Urban/Rural (URBAN)	0.67 (1985) 0.52 (2002)	0.47 (1985) 0.5 (2002)
Region of Residence (REGION)	.18 [E] .27 [M] .17 [W] (1985) .13 [E] .23 [M] .13 [W] (2002)	.384 [E] .443 [M] .375 [W] (1985) .333 [E] .420 [M] .338 [W] (2002)

- [Letter]: Variable Name  
 -EX. [O] =Obesity  
 -- (YEAR): Period of study.

a one-dollar increase in respondent's total family income decreases the BMI measure by .0001, while a one-grade increase in mother's education decreases BMI by .184. These findings support my hypothesis that a more favorable parental socioeconomic background will result in a less obese and a more healthy weight outcome for the individual. The problem lies in that Model 1A is

not very good at predicting respondent's current Body Mass Index. With an adjusted R-squared of 0.016, these two parental socioeconomic variables account for merely 1.6 percent of the variation in 2002 BMI. Due to this small adjusted R-squared, it must be the case that other factors influence changes in an individual's weight status.

For a better prediction of the differences in a person's weight condition, Model 1B regresses BMI against the two parental socioeconomic variables and additional control variables. All of the variables, except for FAMINC, show the expected signs. Three variables (MOMED, GENDER, and RACE/BLACK) are highly significant at the one percent level, while RES is significant at the five percent level. Primarily, the mother's education (MOMED) has a coefficient of -.161. This means that a one-unit increase in a mother's years of education causes a decrease in the respondent's future BMI by .161. Out of the two central explanatory variables, mother's education has the largest absolute value t-statistic. The other main explanatory variable, total family income, is insignificant and does not have the expected sign. This poor result for FAMINC may be due to the high correlation between total family income and mother's education. With a separate bi-variate correlation, I find that these two variables are significantly correlated at the one percent level. In this case, the mother's education variable might already be including the effect of total family income on the change in BMI. Nevertheless, this finding agrees with the large significance found by both Davis (2003) and Mancino, Lin, and Ballenger (2004) of the mother's general knowledge on the child's nutritional status and, thus, weight outcome.

Besides these core independent variables in Model 1B, the variables gender and black demonstrate robust and significant coefficients and t-statistics. On the whole, being female decreases the BMI measure by .828, while being black increases the BMI measure by 1.75. Black is the most significant variable

with an absolute t-statistic of 5.366. Again, this variable may be capturing the average lower socioeconomic conditions found amongst black families. Overall, the model has an adjusted R-squared value of 0.031. Although this adjusted R-squared is slightly better than in Model 1A, these explanatory variables still explain only 3.1 percent of the variation in BMI. This small R-

Table 3 – Regression Results: Dependent Variable=2002 BMI

Variable (1979)	Model 1A	Model 1B
CONSTANT	30.5	30.6
FAMINC	-0.0000110*** (-3.34)	0.00000609 (-1.803)
MOMED	-0.184*** (-4.49)	-0.161*** (-3.73)
GENDER	-----	-0.829*** (-4.02)
BLACK	-----	1.75*** -5.37
HISPANIC	-----	0.827 -1.93
RES	-----	-0.654* (-2.65)
N	2,972	2,972
Adjusted R <sup>2</sup>	0.016	0.031

-\* indicates significance at the 10% level

-\*\* indicates significance at the 5% level

-\*\*\* indicates significance at the 1% level

-- Values in parentheses are t-statistics

squared implies that there are even further factors that characterize the alteration in an individual's BMI. To improve this value, it may be beneficial to include other important familial demographic variables such as family size and parental marital status, as well as a variable that more accurately reflects the health knowledge of the mother. For further regression results of Model 1, see Table 3.

Unlike Model 1, the findings for the relationship between obesity and earnings in Model 2 are more convoluted and difficult to interpret. With Model 2A, the linear regression takes 1985 WAGE and regresses it against the OBESE and UNDERWEIGHT independent variables for the year. First, Model 2A has an adjusted R-squared of 0.002. In this way, the model does not explain much of the variance in 1985 WAGE. Surprisingly, the variable OBESE is insignificant and has a positive coefficient. Although this positive coefficient goes against

theory, it does agree with the wage premiums observed for obese individuals by McLean and Moon (1980) in their NLSY hourly wage/obesity study. Next, the UNDERWEIGHT dummy variable has a negative sign for its coefficient and is significant at the one percent level. The coefficient suggests that an individual who is underweight and, therefore, has an unhealthy weight outcome, experiences a \$3,400 decline in total wages or salaries earned in 1985.

Overall, Model 2A shows that obesity does not result in a loss of total wages or salaries for the year. This result may be because of the limited sample of obese individuals in 1985. In this regard, most respondents fell into a normal weight category so that employers did not factor into their wage or salary decisions the weight outcome of the employee. Moreover, because respondents in this period are young and just entering the job market, they may be able to overcome an unhealthy weight condition and earn the same or more than an individual with a normal weight index.

As a correlated equation to Model 2A, Model 2B is a simple linear regression that takes 2002 WAGE and regresses it against OBESE and UNDERWEIGHT explanatory variables for the year. This model presents a trivial improvement over the 1985 model in explaining the variation in total earnings. With an adjusted R-squared of .004, Model 2B describes 0.4 percent of the disparity in 2002 WAGE. Despite its poor ability to understand changes in total earnings, the model's specific results support my hypothesis that an obese individual observes a decline in total income from wages or salaries. In this model, OBESE and UNDERWEIGHT have negative coefficients. Yet, UNDERWEIGHT is now insignificant, whereas OBESE is statistically significant at the one percent level. By interpreting the coefficient, a respondent experiences a loss of \$6,000 in total earnings from being obese in 2002.

Generally, Model 2B demonstrates that obesity does effect an individual's total income

from earnings in 2002. Because of the large number of obese individuals in 2002, the positive results for this model may be caused by something different than I expected. We can assume that as a person ages it becomes more difficult to maintain a normal weight. Thus, an employed individual in this unhealthy condition will probably not be able to work as many hours and obtain as much income from earnings as an individual that has put in the effort to keep a normal body weight at their age. Therefore, the human capital investment of maintaining a normal weight may not be as important for an employer in their decision to offer wage or salary discounts. In other words, a normal weight might be more important as an investment in a health quality that allows an individual to keep working and acquire higher total earnings. For regression results for Model 2A and 2B, please refer to Table 4.

Before formulating any conclusions on the relationship between unhealthy weight situations, it is important to include any other factors in the models that may have an effect on total wage or salary disparities. Model 2C and Model 2D present linear regressions using the same two weight conditions OBESE and UNDERWEIGHT, along with secondary control variables, to predict WAGE in 1985 and 2002, respectively. In this instance, Model 2D for 2002 has a much larger adjusted R-squared at 0.246 than Model 2C for 1985 at 0.103. As such, the variables included in Model 2D explain 24.6 percent of the disparities amongst respondents' total incomes from wages or salaries in 2002, while Model 2C predicts 10.3 percent of the variation in total incomes from wages or salaries in 1985. In this way, the year 2002 observes a 14.3 percentage point improvement over 1985 in explaining the variation in total income from wages and salaries.

Along with explaining the percentage variation in total income from wages or salaries for each year, Model 2C and Model 2D study the impact of weight outcomes on earnings.

In Model 2C, OBESE and UNDERWEIGHT have the same signs as Model 2A, but both are insignificant. Consequently, neither being obese nor underweight factor into wage or salary differentials in 1985. On the other hand, although OBESE and UNDERWEIGHT have the same signs as Model 2C, Model 2D confirms that OBESE is significant at the five percent level in 2002. According to Model 2D, a person faced with obesity will earn \$2,800 less than a healthy individual in 2002. This evidence seems to suggest the possibility that a healthy bodyweight has become more important over time for the continued productivity of the individual. This result, although not expressly determining obesity's impact on wage premiums or discounts, agrees in part with the recent findings of Baum and Ford (2004) and Cawley (2004) that obesity decreases the productivity of an individual and leads to negative earnings potential.

In addition to the main weight categories, six supplementary variables including EDUC, OCPT, GENDER, BLACK, HISPANIC, and URBAN have the appropriate signs and are significant at the one percent level in both 1985 and 2002. In Model 2C, occupation and gender have the highest absolute value t-statistics of 9.6 and 18.8, respectively, in 1985. If the respondent holds a white-collar, professional job, his/her total income from wages and salaries increases by \$4,200. With Model 2D, education and gender have the largest absolute value t-statistics of 19.2 and 21.7, respectively, in 2002. In the case of education, a one-year increase in educational attainment yields a \$5200 increase in total income earned from wages or salaries. This finding matches with Ehrenberg and Smith (2005) in their discussion of the human capital theory in that higher wages are obtained by those individuals with greater educational attainment.

In regards to gender, being a female worker, *ceteris paribus*, will decrease total income from wages and salaries by \$7,600 in 1985. Subsequently, being female produces a decline in total earnings by \$26,000 in 2002 as shown

from Model 2D. This agrees with the literature because women have historically found it hard to enter into the high-paying positions of the business world due to male employers observing women as unreliable from their expected shorter working lives (Ehrenberg and Smith, 2005). However, it is surprising that such a large difference exists between wages or salaries earned from 1985 to 2002. One possible explanation may be that women, because of their expected shorter working lives and loss of upward mobility in high-paying careers, fulfill the stereotype by dropping out of the labor force or working part-time. By working part-time, the female individual does not work as many hours and earns considerably less than males in later years of life.

After observing the gender variable, I find that BLACK has a negative coefficient and a large significance in both models. In Model 2C, an individual experiences a \$3,400 decline in total income from wages and salaries from being black. For Model 2D, a person suffers a \$9,400 decline in total earnings from being black. This is substantially higher than the coefficient in 1985. Furthermore, it is unexpected given the rise in affirmative action programs, which have provided better entrance into higher-paying careers for African-American workers. With HISPANIC, there is the expected negative coefficient. A potential assumption that can account for this development may be the widening income inequality between minority and majority groups that has arisen in the last 10 years. However, the variable goes from being statistically significant in 1985 to insignificant in 2002. A possible explanation for this occurrence may be the small sample size of Hispanic persons. It may be beneficial to include a larger bias sampling of minority groups. Nonetheless, it will be important to examine the issue of race more closely in future earnings studies.

The other variables in this study include urban (URBAN) and the three region “dummy variables” (REGION). As predicted, living in an

urban area will cause an increase in a person’s total income from wages or salaries. In the urban areas, there is a higher level of professional occupations than in the rural sections of the country. As a result, Model 2C shows that residing in an urban sector, *ceteris paribus*, increases total earnings by \$1,900. Furthermore, the recent year of 2002 as expressed in Model 2D finds that living in an urban area increases total earnings by \$4,000. However, it is important to note that there is a correlation between occupation and degree of urbanization, which may skew the results of the URBAN variable because it is partly being captured by the more encompassing occupation of the respondent. We can assume that the higher wages and salaries offered in cities can be a result of more high-paying, professional jobs in the area.

In a similar fashion, occupation has the same effect on region. Certain regions of the country offer more management and professional careers than others. For instance, the Northeast has a larger number of metropolitan areas than the South and the West. In addition, the cities in the Northeast are much larger in size and population than other regions. Consequently, because of the quantity and size of the cities, there are higher paying professional occupations in the region. Potentially because of this correlation with other variables, REGION displays muddled findings. Model 2C agrees with the theory in that EAST has a positive coefficient, while MIDWEST and WEST have negative coefficients. There are two statistically significant region variables. EAST is statistically significant at the five percent level, while MIDWEST is statistically significant at the ten percent level. For 2002, Model 2D finds that EAST is once more significant at the five percent level, but MIDWEST is also significant at the five percent level. In both models, WEST is statistically insignificant and switched from a negative to a positive sign. Again, the correlation between the urban, region, and occupation variables makes these results less than appealing. To reference these regression results for Model

2C and 2D, see Table 4.

and earn greater income from wages or salaries. Nevertheless, this is not to say that obesity causes a decline in a person's current wage or

Table 4: Regression Results: Dependent Variable=WAGES (1985/2002)

Variable	Model 2A (1985)	Model2B (2002)	Model2C (1985)	Model2D (2002)
CONSTANT	17,462.80	44,458.80	11,105.60	-20,265.40
OBESE	306.8 -0.377	-6,059.0*** (-3.93)	1,272.50 -1.64	-2,836.3** (-2.09)
UNDERWEIGHT	-3,404.5*** (-3.48)	-13,296.2* (-1.70)	-1,514.90 (-1.62)	-3,755.50 (-1.551)
EDUC	-----	-----	556.3*** -5.5	5,220.3*** -19.2
OCPT	-----	-----	4,166.7*** -9.56	10,960.9*** -8.08
GENDER	-----	-----	-7,589.9*** (-18.8)	-26,003.9*** (-21.7)
BLACK	-----	-----	-3,393.4*** (-5.39)	-9,371.8*** (-4.72)
HISPANIC	-----	-----	-2,232.5*** (-2.85)	-1,179.70 (-1.472)
URBAN	-----	-----	1,905.6*** -4.24	4,032.7*** -3.09
EAST	-----	-----	1,265.9** -2.27	3,591.3** -1.97
MIDWEST	-----	-----	-1,171.5** (-2.36)	-2,576.3* (-1.72)
WEST	-----	-----	162.9 -0.282	-2,147.10 (-1.18)
N	4,800	3,875	4,788	3,875
Adjusted R <sup>2</sup>	0.002	0.004	0.103	0.246

-\* indicates significance at the 10% level  
 -\*\* indicates significance at the 5% level  
 -\*\*\* indicates significance at the 1% level  
 =- Values in parentheses are t-statistics

## VI. Conclusion

The results of this study show that obesity, or an unhealthy weight outcome, leads to a decrease in productivity and, thus, current earnings as an older individual in 2002. From a lack of a human capital investment in one's health, obesity can be detrimental to an individual's ability to work

salary rate, but that it decreases total earnings from a person's inability to work. In that regard, the poor choice in WAGE variable does not allow me to adequately test whether obesity leads to a decline in the current wage or salary offered to the individual. Moreover, other human capital variables such as education and occupation play a larger role in determining differences in earnings. Various social demographic variables including gender, race, and degree of urbanization are also important to the attainment of higher total earnings.

Despite these complex results for obesity and current earnings, the study agrees with my hypothesis that favorable parental socioeconomic traits decrease the probability that an individual will be obese, or have an unhealthy weight outcome, in the future. Both total family income and mother's education, without controlling for other factors, are statistically significant when it comes to describing the variation in body mass index measure. However, when controlling for additional factors, the strong correlation between the two variables suggests that mother's education captures the effects of total family income and is more important in decreasing the likelihood of obesity in the future for the individual.

As the research problem proposed, it is useful to understand what, if any, socioeconomic background characteristics drove an individual towards an unhealthy weight status. Even though total family income is found to be insignificant when factoring in additional variables, the favorable socioeconomic condition of parental

education does produce a relevant finding. I find that a one-year increase in a mother's education lessens the BMI figure for the adult respondent by .184. This may appear to be a minimal factor, but it illustrates that, with the inclusion of a variable observing the mother's dietary knowledge, the model might improve in its predictive power of obesity through the body mass index.

It is difficult to observe any direct policy implications that can be applied to the results since this study documents a correlation between obesity, socioeconomic background, and current earnings. The paper does reaffirm the importance of human capital accumulation to expected increased total earnings through the coefficients of obese, education and occupation. In 2002, an obese individual, *ceteris paribus*, experiences a decline in total income from wages or salaries of \$2,800. Furthermore, a one-year increase in educational attainment yields a \$600 and \$5,200 improvement in total earnings in 1985 and 2002, respectively. In regards to occupation, as a proxy for experience, an individual employed in a white-collar, management position encounters a \$4,200 increase in total earnings for 1985 and an \$11,000 increase in total earnings for 2002.

From these results, I have come across some areas for future research. First, it may be more appropriate to use an earnings variable such as hourly wages to study whether individuals experience earnings discounts for having an unhealthy weight condition such as obesity. From the inclusion of this dependent variable, hourly wages may better predict the loss of current wage or salary levels without factoring in the inability of an obese person to work full-time and earn greater earnings. Additionally, this study observes the cumulative effect of obesity on total earnings. It looks at a small sample of all types of individuals. An interesting sector of focus may be to examine the effect of obesity on distinct occupations. For example, I can conceive of certain manual labor positions and other human service careers considering employee health

conditions essential to the productivity of the business. Therefore, it would be interesting to test whether salary or wage discrimination occurs on the part of the employer when an individual does not have a healthy weight or is considered by society to be obese. Perhaps with this more detailed economic investigation, obesity can be shown to have a more significant impact on certain industry wage structures. With the country facing rising health problems concerning obesity, it is relevant to establish the causes and labor market results of this serious health condition. Regardless, I believe this economic research effectively examines a pertinent issue within American society.

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