6-2014

The Economic Causes and Consequences of Overweight and Obesity in the United States

David Alan Lempert
Graduate Center, City University of New York

THE ECONOMIC CAUSES AND CONSEQUENCES OF OVERWEIGHT AND OBESITY IN THE UNITED STATES

by

DAVID LEMPERT

A dissertation submitted to the Graduate Faculty in Economics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2014

This manuscript has been read and accepted by the
PhD Program in Economics in satisfaction of the
dissertation requirement for the degree of Doctor of Philosophy.

Professor David A. Jaeger

Date

Chair of Examining Committee

Professor Merih Uctum

Date

Executive Officer

Professor David A. Jaeger

Professor Michael Grossman

Professor Inas R. Kelly

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

Abstract

THE ECONOMIC CAUSES AND CONSEQUENCES OF OVERWEIGHT AND OBESITY IN THE UNITED STATES

by

David Lempert

Advisor: Professor David A. Jaeger

Obesity is a serious public health issue, associated with increased risks of premature death, heart disease, diabetes, cancer, breathing problems, arthritis, reproductive complications, and other diseases. There are economic causes and consequences of overweight and obesity. Researchers have recently suggested that the inability of Body Mass Index to appropriately distinguish between body fat and non-body fat components may lead to inaccurate results when analyzing the economics of obesity. I use Percentage Body Fat, defined as Body Fat divided by the sum of Fat-Free Mass and Body Fat, as the primary measure of body composition.

A growing body of literature explores the relationship between body composition and income in the United States. There are two views: (1) overweight and obesity lead to lower wages; and (2) low family income and low wages contribute to overweight and obesity. I study both relationships using a dataset comprised of the most recent years of data available in the National Longitudinal Survey of Youth 1979.

I find relatively larger effects of body composition on wage levels in *Not Worth the Weight: The Relationship between Body Composition and Wages,* and relatively smaller effects of family income on body composition in *Poor Choices: The Effects of Family Income on Body Composition*. In *Not Worth the Weight*, I hypothesize that the negative impact of body composition increases at higher wage levels because the associated positions require additional education and perhaps a slimmer figure. The results show that for women, the effects of body composition on wage levels are larger than for men, and a higher wage level is associated with a higher wage penalty for being overweight. *Poor Choices* is unable to prove that low family income has a significantly large impact on body composition.

In *The Heavy Cost of Healthcare: The Ex Ante Moral Hazard Effect of Health Insurance Possession on Body Composition*, I use the National Longitudinal Survey of Youth 1979, augmented with state-level food and tobacco prices, in an attempt to prove there is ex ante moral hazard associated with the possession of health insurance such that the insured are more likely to be overweight or obese. I hypothesize that the effect is larger when an individual is covered by government health insurance and smaller when the individual is covered by private insurance. The analysis shows that the ex ante moral hazard effect is larger when Medicaid covers the individual. When I control for individual fixed effects as well as endogeneity, however, results are insignificant. Thus it is inconclusive whether insurance has an impact on body composition. I conclude with suggestions for future research and effective policies to combat the public health epidemic of overweight and obesity.

Acknowledgements

I would like to thank my dissertation advisor, Professor David Jaeger. He has taught me a great deal about econometrics, labor economics, and research through his teaching and his advising. Distinguished Professor Michael Grossman, the founding father of the demand for health model, has demonstrated the importance of developing interesting research questions from both a solid theoretical framework of microeconomics, and critical, intuitive thinking. Professor Inas R. Kelly introduced me to theory and literature of the health economics field, and has provided me many valuable resources, including data sources and computer programs.

Professor Merih Uctum, Executive Officer, has been enthusiastically supportive of me throughout my years in the program. Finally, I would like to thank Professor Thom Thurston, former Executive Officer, who took a risk by accepting me into the program on a part-time basis in the Fall of 2008. Thank you to Diana Santiago, Assistant Program Officer, for her exceptional assistance in administrative matters, and for adding an energetic spirit to the department. You have all made my education at the Graduate Center a tremendous learning experience.

On a personal note, I gratefully acknowledge my parents Carolyn and Eugene Lempert for supporting me in this endeavor and in my life, and for providing the titles of the sections of this dissertation. My sister, Michelle, has provided comic relief and inspiration. My family, friends, and colleagues, both inside and outside the Graduate Center, have also been very supportive.

Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter 1

Introduction

Overweight and obesity have become serious public health concerns in the United States. These levels of body composition increase the risks of premature death, heart disease, diabetes, cancer, breathing problems, arthritis, reproductive complications, and other diseases (U.S. Dept. of HHS, 2001). Cawley (2010) estimated that the average impact of obesity on annual medical costs for men and women was $2,741 in 2005. He also estimated that the national medical care costs of obesity-related illness in adults were $209.7 billion, or 20.6 percent of U.S. national health expenditures.

I address the economic causes and consequences of excess body weight. Body Mass Index (BMI), defined as weight (kg) divided by the square of height (m), is the traditional measure of body composition.[1] According to several sources, including the Centers for Disease Control and Prevention (CDC), a BMI reading greater than or equal to 25 but less than 30 classifies an individual as overweight, while a reading greater than or equal to 30 signifies obesity.[2] A BMI reading greater than or equal to 40 classifies an individual as morbidly obese (World Health Organization, 1997).

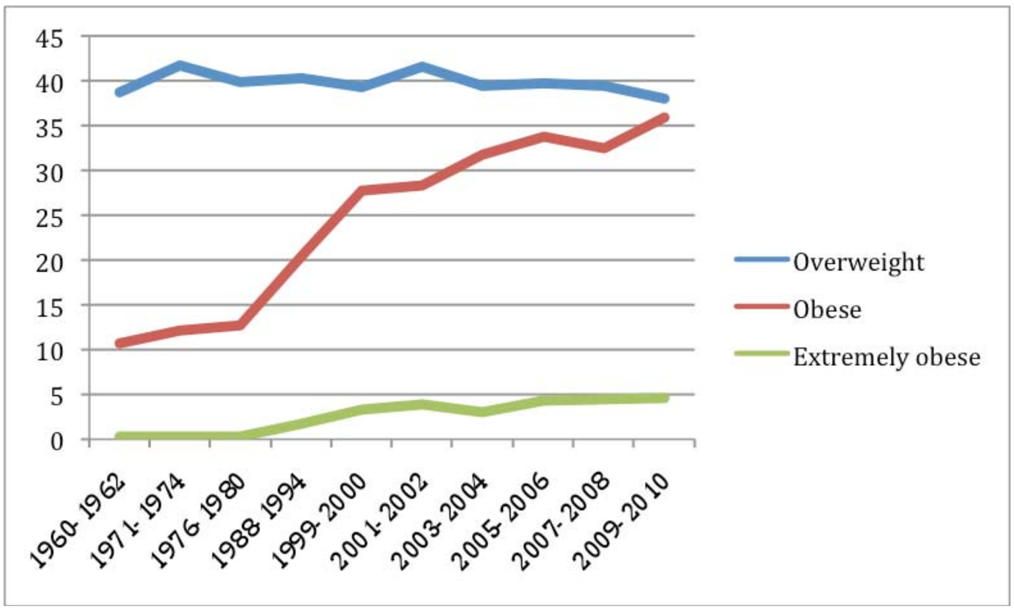
Results from the 2009–2010 National Health and Nutrition Examination Survey (NHANES), using measured heights and weights, show that an estimated 32.7 percent of U.S. adults ages 20 years and over were overweight, and 35.7 percent were obese. Further, 6.6 percent of adults were classified as morbidly, or extremely, obese (Fryar, 2012). For men, 36.2 percent of whites, 38.8 percent of blacks, and 36.6 percent of Mexican Americans were obese (see Figure 1.1). For women, 32.2 percent of whites, 58.5 percent of blacks, and 44.9 percent of Mexican Americans

---

[1] Equivalently, it is calculated as 703*weight (lb) / height^2 (in).
[2] Source: http:// http://www.cdc.gov/obesity/adult/defining.html.

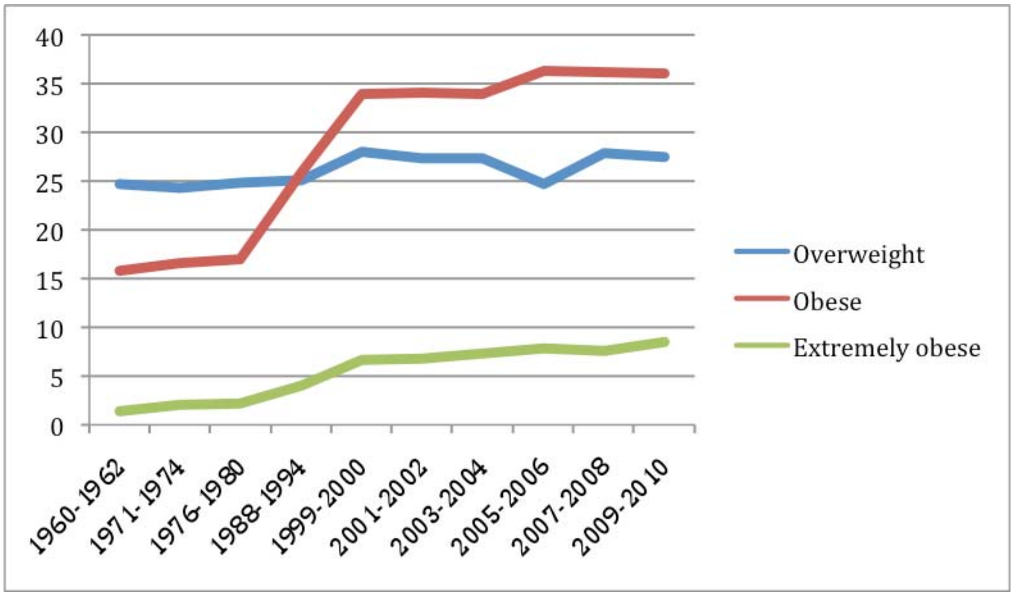
were obese (see Figure 1.2). By comparison, in NHANES I (1960-1962), 31.5 percent of adults were overweight, 13.4 percent were obese, and 0.9 percent were extremely obese. In NHANES III (1988-1994), 32.7 percent of adults were overweight, 23.2 percent were obese, and 3.0 percent were extremely obese. Rates of overweight have stayed about the same, while rates of obesity have skyrocketed.

Figure 1.1. 2009-2010 National Health and Nutrition Examination Survey, Trends in Overweight, Obesity, and Extreme Obesity Among Men aged 20–74 years: United States, 1960–1962 through 2009–2010[3]



[3] As per Fryar, et al. (2012).

Figure 1.2. 2009-2010 National Health and Nutrition Examination Survey, Trends in Overweight, Obesity, and Extreme Obesity Among Women Aged 20–74 Years: United States, 1960–1962 through 2009–2010[4]



SOURCES: CDC/NCHS, National Health Examination Survey I 1960–1962; National Health and Nutrition Examination Survey (NHANES) I 1971–1974; NHANES II 1976–1980; NHANES III 1988–1994; NHANES 1999–2000, 2001–2002, 2003–2004, 2005–2006, 2007–2008, and 2009-2010.

While social scientists widely use BMI, some researchers have recently suggested that its inability to distinguish appropriately between body fat and non-body fat components may lead to inaccurate results when measuring the effects of obesity (Burkhauser and Cawley, 2008). Wada and Tekin (2010) used the two-compartment model that distinguishes between body fat (BF) and fat-free mass (FFM).[5] BF consists of fat tissues while FFM is everything else, including muscles, skin and skeleton. The development of bioelectrical impedance analysis (BIA) has allowed for more accurate measurement of BF and FFM on the principle that FFM registers a lower electrical resistance than BF (National Institutes of Health, 1994). In addition to BMI and a binary obesity indicator variable, I use Percentage Body Fat (PBF), defined as BF divided by the

[4] Ibid.
[5] Siri (1961) and Brozek et al. (1963) first proposed the two-compartment models. FFM is known as lean body mass (Heyward and Wagner, 2004). Technically, lean body mass contains a small amount of lipids, while FFM does not contain any lipids at all. In males, about 97% of lean body mass is FFM, while it is about 92% in females (Lohman, 1992).

sum of FFM and BF, in the study of the economic causes and consequences of overweight and obesity.

Gallagher (2000) defined overweight and obesity using PBF.

Figure 1.3. Gallagher's Categories of Body Composition

Women

Age	Underweight	Healthy	Overweight	Obese
20-40 yrs	<=21%	22-32%	33-38%	>=39%
41-60 yrs	<=23%	24-33%	34-39%	>=40%
61-79 yrs	<=24%	25-35%	36-41%	>=42%

Men

Age	Underweight	Healthy	Overweight	Obese
20-40 yrs	<=8%	9-19%	20-24%	>=25%
41-60 yrs	<=11%	12-21%	22-26%	>=27%
61-79 yrs	<=13%	14-24%	25-29%	>=30%

The American Society of Bariatric Physicians (2009) determined that body fat greater than or equal to 30 percent in females and 25 percent in males signifies obesity. In the data used in my study, for respondents ages 25 and above, the mean PBF is 24.7 percent for white males, 34.8 percent for white females, 22.5 percent for black males, and 36.7 percent for black females.

A growing body of literature explores the relationship between body composition and wages in the United States. There are two views: (1) overweight and obesity cause lower wages; (2) low wages and low family income cause overweight and obesity (Kim and Leigh, 2010). I study the relationship between body composition and wages using a dataset that includes the most recent years of data available in the 1979 cohort of the National Longitudinal Survey of Youth (hereafter NLSY), 1981 to 2010.

Our culture promotes and rewards thinness and beauty, levying consequences for excess weight. Obesity may contribute to health problems that reduce productivity. Employers may believe that overweight and obese employees will add disproportionate costs to medical or workers' compensation insurance premiums. Finally, customers, coworkers, or employers themselves may discriminate against overweight and obese workers. *Not Worth the Weight: The Relationship between Body Composition* uses methods of ordinary least squares (OLS), Fixed Effects and instrumental variables (IV, employed here as two-stage least squares (2SLS)). A rise in PBF is associated with decreases in the wages of white males and females. For blacks, there is some evidence of the opposite effect. I hypothesize that the negative impact of excess weight on wages is larger at higher levels of income because associated positions that require more education might place may emphasis on thinness. A quantile regression analysis provides some evidence that, at least for females, the penalty associated with increased PBF is larger at higher levels of income.

Low wages might contribute to excess weight because poorer individuals might consume cheaper, high-calorie food, and exercise less because they live in relatively unsafe neighborhoods. *Poor Choices: The Effects of Family Income on Body Composition* shows through OLS, Fixed Effects and 2SLS that changes in family income are associated with small changes in measures of body composition, consistent with previous literature. While we would expect a rising income to provide families with more options in terms of diet and exercise, my analysis cannot prove that income has a sizeable impact on body composition.

I shift gears in the final section, *The Heavy Cost of Healthcare: The Ex Ante Moral Hazard Effect of Health Insurance Possession on Body Composition.* While we generally view health insurance as essential to the financial protection of an individual and his or her family in the event of illness, it could be that the possession of health insurance causes an individual to take fewer precautions and engage in unhealthy activities with the knowledge that he or she will be covered if these activities contribute to illness. Previous literature has generally shown that possession of health insurance causes ex ante moral hazard; however, some of the literature has estimated that possession of health insurance contributes to smaller waistlines. I analyze data from the NLSY, augmented with food and cigarette prices from the Council for Community and Economic Research (C2ER), to study the effects of the possession of health insurance on body composition. Results from OLS, 2SLS, and probit models show that possession of health insurance has statistically significant positive effects on body composition measured three ways: PBF, BMI, and overweight and obesity indicators. I also evaluate the effect by source of insurance, hypothesizing that the effect is larger when an individual is covered by government health insurance, and smaller when the individual is covered by private insurance. The analysis shows that the moral hazard effect is larger when Medicaid covers the individual, though this could be due to selection bias. When I control for individual fixed effects given the panel nature of the dataset as well as endogeneity, however, the results are at best slim, and in most cases, insignificant. Thus it is inconclusive whether insurance has an impact on body composition.

I conclude with suggestions for additional research and policies to help reduce the severity of this public health challenge.

Chapter 2

Not Worth the Weight: The Relationship between Body Composition and Wages

I. Introduction

I analyze the effects of body composition on wages using a dataset that includes the most recent waves of the 1979 cohort of the NLSY, 1981 through 2010. I use a proxy measure of PBF, which is calculated on the basis of bioelectrical impedance analysis data from the Third National Health and Nutrition Examination Survey (NHANES III).[6]

Our culture promotes and rewards thinness and beauty, levying consequences for excess weight. Obesity can contribute to health problems that reduce productivity. Employers might believe that the obese will add disproportionate costs to medical or workers' compensation insurance premiums. Finally, customers, coworkers and employers themselves might discriminate against overweight and obese workers.

Because of the panel nature of the NLSY, we should control for time-invariant, unobserved heterogeneity within individuals. Therefore we estimate models using Fixed Effects. Additionally, because of the endogeneity of both weight and wages (i.e., these variables are correlated with unobserved factors in the error term of the wage equation), linear regression estimates will be biased. Endogeneity refers to both reverse causality, which is sometimes referred to as structural endogeneity, and unobserved heterogeneity, which is sometimes referred to as statistical endogeneity. I use 2SLS to more accurately estimate the effect of body composition on wages. This study finds that there is a statistically significant wage penalty for white males and females.

[6] The Third National Health and Nutrition Examination Survey (NHANES III), conducted in 1988-1994, surveyed a nationally representative sample of 33,994 persons aged 2 months or older; 31,311 of those respondents also underwent physical examinations.

Finally, I hypothesize that the effect of weight on wages is larger at higher levels of income because higher-level positions might place more value on thinness and lean body mass. Using quantile regression, I explore how weight's wage penalty differs at each 5^{th} percentile of the wage level. I find that the penalty associated with PBF is larger at higher levels of income for women. This goes beyond what has been done in prior research on the relationship between body composition and wages.

Section II includes a review of economic literature relevant to this discussion. Section III discusses the dataset. Section IV describes the econometric methods and analysis. Section V concludes, with suggestions for further research on mechanisms through which weight affects wage levels.

II. Literature Review

The economics literature regarding the effect of body composition on wages has grown substantially. This literature review focuses on studies that analyzed NLSY data.

Register and Williams (1990) studied the effect of obesity on wage rates with a sample of men and women between the ages of 18 and 25 using data from the 1982 wave of the NLSY. Controlling for the link between physical appearance and occupational choice, the authors estimated a statistically significant 12 percent penalty for obese women, and an insignificant penalty for obese men.

Loh (1993) continued this research with analysis of wage levels for full-time workers in the 1982 and 1985 waves of the NLSY. He found that weight insignificant effects on wages in 1982 for either males or females. Wages, however, rose roughly five percent less between the two waves for obese men and women as compared with normal weight individuals.

Averett and Korenman (1996) used a sample of respondents ages 23 to 31 from the 1988 wave of the NLSY to study the effects of BMI on income, marital status and hourly pay differentials. To control for the endogeneity of weight, Averett and Korenman used 1981 BMI in their first model. The authors estimated a statistically significant 15 percent penalty on hourly wages for women with a BMI greater than or equal to 30. Using 1988 BMI, they estimated a 10 percent penalty on wages. For men, the authors estimated an eight percent penalty using 1981 BMI and a three percent penalty using 1988 BMI.

Pagan and Davila (1997) estimated cross-sectional wage models, similar to those of Averett and Korenman (1996), using 1989 NLSY data. First, the authors ran multinominal logit models to compare the occupational distribution of the obese and the non-obese samples. The authors found that obese men chose jobs where they had a productivity advantage over the non-obese or where they received a premium for undertaking risks. Men faced lower barriers when moving across occupations, and were more likely to work in repair, transportation and manufacturing industries. Larger women, confined to low-level service sector and clerical occupations, faced wage penalties of at least 10 percent.

Baum and Ford (2004) explored the mechanisms through which obese workers earn lower wages, proposing several possibilities based on analysis of data from the 1981 to 1998 waves of the NLSY. By including a term interacting obesity and health insurance dummy variables, the authors showed that there was a smaller wage penalty when employers provided health insurance. In the individual difference models, obese men obtained a 4.7 percent relative increase in their pay, while women obtained a 2.7 percent relative increase. Finally, the authors found that workers in customer-oriented occupations earned less, but they did not face a larger wage penalty for being obese.

Bhattacharya and Bundorf (2009) estimated a model in which they compared the wage penalty for obesity using two separate cohorts, those with health insurance and those without health insurance. Using 1989-1999 NLSY data, they provided evidence that the obese pay for higher expected medical expenditures through lower wages, contrary to the findings of Baum and Ford (2004). The authors showed that employers providing health insurance coverage paid obese employees $1.70 less per hour than they paid non-obese employees throughout the entire period. The difference in wages between uninsured obese and non-obese people was only $0.40.

Cawley (2004) used data from the 1981 to 2000 waves of the NLSY data, in particular the 13 years in which surveyors recorded both weight and height for each respondent. He obtained estimates of true weight and height in the NLSY data by applying coefficients reported in the NHANES III, a survey conducted by the National Center for Health Statistics (NCHS), which includes self-reported numbers as well as actual values taken from physical examinations.

Using OLS, Cawley found that weight has statistically significant effects on wages for white women, but less substantial effects for black and Hispanic women. Given a two standard deviation increase in weight (64 lbs.), employers paid women nine percent less. Black men earned higher wages with higher weight, while Hispanic men incurred a wage penalty.

Because of the endogeneity of weight, Cawley turned to 2SLS and attempted to find a set of instruments that were correlated with BMI but uncorrelated with the error term in the structural, or second-stage, equation. The first instrument Cawley discussed was sibling BMI, which is highly correlated with respondent BMI. Cawley assumed that sibling BMI is uncorrelated with the respondent's wage residual. To control for the age and gender of the sibling, the author also included these variables in the set of instruments. Cawley concluded that the instruments were good predictors of a woman's weight because the first-stage equations presented high coefficients of determination (R^2).

It is very difficult to prove that sibling BMI is uncorrelated with the residual in the wage equation because the residual includes the respondent's rate of time discount in addition to other unobservable variables that might influence wage levels (e.g., self-confidence). If the family's situation influences this rate, then the sibling's BMI would also be correlated with the residual. Cawley's results showed that both BMI and weight in pounds had effects on wages that were statistically significant at the five percent level for white females only. Here, a two standard-deviation increase in weight was associated with an 18 percent decline in wages. Averett and Korenman (1999) explained that increased weight has a larger negative impact on the self-esteem of white females than in other demographic groups.

In prior work, I used Cawley's (2004) dataset to analyze how the effect of weight on wages changed throughout the year by adding to Cawley's wage equation a term interacting BMI and year (Lempert, 2007). Results revealed a statistically significant continual increase in the wage penalty for overweight and obese white women followed throughout two decades. Using OLS, I found that the wage penalty from an increase in BMI from the 25th to the 75th percentile (from 21.0 to 28.4) rose from 4.29 percent in 1981 to 7.47 percent in 2000. According to my prior study, the bias against weight has increased, despite dramatic increases in the rate of obesity in the United States. Increasingly scarce thinness is rewarded with an increasing wage premium.

Johansson et al. (2009) examined the relationship between obesity and labor market success in Finland. They found that only waist circumference has a negative associated with wages for women, while no obesity measure was significantly in the linear wage model for men. All measures of obesity were negatively associated with women's employment probability and fat mass was negatively associated with men's employment probability. Further, high fat mass was associated with approximately 6 percent lower wages for men. The authors concluded that there is a risk that labor market penalties associated with obesity are measured with bias.

Wada and Tekin (2010) estimated wage models using the 1981 to 2004 waves of the NLSY. In a departure from the standard definition of obesity, the authors first used the NHANES III in order to formulate predictive equations regarding the relationship between self-reported weight and height, and FFM and BF. They began their analysis by using predictive equations for FFM developed by Sun et al. (2003). The predictive equations are in the following forms for males:

(2.1) $\text{FFM} = -10.678 + 0.262 \times \text{weight} + 0.652 \times (\text{stature})^2/\text{resistance} + 0.015 \times \text{resistance}$

and for females:

(2.2) $\text{FFM} = -9.529 + 0.168 \times \text{weight} + 0.696 \times (\text{stature})^2/\text{resistance} + 0.016 \times \text{resistance}$

where weight is clinically measured in kilograms and stature is clinically measured in centimeters. The resistance, a measure of resistance to electric current at a frequency of 50 kHz, is measured in ohms. The authors calculated BF by subtracting FFM from total measured weight.

The authors then separately regressed their predicted FFM and BF values on variables that are available in both the NHANES III and the NLSY: age (age^2, age^3), self-reported weight (weight^2, weight^3), self-reported height (height^2, height^3), and an interaction between self-reported height and self-reported weight.[7] The authors estimated the FFM and BF predictive equations separately for white males, white females, black males, and black females. Because these models reported high R^2 values, the authors determined that they could use their predictive equations to estimate values of FFM and BF in the NLSY data. Their reduced-form wage equation had the following form:

[7] The height and weight information provided in the NLSY is self-reported. To correct for possible reporting errors in the NLSY, Wada and Tekin (2010) use self-reported weight and height in estimating clinical measures of FFM and BF in the NHANES III.

(2.3) $$\ln(w_{it}) = \alpha + \beta_1 FFM_{it} + \beta_2 BF_{it} + \beta_3 X_{it} + \varepsilon_{it}$$

where $\ln(w_{it})$ is the natural logarithm of the hourly wage rate for individual i in year t, X_{it} is a vector of the observed determinants of wages, α and βs are the parameters, and ε_{it} is an idiosyncratic disturbance term. The authors excluded self-reported weight and height from their wage model as these are already incorporated in the measures of FFM and BF.

Using OLS, the authors found that a 1 kg increase in BF reduced wages by about 1 percent for both white males and females. For whites, an increase in FFM of 1kg increased wages by about 0.7 percent for males and about 1.2 percent for females. For blacks, an increase in the FFM of 1kg increased wages by about 0.5 percent for males and about 0.7 percent for females. Using 2SLS, the authors found significant effects for white males only. Wada and Tekin concluded that individuals with high levels of FFM or lean body mass earn a wage premium.

III. Data

I use NLSY data from the years 1981 through 2010. The NLSY is a panel survey conducted by the U.S. Department of Labor, Bureau of Labor Statistics.[8] It began with annual interviews of 12,686 young males and females who were between the ages of 14 and 21 in 1979. Since 1994, interviews have been conducted every other year. I analyze the effects of weight on wages using the most recent years of available data.

The NLSY simplifies race categories into three groups: black, Hispanic and non-black/non-Hispanic (referred to as white in the literature). The NLSY reported height in 1981, 1982, 1985, 2006, 2008 and 2010 only; I use final height from 2010. The age range for the NLSY sample is 16 to 53; however, I limit the sample to those observations with an age of at least 25 years to better understand the effect of body composition on wages in the labor market when respondents

[8] Data downloaded from https://www.nlsinfo.org/investigator/pages/login.jsp.

were full participants. I exclude pregnant females from the sample. I also limited all models to the sample of working men and women who reported positive wages.

I adjust wages for all years to 2004 dollars according to the CPI – All Urban Consumers series,[9] recoding outliers such that the wage range is \$1 to \$500. Finally, I limit the sample to observations having PBF values within three standard deviations of the mean. The resulting OLS sample contains 59,675 pooled observations: 24,180 white males, 18,745 white females, 8,913 black males and 7,837 black females. The 2SLS sample is limited to those respondents who have at least one sibling. The resulting 2SLS sample includes 30,378 pooled observations: 12,403 white males, 9,085 white females, 4,816 black males and 4,074 black females.

I use predictive equations for FFM and BF developed by Wada and Tekin (2010), calculating FFM and BF as functions of self-reported characteristics available in both datasets: age (age^2, age^3), self-reported weight ($weight^2$, $weight^3$), self-reported height ($height^2$, $height^3$), and an interaction between self-reported height and self-reported weight. Their sample contained 3,201 white males, 3,539 white females, 2,283 black males, and 2,513 black females. After calculating FFM and BF in the NLSY, I then calculate PBF as BF divided by the sum of FFM and BF.

To test the reliability of the Wada and Tekin (2010) predictive equations, I obtained NHANES III data and calculated FFM using Sun et al. (2003) predictive equations. After calculating BF and then PBF, I ran regressions of FFM, BF and PBF on the same covariates Wada and Tekin (2010) used in their predictive equations. I then calculated values of FFM and BF using the NLSY observations, and then derived two values of PBF, one calculated from my FFM and BF predictive equations, and one based on a direct regression of PBF on the self-reported characteristics available in both NHANES III and the NLSY. I calculated a covariance matrix for the three PBF measures (including the one based on Wada and Tekin's predictive

[9] Source: http://www.bls.gov/cpi/.

equations) for each race-gender group and found covariance values of approximately 0.99 for all groups with the exception of black females, which had covariance values of roughly 0.95. Thus, for the purposes of comparing my results with that of Wada and Tekin (2010), I use their predictive equations. See their study for the results from the predictive equations for FFM and BF.[10]

The set of control variables includes the total number of biological, step and adopted children in the household; age and its square; year; general intelligence (derived from the 1980 Armed Forces Qualification Test (AFQT)); a dummy variable indicating whether health limits the amount or kind of work performed; indicator variables for high school, some college, college, and education missing; mother's highest grade completed; father's highest grade completed; job tenure; an indicator variable for blue collar work; current school enrollment; marital status indicators; region of residence; state unemployment rate; and an indicator variable for whether the respondent lives in an urban area.

Table 2.1A presents summary statistics for the full NLSY sample, including the predicted FFM, BF and PBF, along with the definitions of the variables. Table 2.1B presents summary statistics for the 2SLS sample.

[10] Wada and Tekin (2010), p. 251, Table A1.

Table 2.1A
Descriptive Statistics (Weighted Mean and Standard Deviation) of NLSY79 1981-2010 Waves, OLS Sample

Variables	Definitions	White males	White females	Black males	Black females
Real Wage	Real wage in 2004 dollars (adjusted by CPI)	21.21 (23.97)	16.05 (19.63)	15.55 (19.67)	13.23 (11.51)
Real Household Income	Real Household Income in 2004 dollars (in thousands, adjusted by CPI)	73.99 (107.38)	68.24 (85.61)	51.94 (77.35)	43.83 (50.30)
Percentage Body Fat	Body Fat / (Fat-Free Mass + Body Fat)	0.247 (0.040)	0.348 (0.064)	0.224 (0.047)	0.367 (0.066)
Fat-Free Mass	Estimated fat-free mass in kilograms	63.84 (8.677)	44.76 (6.058)	66.38 (9.220)	49.01 (6.938)
Body Fat	Estimated body fat in kilograms	21.68 (7.639)	25.39 (10.89)	20.10 (8.273)	30.26 (12.40)
Body Mass Index	Weight/Height-Squared	26.70 (4.312)	25.30 (5.744)	27.46 (4.619)	28.96 (6.836)
Underweight	Dummy variable = 1 if BMI< 18.5	0.004 (0.063)	0.034 (0.182)	0.002 (0.049)	0.011 (0.106)
Normal Weight	Dummy variable = 1 if 18.5 ≤ BMI < 25	0.371 (0.483)	0.555 (0.497)	0.315 (0.464)	0.310 (0.462)
Overweight	Dummy variable = 1 if 25 ≤ BMI < 30	0.434 (0.496)	0.234 (0.423)	0.429 (0.495)	0.312 (0.463)
Obese	Dummy variable = 1 if 30 ≤ BMI	0.191 (0.393)	0.177 (0.382)	0.254 (0.435)	0.367 (0.482)
Obese 1	Dummy variable = 1 if 30 ≤ BMI < 35	0.145 (0.352)	0.111 (0.314)	0.186 (0.389)	0.196 (0.397)
Obese 2	Dummy variable = 1 if 35 ≤ BMI<40	0.034 (0.185)	0.040 (0.196)	0.054 (0.225)	0.100 (0.300)
Obese 3	Dummy variable = 1 if 40 ≤ BMI	0.010 (0.102)	0.026 (0.160)	0.015 (0.120)	0.071 (0.257)
Weight	Kilograms	86.04 (15.48)	68.32 (16.11)	87.24 (16.00)	77.11 (18.42)
Height	Meters	1.794 (0.070)	1.643 (0.065)	1.782 (0.078)	1.632 (0.073)
Health limitation	Dummy variable = 1 if health limits amount or kind of work	0.039 (0.194)	0.057 (0.232)	0.035 (0.184)	0.060 (0.237)
AFQT	Armed Forces Qualification Test from 1980 to 1981	54.62 (27.66)	54.78 (25.15)	23.29 (21.66)	24.89 (19.64)
Mother HGC	Years of education completed by mother	11.94 (2.447)	11.88 (2.424)	11.00 (2.590)	10.83 (2.612)
Father HGC	Years of education completed by father	12.23 (3.399)	12.10 (3.242)	10.28 (3.430)	10.26 (3.637)
Children	# of biological/step/adopted children in the household	1.025 (1.168)	1.170 (0.065)	0.811 (1.158)	1.372 (1.206)
Attend	Dummy variable = 1 if currently attending school	0.030 (0.170)	0.049 (0.216)	0.023 (0.151)	0.051 (0.219)
Married	Dummy variable = 1 if married	0.649 (0.477)	0.649 (0.477)	0.417 (0.493)	0.371 (0.483)

Some High School	Dummy variable = 1 if some high school	0.101 (0.301)	0.056 (0.230)	0.134 (0.341)	0.074 (0.262)
High School	Dummy variable =1 if high school graduate	0.424 (0.494)	0.416 (0.493)	0.508 (0.500)	0.399 (0.490)
Some College	Dummy variable = 1 if some college	0.196 (0.397)	0.239 (0.426)	0.218 (0.413)	0.345 (0.475)
College	Dummy variable = 1 if college graduate	0.279 (0.448)	0.290 (0.454)	0.140 (0.347)	0.182 (0.386)
Age	Age in years (to the closest month)	35.19 (7.272)	36.14 (7.387)	35.84 (7.273)	37.00 (7.220)
Tenure	Weeks of tenure (50 weeks/year)	313.67 (316.72)	282.77 (295.63)	251.86 (280.04)	296.24 (312.33)
Urban	Dummy variable = 1 if urban	0.715 (0.487)	0.716 (0.489)	0.854 (0.403)	0.859 (0.390)
Northeast	Dummy variable = 1 if Northeast region	0.180 (0.385)	0.185 (0.389)	0.153 (0.360)	0.133 (0.340)
West	Dummy variable = 1 if West region	0.167 (0.373)	0.164 (0.370)	0.082 (0.275)	0.061 (0.239)
Midwest	Dummy variable = 1 if Midwest region	0.335 (0.472)	0.317 (0.465)	0.165 (0.372)	0.171 (0.377)
South	Dummy variable = 1 if South region	0.312 (0.463)	0.330 (0.470)	0.597 (0.491)	0.631 (0.483)
Blue-collar	Dummy variable = 1 if blue-collar occupation	0.764 (0.424)	0.948 (0.223)	0.811 (0.391)	0.966 (0.180)
Year	Year indicator (1981 - 2010)	1996.11 (7.346)	119.95 (7.501)	1996.81 (7.248)	1997.93 (7.248)
Unemployment rate	State unemployment rate	5.790 (1.810)	5.874 (1.852)	5.806 (1.716)	5.894 (1.805)
Observations		24,180	18,745	8,913	7,837

Table 2.1B.
Descriptive Statistics (Weighted Mean and Standard Deviation) of NLSY79 1981-2010 Waves, IV Sample

Variables	Definitions	White males	White females	Black males	Black females
Real Wage	Real wage in 2004 dollars (adjusted by CPI)	20.88 (24.82)	16.75 (20.73)	14.71 (17.71)	12.93 (12.56)
Real Household Income	Real Household Income in 2004 dollars (in thousands, adjusted by CPI)	72.16 (106.48)	71.60 (94.26)	48.42 (66.81)	42.65 (46.93)
Percentage Body Fat	Body Fat / (Fat-Free Mass + Body Fat)	0.247 (0.040)	0.346 (0.064)	0.222 (0.047)	0.366 (0.069)
Fat-Free Mass	Estimated fat-free mass in kilograms	63.71 (8.511)	44.68 (6.164)	66.05 (9.112)	49.10 (7.037)
Body Fat	Estimated body fat in kilograms	21.60 (7.559)	25.17 (11.09)	19.76 (9.112)	30.32 (12.65)
Body Mass Index	Weight/Height-Squared	26.69 (4.308)	25.18 (5.819)	27.29 (4.588)	28.99 (7.106)
Underweight	Dummy variable = 1 if BMI< 18.5	0.003 (0.058)	0.036 (0.185)	0.003 (0.054)	0.015 (0.120)
Normal Weight	Dummy variable = 1 if 18.5 ≤ BMI < 25	0.379 (0.485)	0.566 (0.496)	0.328 (0.470)	0.313 (0.464)
Overweight	Dummy variable = 1 if 25 ≤ BMI < 30	0.424 (0.494)	0.224 (0.417)	0.429 (0.495)	0.301 (0.459)
Obese	Dummy variable = 1 if 30 ≤ BMI	0.193 (0.394)	0.174 (0.379)	0.240 (0.427)	0.371 (0.483)
Obese 1	Dummy variable = 1 if 30 ≤ BMI < 35	0.147 (0.354)	0.104 (0.305)	0.177 (0.381)	0.192 (0.394)
Obese 2	Dummy variable = 1 if 35 ≤ BMI<40	0.037 (0.188)	0.041 (0.197)	0.047 (0.212)	0.101 (0.301)
Obese 3	Dummy variable = 1 if 40 ≤ BMI	0.010 (0.097)	0.029 (0.168)	0.016 (0.126)	0.078 (0.268)
Weight	Kilograms	85.84 (15.25)	68.02 (16.43)	86.61 (15.77)	77.26 (18.71)
Height	Meters	1.792 (0.069)	1.643 (0.066)	1.781 (0.079)	1.634 (0.076)
Health limitation	Dummy variable = 1 if health limits amount or kind of work	0.041 (0.198)	0.058 (0.231)	0.036 (0.187)	0.058 (0.231)
AFQT	Armed Forces Qualification Test from 1980 to 1981	52.99 (28.03)	55.17 (25.58)	21.30 (20.66)	23.31 (18.49)
Mother HGC	Years of education completed by mother	11.95 (2.454)	12.02 (2.419)	10.85 (2.427)	10.73 (2.389)
Father HGC	Years of education completed by father	12.27 (3.513)	12.28 (3.324)	9.96 (3.483)	9.925 (3.614)
Children	# of biological/step/adopted children in the household	1.063 (1.214)	1.148 (1.141)	0.821 (1.155)	1.394 (1.212)

Attend	Dummy variable = 1 if currently attending school	0.031 (0.172)	0.052 (0.222)	0.018 (0.132)	0.045 (0.206)
Married	Dummy variable = 1 if married	0.642 (0.479)	0.643 (0.479)	0.416 (0.493)	0.362 (0.481)
Some High School	Dummy variable = 1 if some high school	0.112 (0.316)	0.052 (0.223)	0.150 (0.357)	0.069 (0.253)
High School	Dummy variable =1 if high school graduate	0.418 (0.493)	0.398 (0.490)	0.529 (0.499)	0.405 (0.491)
Some College	Dummy variable = 1 if some college	0.190 (0.392)	0.208 (0.406)	0.194 (0.396)	0.340 (0.474)
College	Dummy variable = 1 if college graduate	0.280 (0.449)	0.341 (0.474)	0.127 (0.333)	0.185 (0.389)
Age	Age in years (to the closest month)	34.72 (7.127)	35.62 (7.237)	35.19 (7.115)	36.51 (7.114)
Tenure	Weeks of tenure (50 weeks/year)	309.26 (310.62)	284.80 (298.89)	251.58 (280.32)	295.23 (310.63)
Urban	Dummy variable = 1 if urban	0.717 (0.482)	0.729 (0.480)	0.828 (0.420)	0.847 (0.405)
Northeast	Dummy variable = 1 if Northeast region	0.175 (0.380)	0.203 (0.403)	0.128 (0.334)	0.111 (0.315)
West	Dummy variable = 1 if West region	0.155 (0.362)	0.154 (0.361)	0.062 (0.242)	0.045 (0.208)
Midwest	Dummy variable = 1 if Midwest region	0.366 (0.482)	0.339 (0.473)	0.167 (0.373)	0.162 (0.369)
South	Dummy variable = 1 if South region	0.299 (0.458)	0.301 (0.459)	0.641 (0.480)	0.677 (0.468)
Blue-collar	Dummy variable = 1 if blue-collar occupation	0.757 (0.429)	0.954 (0.210)	0.793 (0.405)	0.969 (0.175)
Year	Year indicator (1981 - 2010)	1995.74 (7.218)	1996.72 (7.373)	1996.38 (7.156)	1997.75 (7.163)
Unemployment rate	State unemployment rate	5.787 (1.793)	5.829 (1.809)	5.800 (1.658)	5.827 (1.751)
Observations		12,403	9,085	4,816	4,074

IV. Econometric Methods and Analysis

A. OLS Models

The probability of being employed may decline with higher body weight because a lower wage creates a disincentive to work. In this case, my estimates of the effects of weight on wages could be underestimates because my dataset excludes those individuals who are not in the labor force.[11] Cawley (2004), however, did not find that this selection bias led to any significant change in the coefficients, so I report only results without corrections.[12] The baseline econometric model follows:

(2.4) $$\ln(w_{it}) = \alpha + \beta_1 PBF_{it} + \beta_2 X_{it} + \varepsilon_{it}$$

The dependent variable is the natural log of the hourly wage. By using PBF as the key independent variable, this analysis allows the data to determine how weight and height should interact with each other and other characteristics in order to classify an individual as overweight or obese. All models have standard errors that were clustered to account for both heteroskedasticity, or non-constant variance of the error terms, and the fact that individuals are in the sample more than once.[13]

Table 2.2A presents results from the OLS wage models with one contemporaneous measure of body composition, PBF. Because PBF is measured as a decimal (e.g., 25 percent body fat equals 0.25), a one-percentage point increase in PBF reduces wages by about 0.67 percent for

---

[11] Some studies, such as Morris (2006), Morris (2007) and Greve (2008), have found effects of BMI on employment.

[12] Cawley (2004) used Heckman's (1979) method to correct for selection bias in the log wage regression results for women. Family income not attributable to respondent wages served as an instrument for women's market employment. Cawley found little evidence of selection bias. The Heckman selection correction had very little effect on the coefficients on weight. Cawley only reports results without a correction. Register & Williams (1990) also used Heckman's procedure to correct for selection.

[13] Because these models use measures of body composition constructed form the regressions coefficients that are transferred from the NHANES to the NLSY, the standard errors will be underestimated. Therefore, all of our analyses contain bootstrapped standard errors, implemented with 399 replications.

white females, and 0.38 percent for black females. A one-percentage point increase in PBF raises wages by about 0.60 percent for black males. See Appendix 2.A for OLS regression results.

Table 2.2A
OLS Results from the Models using PBF

Log Wage	White males		White females		Black males		Black females	
Percentage Body Fat	-0.0730		-0.6640	***	0.6023	*	-0.3801	*
	(0.217)		(0.149)		(0.261)		(0.182)	
Observations	24,180		18,745		8,913		7,837	

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
* Statistical significance at the 5% level.
*** Statistical significance at 0.1% level.

B. Fixed Effects Models

Because I use panel data with the same respondents tracked throughout time, there are time-invariant, unobserved factors that might be correlated with both body composition and wages. To account for these factors, I present coefficient estimates from regressions with individual fixed effects. In addition to using PBF, I estimate Fixed Effects and 2SLS models with FFM and BF in order to test the findings of Wada and Tekin (2010). Table 2.2B contains the results with PBF. A one-percentage point increase in PBF raises wages by about 1.00 percent for black males, and 0.52 percent for black females.

Table 2.2B
Fixed Effects results from the Models using PBF

Log Wage	White males	White females	Black males		Black females	
Percentage Body Fat	-0.0191	-0.0567	1.0040	**	0.5230	*
	(0.245)	(0.196)	(0.316)		(0.232)	
Observations	24,180	18,745	8,913		9,918	
Individuals	2,697	2,650	991		968	

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
* Statistical significance at the 5% level.
** Statistical significance at 1% level.

Table 2.2C contains the results with FFM and BF. The results imply that for white males, when FFM is raised by 1 kg, the wages increase by 1.88 percent, and when BF is raised by 1 kg, the wages decline by 1.83 percent. Further, for black males, when FFM is raised by 1 kg, the wages increased by 2.02 percent.

By comparison, Wada and Tekin (2010) found significant (i.e., 1%) effects of 0.0150 and -0.0158 for FFM and BF, respectively, for white males. For white females, they found statistically significant (10% and 5%) effects of 0.0252 and -0.0150 for FFM and BF, respectively. See Appendix 2.B for Fixed Effects regression results.

Table 2.2C
Fixed Effects Results from the Models using Fat-Free Mass and Body Fat

Log Wage	White males		White females	Black males		Black females
Fat-free mass (kg)	0.0188	*	0.0091	0.0202	^	0.0087
	(0.009)		(0.024)	(0.012)		(0.024)
Body fat (kg)	-0.0183	*	-0.0046	-0.0137		-0.0016
	(0.008)		(0.012)	(0.011)		(0.012)
Observations	24,180		18,745	8,913		7,837
Individuals	2,697		2,650	991		968

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
^ Statistical significance at the 10% level (0.084 for black males' fat-free mass).
* Statistical significance at the 5% level.

C. Instrumental Variables (2SLS) Models

I use 2SLS to address the potential endogeneity of the measures of body composition. Cawley (2004) used sibling BMI, controlled for age and gender, as the instrument. I use sibling PBF, controlled for age and gender, as the instrument. The goal was to obtain unbiased estimates of the variables that are suspected to be endogenous. The instruments must be uncorrelated with the dependent variable and the error term in the wage equation. A common rule of thumb for models with endogenous regressors is that the first-stage F-statistic, which tests the null hypothesis that the instruments are irrelevant in the first-stage regression, should be at least 10 (Bound et al., 1995). Using sibling PBF, however, as an instrument will limit the abilities to make generalizations and out-of-sample validity of the results

In the PBF models, F-statistics for the instruments are significant (greater than 10) for black males only. For all groups, p-values for over-identification tests are greater than 0.10, suggesting that the instruments are legitimately excludable from the main equation. In the FFM and BF models, F-statistics for the instruments are significant for all groups, however the Angrist-Pischke tests are less than 10 for all groups, and insignificant ($p>0.05$) for black males and black females. All groups pass the over-identification test, suggesting that the instruments are legitimately excludable from the main equation.

Table 2.2D presents the PBF results from the 2SLS wage models. A one-percentage point increase in PBF reduces wages by 3.08 percent for white males. This provides some evidence that higher PBF triggers a significant wage penalty.

Table 2.2D
Sibling 2SLS Results from the Models using Percentage Body Fat

Log Wage	White males		White females	Black males	Black females
Percentage Body Fat	-3.0760	^	1.0031	0.7776	-0.9082
	(1.645)		(2.228)	(1.108)	(1.525)
Observations	12,403		9,085	4,816	4,074
F-statistic	1.57		2.51	30.23	1.38
Overidentification p-value	0.31		0.46	0.79	0.59

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
^ Statistical significance at the 10% level (0.061 for white males).

In the FFM and BF models, F-statistics for the instruments are significant for all groups. Further, p-values for over-identification tests are greater than 0.10, suggesting that the instruments are legitimately excludable from the main equation. Table 2.2E presents the FFM and BF results from the 2SLS wage models. For white males, when FFM is raised by 1 kg, the wages increase by 2.040 percent, and when BF is raised by 1 kg, the wages decline by 3.4 percent. Wada and Tekin (2010) found significant (i.e., 10%) effects of 0.0203 and -0.0261 for FFM and BF, respectively, for white males. This provides some evidence that higher FFM contributes to a wage premium, and higher BF to a wage penalty. See Appendix 2.C for instrumental variables regression results.

Table 2.2E
Sibling 2SLS Results from the Models Using Fat-Free Mass and Body Fat

Log Wage	White males		White females	Black males	Black females
Fat-free mass (kg)	0.0240	^	0.0305	0.0119	-0.0196
	(0.014)		(0.026)	(0.023)	(0.023)
Body fat (kg)	-0.0341	^	-0.0203	-0.0071	0.010
	(0.019)		(0.016)	(0.027)	(0.015)
Observations	12,403		9,085	4,816	4,074
F-statistic – FFM	48.80		37.91	29.61	14.23
F-statistic - BF	33.55		29.83	30.25	12.37
Overidentification p-value	0.27		0.50	0.51	0.50

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
^ Statistical significance at the 10% level (0.085 and 0.069 for white males' FFM and BF, respectively).

D. Quantile Regression Models

My study is the first to hypothesize that the negative impact of excess weight on wages is larger at higher levels of income. Perhaps higher-level positions that require more education and experience also place more value on thinness and lean body mass. The paper uses quantile regression to model this effect. In linear regression, the regression coefficient represents the change in the response variable produced by a one-unit change in the predictor variable associated with that coefficient. The quantile regression parameter estimates the change in a specified quantile of the response variable produced by a one-unit change in the predictor variable. This allows for an analysis of the effects of weight on wages at specified percentiles of the wage level.[14]

I estimate equations at each 5th percentile of the wage. Table 2.3 presents sets of coefficients on PBF for each race-gender group. Table 2.4 includes graphs for each race gender group. The x-axis is the quantile of the wage, and the y-axis is the percentage point change in the wage from a

[14] Source: http://www.cscu.cornell.edu/news/statnews/stnews70.pdf.

one-percentage point increase in PBF. The graphs contain the quantile coefficients in addition to OLS coefficients from Section IV.A.

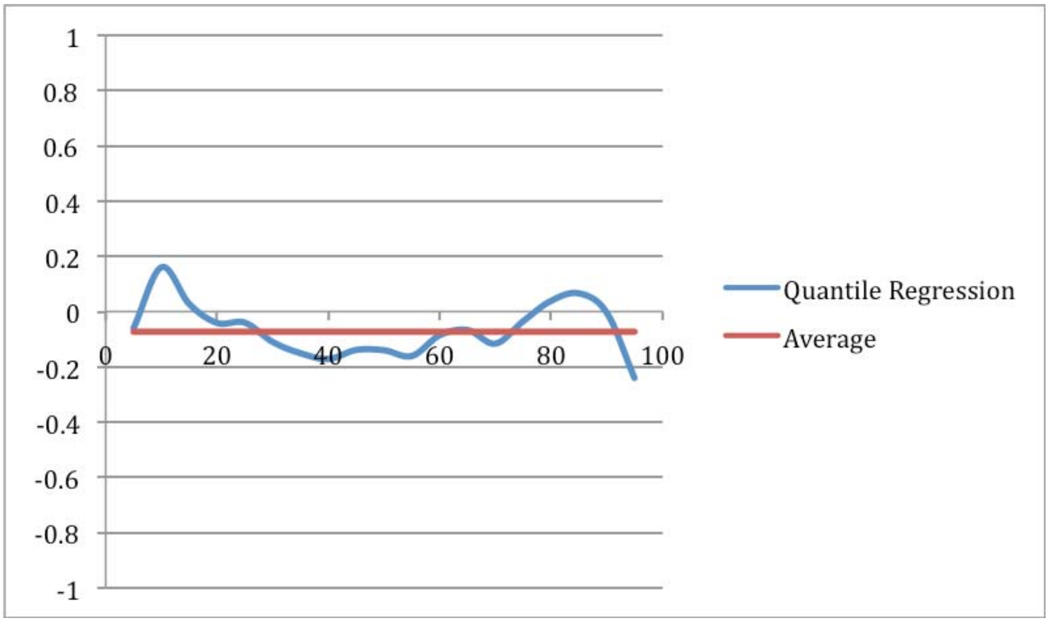
For white men, the effects are generally insignificant. For white women and black women, the wage penalty associated with higher PBF generally increases at higher income levels. For white women on average, a one-percentage point increase in PBF reduces wages by about 0.67 percent, however, this analysis shows that the penalty increases in absolute terms from 0.37 percent at the 10th percentile of the wage distribution to 0.88 percent at the 95th percentile. For black men, there is a wage premium associated with higher PBF that increases somewhat with higher income levels.

Table 2.3
Quantile OLS Results from the Models using Percentage Body Fat

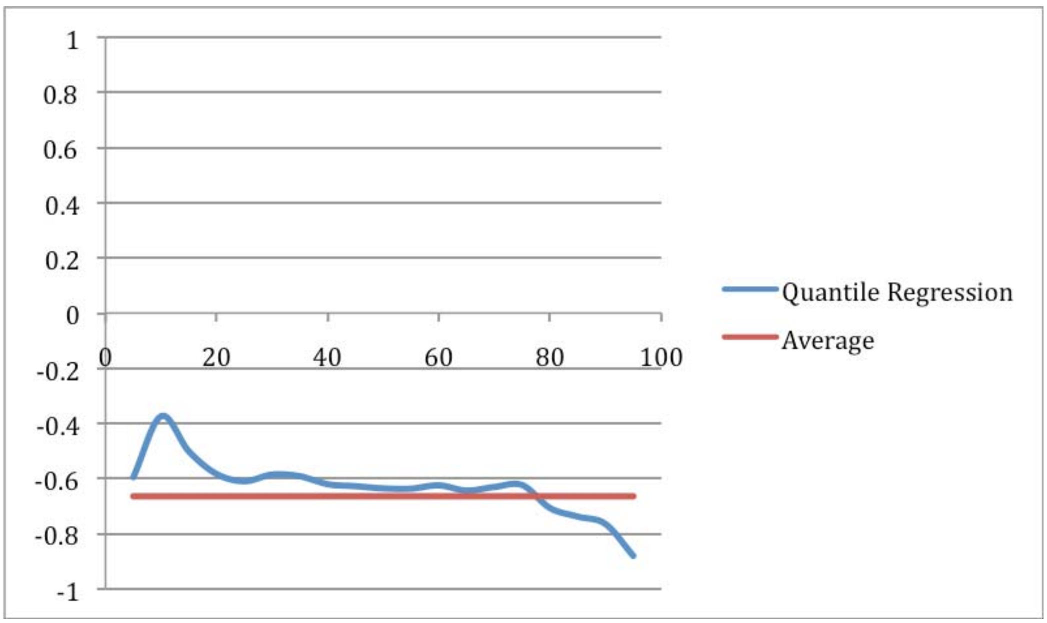
Log Wage				
Quantile	White Males	White Females	Black Males	Black Females
5	-0.0634	-0.597	0.415	-0.0476
10	0.16	-0.374**	0.304	-0.244
15	0.0265	-0.501**	0.410*	-0.224*
20	-0.0426	-0.583**	0.571**	-0.228**
25	-0.0416	-0.609**	0.627**	-0.250**
30	-0.112	-0.585**	0.625**	-0.252**
35	-0.153	-0.591**	0.584**	-0.326**
40	-0.174	-0.620**	0.662**	-0.359**
45	-0.141	-0.627**	0.753**	-0.336**
50	-0.142	-0.635**	0.762**	-0.375**
55	-0.163*	-0.636**	0.820**	-0.427**
60	-0.0875	-0.624**	0.818**	-0.440**
65	-0.0681	-0.643**	0.797**	-0.441**
70	-0.118	-0.630**	0.755**	-0.433**
75	-0.0362	-0.623**	0.649**	-0.404**
80	0.0376	-0.706**	0.532**	-0.288**
85	0.0654	-0.737**	0.499**	-0.361*
90	-0.00491	-0.764**	0.744**	-0.566**
95	-0.243	-0.879**	0.632	-0.533**
	* p<0.05,	** p<0.01		

Figure 2.1
Graphs of Quantile OLS Results from the Models using Percentage Body Fat

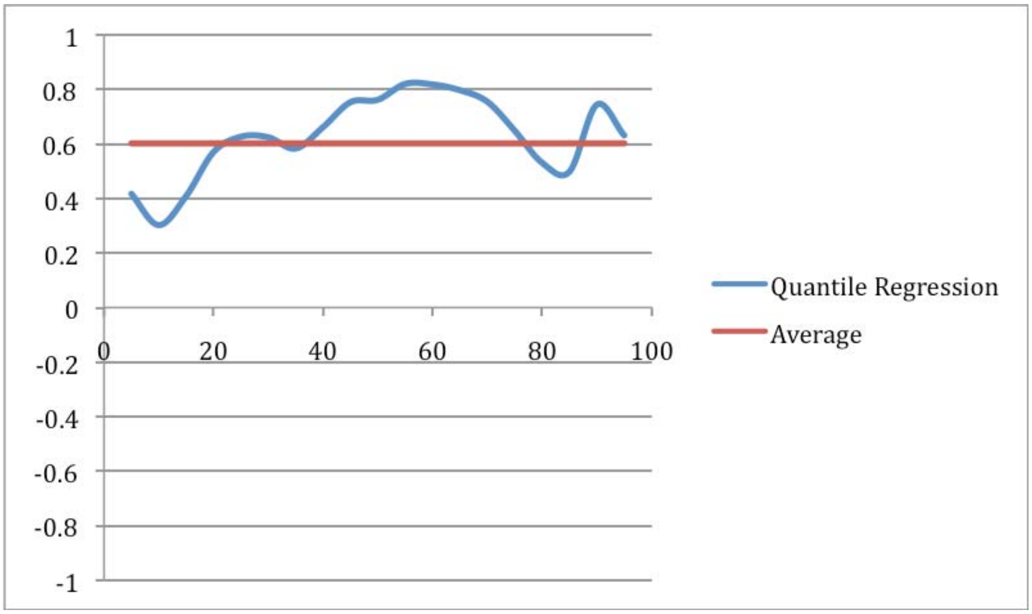
White Males



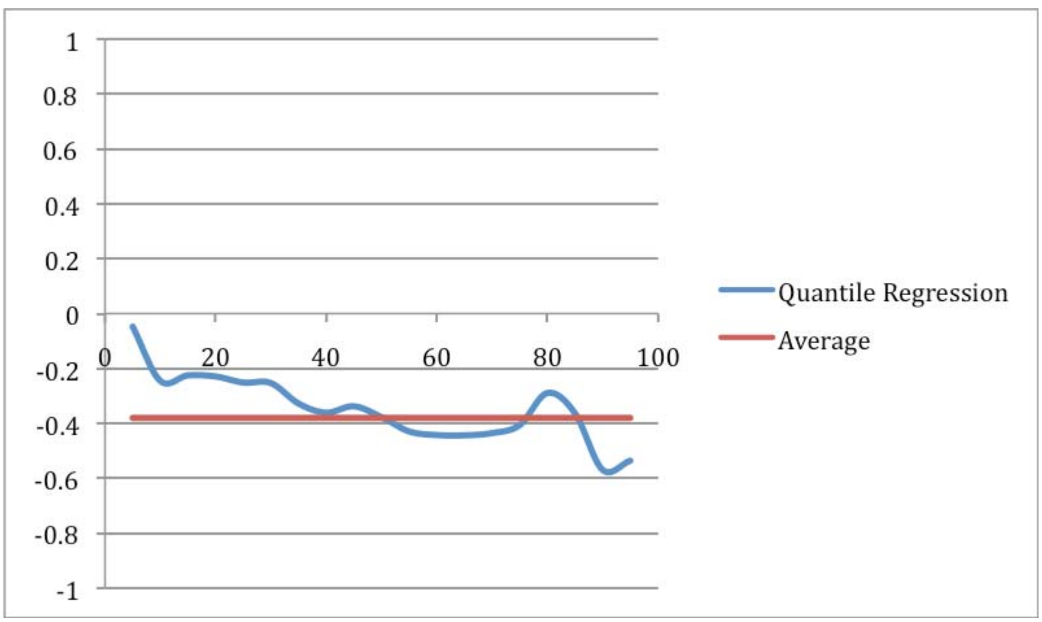
White Females



Black Males



Black Females



V. Conclusion

The purpose of this paper is to estimate the relationship between body composition and wages in the United States. By using NLSY 1981-2010 data and replacing self-reported weight and height with more accurate measures of body composition, I show that for whites there are wage penalties associated with PBF, wage premiums associated with FFM, and wage penalties associated with BF. However, Fixed Effects results show that for blacks there is a premium associated with PBF.

I hypothesize that the effect of weight on wages is larger at higher levels of income because higher-level positions that require more education might place more value on thinness and lean body mass. A quantile regression analysis shows that the wage penalty associated with PBF increases with income level for females, and decreases with income level for black males.

The wage penalty corresponds to psychological research that finds increased weight stigmatization in the United States. As heavier individuals become older, their wages are cumulatively affected by years of discrimination. With other factors controlled, their starting wages are lower. Throughout their working careers, they receive less frequent raises and promotions. This process might affect the overall labor market: if discrimination exists, there are fewer optimal job matches.

Future research may study the mechanisms through which the wage disparities occur, how wage penalties differ by occupation, and how age interacts with weight in relation to the wage penalties. Regardless of the mechanisms, there is strong evidence that excess body weight has significant economic consequences. The market rewards thinness and lean body mass with a wage premium.

Chapter 3

Poor Choices: The Effects of Family Income on Body Composition

I. Introduction

This chapter studies the second relationship described in Chapter 2, that low family income contributes to excess body weight, using a dataset comprised of the most recent years of the NLSY). Employing the methods of OLS, Fixed Effects, and 2SLS, my study is the first to analyze the effects of family income on PBF. I find that the effects of family income on body composition are significant, but relatively small, for white females and black males, but insignificant for white males and black females.

Section II includes a review of economic literature. Section III discusses the dataset. Section IV describes the econometric methods and analysis. Section V concludes with suggestions for further research on the mechanisms through which family income affects body composition.

II. Literature Review

Most of the literature regarding the relationship between body composition and weight studies the effect of excess weight on wages. The limited literature on the effect of income on body composition is limited, and has estimated that the effect of family income on body composition is relatively small. Two studies include as covariates household income and household income squared in order to capture the potential non-linear relationship between family income and body composition. Chou et al. (2004) employed the 1984-1999 Behavioral Risk Factor Surveillance System (BRFSS) and find that real household income has significant, yet small negative effects on BMI and the probability of being obese. With both income and income squared in their regressions, Chou et al.'s results imply that a 10 percent increase in income above the mean was associated with just a 0.0684 kg/m^2 decline in BMI and a 0.884 percent decline in the probability of being obese. A 100 percent increase in income was associated with a 0.684 kg/m^2 decline in BMI and an 8.84 percent decline in the probability of being obese.

Rashad et al. (2006) used micro-level data from the NHANES for years 1971 through 1994, finding a statistical significant negative correlation between family income and BMI for women, and a statistically significant positive correlation between family income and BMI for men. Further, the authors find a statistically significant negative correlation between family income and the probability of being obese for women, but an insignificant negative correlation for men. Based on pooled regressions including men and women, a 10 percent increase in income above the mean was associated with a 0.0291 kg/m^2 decline in BMI an a 0.296 percent decrease in the probability of being obese. A 100 percent increase in income was associated with a 0.291 kg/m^2 decline in BMI and a 2.96 percent decrease in the probability of being obese.

Smith et al. (2009) used NLSY data from years 1988 through 2000 to study the hypothesis that economic insecurity causes weight gain. They excluded women from their analysis for three reasons: (1) labor supply decisions for men are more uniform than those of women; (2) body weight in women may be partly related to fertility decisions which are likely to be related to economic variables; and (3) economic security of women is more dependent on spousal income than it is for men. Their first model includes both family income and hourly wage as independent variables. OLS results show an insignificant negative effect of income on body weight.

However, family income and hourly wage could be endogenous. The authors employed 2SLS, using state median household income from the US Census and the legal minimum wage in the state, respectively, as instruments for family income and hourly wage. The instruments must meet three conditions to be valid: (1) orthogonality, or that the instruments are not related to the error term in the main equation; (2) relevance, or that the instruments are statistically related to the endogenous variable; (3) exclusion, or that the instruments affect the dependent variable in the main equation only through their effects on the endogenous variable. Their 2SLS results show a significant positive correlation between income and weight change, suggesting that, at least for men, being better off makes people fatter. A $1000 increase in family income was associated with a 0.131 lb. increase in body weight.

Kim and Leigh (2010) used data from the 2003, 2005 and 2007 waves of the Panel Study of Income Dynamics (PSID) to estimate the effects of wages on body composition. They theorized that low wages contribute to excess weight because poorer individuals consume cheaper, high-calorie food, and exercise less because they might live in relatively unsafe neighborhoods. While previous studies focused on family income, Kim and Leigh asserted their "primary contribution, therefore, is to provide an IV analysis of the effects of [log, hourly] wages on obesity and body mass for a public health and epidemiologic audience" (p. 495).

The authors restricted their attention to heads of household because the PSID collects more information on heads of household than other family members, and the authors wanted to limit the bias arising from labor force participation decisions of non-heads of household. Using OLS, the authors found significant, though small, effects. In the BMI equation, a 10 percent increase in wages was associated with a 0.036 decline in BMI. A 100 percent increase in wages was associated with a 0.26 decrease in BMI. In the obesity equation, a 10 percent increase in wages was associated with a 0.003 decline in the chances of being obese. A 100 percent increase in wages was associated with a 0.02 decrease in the chances of obesity. The authors noted that wages are skewed because many respondents earn more than the minimum wage; their results thus do not estimate the marginal effects for those individuals at the lower part of the wage distribution. Due to the possible endogeneity of weight and wages (i.e., these variables are correlated with unobserved factors in the error term of the wage equation), their linear regression estimates could be biased.

The authors used two instruments for the endogenous variable, respondent computer skill level and the minimum wage in the state in which the respondent resides. In the BMI equation, a 10 percent increase in wages was associated with a 0.32 decline in BMI. A 100 percent increase in wages would be associated with a 2.29 decline in BMI. In the obesity equation, a 10 percent increase in wages was associated with a 0.024 decline in the chances of being obese. A 100 percent increase in wages would be associated with a 0.17 decrease in the chances of obesity. The larger estimates from IV are less credible than the OLS estimates, but they lend additional support to the hypothesis that low wages contribute to excess weight.

III. Data

As in Chapter 2, I use an NLSY dataset consisting of waves 1981 through 2010, augmented with FFM, BF and PBF variables as per Wada and Tekin (2010). I obtained access to restricted NLSY Geocode data to use state identifiers for the respondents. The age range for my study is 16 to 53. I limit the sample to those individuals living independently (i.e., not living with parents). Further, I exclude those observations having PBF outside three standard deviations of the mean PBF for each race-gender group. The resulting sample includes 69,718 pooled observations: 27,039 white males, 25,316 white females, 8,299 black males, and 9,064 black females. The instrumental variables analysis uses state unemployment rate as the instrumental variable. The number of observations for which this data is available is 68,253 observations: 26,270 white males, 25,028 white females, 7,966 black males, and 8,989 black females.

The set of control variables includes the total number of biological, step and adopted children in the household; general intelligence (derived from the 1980 AFQT); age and its square; year; a dummy variable indicating whether health limits the amount or kind of work performed; indicator variables for high school, some college, college, and education missing; mother's highest grade completed; father's highest grade completed; job tenure; an indicator variable for blue collar work; current school enrollment; marital status indicators; region of residence; and an indicator variable for whether the respondent lives in an urban area. Table 3.1 presents summary statistics for the full NLSY sample, including the predicted FFM, BF and PBF, along with the definitions of the variables.

Table 3.1. Descriptive Statistics (Mean and Standard Deviation) of NLSY

Variables	Definitions	White males	White females	Black males	Black females
Real Wage	Real wage in 2004 dollars (adjusted by CPI)	19.04 (23.13)	12.32 (17.87)	13.97 (18.07)	10.06 (11.93)
Real Household Income	Real Household Income in 2004 dollars (in thousands, adjusted by CPI)	66.57 (104.76)	62.10 (85.85)	45.52 (66.92)	35.99 (46.20)
Percentage Body Fat	Body Fat / (Fat-Free Mass + Body Fat)	0.242 (0.041)	0.343 (0.064)	0.221 (0.048)	0.361 (0.071)
Fat-Free Mass	Estimated fat-free mass in kilograms	63.30 (8.654)	44.40 (5.690)	66.00 (9.291)	48.73 (7.176)
Body Fat	Estimated body fat in kilograms	21.03 (7.609)	24.64 (10.77)	19.72 (8.356)	29.63 (12.98)
Body Mass Index	Weight/Height-Squared	26.32 (4.295)	24.92 (5.736)	27.22 (4.675)	28.65 (7.141)
Underweight	Dummy variable = 1 if BMI< 18.5	0.006 (0.075)	0.046 (0.209)	0.003 (0.058)	0.018 (0.135)
Normal Weight	Dummy variable = 1 if 18.5 ≤ BMI < 25	0.412 (0.492)	0.571 (0.495)	0.343 (0.475)	0.335 (0.472)
Overweight	Dummy variable = 1 if 25 ≤ BMI < 30	0.411 (0.492)	0.221 (0.415)	0.410 (0.492)	0.293 (0.455)
Obese	Dummy variable = 1 if 30 ≤ BMI	0.172 (0.377)	0.162 (0.368)	0.244 (0.429)	0.353 (0.478)
Obese 1	Dummy variable = 1 if 30 ≤ BMI < 35	0.131 (0.337)	0.101 (0.302)	0.179 (0.383)	0.185 (0.388)
Obese 2	Dummy variable = 1 if 35 ≤ BMI<40	0.031 (0.174)	0.036 (0.187)	0.050 (0.217)	0.095 (0.294)
Obese 3	Dummy variable = 1 if 40 ≤ BMI	0.010 (0.098)	0.024 (0.154)	0.015 (0.122)	0.072 (0.259)
Weight	Kilograms	84.91 (15.44)	67.23 (15.92)	86.49 (16.18)	76.30 (19.33)
Height	Meters	1.795 (0.070)	1.642 (0.066)	1.782 (0.078)	1.633 (0.073)
Body Mass Index-Adjusted	Weight/Height-Squared Using Adjusted Weight and Height	26.83 (4.510)	25.85 (5.988)	27.34 (5.017)	29.54 (7.369)
Underweight-Adjusted	Dummy variable = 1 if BMI< 18.5	0.005 (0.071)	0.028 (0.166)	0.004 (0.066)	0.015 (0.122)
Normal Weight-Adjusted	Dummy variable = 1 if 18.5 ≤ BMI < 25	0.399 (0.490)	0.525 (0.499)	0.365 (0.481)	0.292 (0.455)
Overweight-Adjusted	Dummy variable = 1 if 25 ≤ BMI < 30	0.388 (0.487)	0.246 (0.431)	0.376 (0.484)	0.290 (0.454)
Obese-Adjusted	Dummy variable = 1 if 30 ≤ BMI	0.208 (0.406)	0.201 (0.401)	0.255 (0.436)	0.402 (0.490)
Obese 1-Adjusted	Dummy variable = 1 if 30 ≤ BMI < 35	0.131 (0.337)	0.120 (0.325)	0.172 (0.378)	0.201 (0.401)
Obese 2-Adjusted	Dummy variable = 1 if 35 ≤ BMI<40	0.031 (0.174)	0.050 (0.218)	0.060 (0.237)	0.107 (0.310)
Obese 3-Adjusted	Dummy variable = 1 if 40 ≤ BMI	0.010 (0.098)	0.031 (0.173)	0.023 (0.149)	0.094 (0.292)
Weight-Adjusted	Kilograms Adjusted with NHANES III Coef.	84.65 (15.44)	68.68 (16.43)	85.52 (17.15)	78.17 (20.08)

Height-Adjusted	Meters Adjusted with NHANES III Coef.	1.795 (0.070)	1.630 (0.061)	1.767 (0.064)	1.626 (0.057)
Health limitation	Dummy variable = 1 if health limits amount or kind of work	0.047 (0.212)	0.075 (0.263)	0.063 (0.243)	0.100 (0.300)
AFQT	Armed Forces Qualification Test from 1980 to 1981	54.84 (27.96)	52.88 (26.05)	24.34 (22.24)	23.10 (19.30)
Mother HGC	Years of education completed by mother	11.93 (2.465)	11.78 (2.471)	11.02 (2.664)	10.61 (2.711)
Father HGC	Years of education completed by father	12.24 (3.433)	11.97 (3.304)	10.31 (3.423)	10.01 (3.696)
Children	# of biological/step/adopted children in the household	0.979 (1.151)	1.234 (1.162)	0.874 (1.169)	1.517 (1.304)
Attend	Dummy variable = 1 if currently attending school	0.053 (0.224)	0.057 (0.232)	0.037 (0.189)	0.058 (0.233)
Married	Dummy variable = 1 if married	0.652 (0.476)	0.670 (0.470)	0.449 (0.497)	0.357 (0.479)
Some High School	Dummy variable = 1 if some high school	0.113 (0.317)	0.093 (0.291)	0.141 (0.348)	0.134 (0.341)
High School	Dummy variable =1 if high school graduate	0.421 (0.494)	0.430 (0.495)	0.485 (0.500)	0.414 (0.493)
Some College	Dummy variable = 1 if some college	0.202 (0.402)	0.224 (0.417)	0.231 (0.422)	0.303 (0.460)
College	Dummy variable = 1 if college graduate	0.263 (0.441)	0.253 (0.435)	0.143 (0.350)	0.148 (0.355)
Age	Age in years (to the closest month)	33.60 (8.183	34.11 (8.296)	35.22 (8.181)	35.69 (8.063)
Tenure	Weeks of tenure (50 weeks/year)	269.93 (306.20)	204.50 (269.54)	221.65 (274.05)	213.24 (292.14)
Urban	Dummy variable = 1 if urban	0.691 (0.493)	0.695 (0.489)	0.835 (0.421)	0.832 (0.410)
Northeast	Dummy variable = 1 if Northeast region	0.166 (0.372)	0.168 (0.374)	0.145 (0.352)	0.127 (0.333)
West	Dummy variable = 1 if West region	0.178 (0.382)	0.173 (0.378)	0.099 (0.298)	0.074 (0.262)
Midwest	Dummy variable = 1 if Midwest region	0.324 (0.467)	0.314 (0.464)	0.167 (0.373)	0.188 (0.391)
South	Dummy variable = 1 if South region	0.321 (0.467)	0.339 (0.474)	0.576 (0.494)	0.607 (0.488)
Blue-collar	Dummy variable = 1 if blue-collar occupation	0.729 (0.444)	0.827 (0.378)	0.756 (0.428)	0.814 (0.389)
Year	Year indicator (1981 - 2010)	1994.53 (8.224)	1995.02 (8.203)	119.22 (8.109)	1996.72 (7.976)
Unemployment rate	State unemployment rate	6.134 (2.003)	6.254 (2.063)	6.066 (1.868)	6.163 (1.921)
Observations		27,039	25,316	8,299	9,064

IV. Econometric Methods and Analysis

A. OLS Models, and Logit and Probit

A researcher could argue that both wages and household income affect body composition. My study focuses on family income. If an individual earns a low wage, or does not work, but is married to someone who earns a decent income, the individual's body composition will be partially determined by the spouse's income. Family income determines where families live, what type of food they consume, what type of education their children receive, and the kind and amount of exercise in which they engage.

The baseline econometric model follows:

(3.1) $$PBF_{it} = \alpha + \beta_1 Y_{it} + \beta_2 X_{it} + \varepsilon_{it}$$

where Y_{it} is the log of the respondent's family income in year t, and X_{it} is the set of covariates. The dependent variable is PBF. All models have standard errors that were clustered to account for both heteroskedasticity and the fact that individuals are in the sample more than once.[15]

I also present estimates using BMI and probability of obesity as the dependent variable. In NHANES III, self-reported height and weight of NLSY-aged white females underestimate actual BMI by an average of 1.58 percent, while males underestimate BMI by an average of 1.0 percent. I multiply self-reported weight and height in the NLSY by the coefficients reported in NHANES III according to the race-gender group.

Table 3.2A presents results from the OLS wage models with one contemporaneous measure of body composition, PBF. Because PBF is measured as a decimal (e.g., 25 percent body fat equals 0.25), the coefficients on the log of family income represent the percentage-point effects on PBF resulting from a one percent increase in income. For white females, a 10 percent increase

[15] Because these models use measures of body composition constructed form the regressions coefficients that are transferred from the NHANES to the NLSY, the standard errors will be underestimated. Therefore, all of our analyses contain bootstrapped standard errors, implemented with 399 replications.

in income above the mean is associated with a 0.06 percentage point decline in PBF, while a 100 percent increase in income is associated with a 0.43 percentage point decline. For black males, a 10 percent increase in income above the mean is associated with a 0.04 percentage point increase in PBF, while a 100 percent increase in income is associated with a 0.27 percent increase. For black females, a 10 percent increase in income above the mean is associated with a 0.02 percentage point decline in PBF, while a 100 percent increase in income is associated with a 0.12 percentage point increase. The result for white males is not significant.

Table 3.2A
OLS Results from the Models using Percentage Body Fat

PBF	White males	White females		Black males		Black females	
Log Real Family Income	0.0010	-0.0062	**	0.0039	**	-0.0017	*
	(0.0007)	(0.001)		(0.01)		(0.002)	
Observations	27,039	25,316		8,299		9,064	

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
* Statistical significance at the 5% level.
** Statistical significance at 1% level.

Table 3.2B presents OLS results when the independent variable is an obesity dummy variable. For white females, a 10 percent increase in income above the mean is associated with a 0.40 percentage point decline in the probability of being obese, while a 100 percent increase in income is associated with a 2.92 percentage point decline. For black males, a 10 percent increase in income above the mean is associated with a 0.17 percentage point increase in the probability of being obese, while a 100 percent increase in income is associated with a 1.25 percentage point increase. For black females, a 10 percentage point increase in income above the mean is associated with a 0.20 percent decline in the probability of being obese, while a 100 percentage point increase in income is associated with a 1.46 percent decline. The result for white males is not significant.

Table 3.2B
OLS Results From the Models using Obesity

Obesity	White males	White females		Black males		Black females	
Log Real Family Income	-0.0093	-0.0421	***	0.0181	^	-0.0210	^
	(0.007)	(0.006)		(0.019)		(0.011)	
Observations	27,039	25,316		8,299		9,064	

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
^ Statistical significance at the 10% level (0.068 for black males), 0.057 for white females).
*** Statistical significance at 0.1% level.

I also use logit and probit methods in order to potentially more accurately measure the effect of family income on the probability of being obese. The logit function is the inverse of the sigmoidal "logistic function" used in statistics. Logistical regression measures the relationship between a categorical dependent variable and one or more independent variables. With logistic regression:

(3.2) $$\Pr(Y=1 \mid X)=[1+e^{-X'\beta}]-1$$

The probit function is the quantile function associated with the standard normal distribution. This cumulative distribution function is commonly noted as $\Phi(X'\beta)$. Consider that the standard normal distribution places 95 percent of probability between -1.96 and 1.96, symmetric around zero:

(3.3) $$\Phi(-1.96) = 0.025 = 1 - \Phi(1.96)$$

The probit function is the inverse of $\Phi(X'\beta)$. Therefore,

(3.4) $$\text{probit}(0.025) = -1.96 = -\text{probit}(0.975)$$

The probit model thus estimates:

(3.5) $$\Pr(Y=1 \mid X)=\Phi^{-1}(X'\beta) \text{ (cumulative normal pdf)}$$

Table 3.2C presents logit coefficients. This paragraph discusses marginal effects. For white females, a 10 percent increase in income from the mean is associated with a 2.5 percentage point decline in the probability of being obese, while a 100 percent increase in income is associated with a 18.0 percentage point decline. For black males, a 10 percent increase in income above the mean is associated with a 1.1 percentage point increase in the probability of obesity, while a 100 percent increase in income is associated with a 7.9 percentage point increase. For black females, a 10 percent increase in income above the mean is associated with a 0.9 percent decline in the probability of obesity, while a 100 percentage point increase in income is associated with a 6.2 percent decline. The result for white males is not significant.

Table 3.2C
Logit Results From the Models using Obesity

Obesity	White males	White females		Black males		Black females	
Log Real Family Income	-0.0480	-0.2601	***	0.1139	^	-0.0895	^
	(0.043)	(0.037)		(0.064)		(0.053)	
Observations	27,039	25,316		8,299		9,064	

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
^ Statistical significance at the 10% level (0.075 for black males, 0.091 for black females).
*** Statistical significance at 0.1% level.

Table 3.2D presents probit coefficients. This paragraph discusses marginal effects. For white females, a 10 percent increase in income from the mean is associated with a 1.5 percentage point decline in the probability of being obese, while a 100 percent increase in income is associated with a 10.7 percentage point decline. For black males, a 10 percent increase in income above the mean is associated with a 0.6 percentage point increase in the probability of obesity, while a 100 percent increase in income is associated with a 4.5 percentage point increase. For black females, a 10 percent increase in income above the mean is associated with a 0.5 percent decline in the probability of obesity, while a 100-percentage point increase in income is associated with a 3.8 percent decline. The result for white males is not significant.

While logit and probit models find larger effects, the results might not be a true representation of the effect of income on body composition because these methods do not take into account the endogeneity of income or the panel nature of the dataset.

Table 3.2D
Probit Results From the Models using Obesity

Obesity	White males	White females		Black males		Black females	
Log Real Family Income	-0.0291	-0.1537	***	0.0646	^	-0.0554	^
	(0.025)	(0.021)		(0.037)		(0.032)	
Observations	27,039	25,316		8,299		9,064	

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
^ Statistical significance at the 10% level (0.079 for black males, 0.085 for black females).
*** Statistical significance at 0.1% level.

Table 3.2E presents OLS results when the independent variable is adjusted BMI. For white females, a 10 percent increase in income from the mean is associated with a 0.07 decline in BMI, while a 100 percent increase in income is associated with a 0.475 decline. For black males, a 10 percent increase in income above the mean is associated with a 0.034 increase in BMI, while a 100 percent increase in income is associated with a 0.25 increase. The result for white males and black females is not significant.

Table 3.2E
OLS Results from the Models using BMI

Variable	White males	White females		Black males		Black females
Log Real Family Income	0.0759	-0.6849	***	0.358	**	-0.2412
	(0.076)	(0.091)		(0.128)		(0.187)
Observations	27,039	25,316		8,299		9,064

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
** Statistical significance at 0.1% level.

See Appendix 3.A for OLS, logit and probit models.

B. Fixed Effects Models

Because I use panel data with the same respondents tracked through time, there are time-invariant, unobserved factors that might be correlated with both family income and body composition. To account for these factors, I present coefficient estimates from regressions with individual fixed effects. Table 3.3A presents results with PBF as the independent variable. For black males, a 10 percent increase in income above the mean is associated with a 0.01 percentage point increase in PBF, while a 100 percent increase in income is associated with a 0.08 percent increase. Results for other groups are insignificant.

Table 3.3A
Fixed Effects Results from the Models using Percentage Body Fat

Variable	White males	White females	Black males		Black females
Log Real Family Income	-0.0002	0.0000	0.0011	*	0.0012
	(0.0002)	(0.0004)	(0.0005)		(0.0008)
Observations	27,039	25,316	8,299		9,064
Individuals	3,036	3,073	1,027		1,034

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
* Statistical significance at the 5% level.

Table 3.3B presents results with the obesity dummy as the independent variable. For white males, a 10 percentage point increase in income above the mean is associated with a 0.07 percentage point decline in the probability of being obese, while a 100 percent increase in income is associated with a 0.49 percentage point decline. Results for other groups are insignificant. I also found insignificant effects from Fixed Effects logit regressions.

Table 3.3B
Fixed Effects Results From the Models using Obesity

Variable	White males		White females	Black males	Black females
Log Real Family Income	-0.0071	*	0.0000	0.010	-0.0005
	(0.0033)		(0.000)	(0.07)	(0.001)
Observations	27,039		25,316	8,299	9,064
Individuals	3,036		3,073	1,027	1,034

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
* Statistical significance at the 5% level.

Table 3.3C presents results with adjusted BMI as the independent variable. For black males, a 10 percent increase in income above the mean is associated with a 0.01 increase in BMI, while a 100 percent in income above the mean is associated with a 0.08 increase in BMI. Results for other groups are insignificant.

Table 3.3C
Fixed Effects Results from the Models using BMI

Variable	White males	White females	Black males		Black females
Log Real Family Income	-0.0335	-0.0563	0.1194	*	0.0492
	(0.0262)	(0.036)	(0.052)		(0.063)
Observations	27,039	25,316	8,299		9,064
Individuals	3,036	3,073	1,027		1,034

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.
* Statistical significance at 5% level.

See Appendix 3.B for Fixed Effects regressions results.

C. Instrumental Variables

I use 2SLS to address the potential endogeneity of family income. I use state unemployment rate as an instrument for family income, having obtained state information after applying and being approved for NLSY restricted-use Geocode data. In the first stage, I regress the log of real family income against state unemployment rate (z_1) as well as the other covariates, obtaining estimated values for real family income.

$$R_{it} = \Pi_1 z_1 + X'_{it}\beta + \varepsilon \quad (3.6)$$

The F-statistic rises to the somewhat significant level of 6.31 for black males only. Table 3.4A presents results with PBF as the independent variable. There are no significant results.

Table 3.4A
2SLS Results from the Models using Percentage Body Fat

Variable	White males	White females	Black males	Black females
Log Real Family Income	0.1018	0.2606	-0.0008	-0.0271
	(0.3131)	(0.3919)	(0.0348)	(0.2651)
Observations	26,270	25,028	7,966	8,989

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.

Table 3.4B presents results with the obesity dummy as the independent variable. There are no significant results.

Table 3.4B
2SLS Results from the Models using Obesity

Variable	White males	White females	Black males	Black females
Log Real Family Income	0.7212	-0.4762	-0.3192	0.2544
	(4.293)	(1.6937)	(0.6588)	(1.3772)
Observations	26,720	25,028	7,966	8,989

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.

Table 3.4C presents results in which adjusted BMI is the independent variable. There are no significant results.

Table 3.4C
2SLS Results from the Models using BMI

Variable	White males	White females	Black males	Black females
Log Real Family Income	11.509	17.997	0.0844	-3.0264
	(47.517)	(38.928)	(5.2808)	(29.267)
Observations	26,720	25,028	7,966	8,989

Note: Bootstrapped, robust standard errors clustered around individuals are in parentheses.

See Appendix 3C for instrumental variables results.

D. Discussion

My study finds very small effects of family income on three measures of body composition. OLS results show what we would expect on a directional basis, with negative effects for females and positive effects for black males. Fixed Effects results show a negative correlation of family income on body composition for white males, but a positive correlation for black males. Instrumental variables results show contradictory effects for black males. While it is an intuitively intriguing idea that family income significantly effects the body composition of family members, my study's analysis has not been able to prove any significant effects. A possible exception could be the larger effects found through logit and probit methods, however, these do not take into account the endogeneity of income or the panel nature of the dataset.

A limitation of this analysis is the estimation of coefficients based on a sample of respondents whose incomes fall along the entire distribution of incomes. It could be that lower income women are more negatively affected by low family income than men because they may be single, working mothers. Given their meager budgets, they might resort to cheap, high-calorie food to feed their families. Additionally, because of their limited time and location in poorer, unsafe neighborhoods, they are unable to engage in healthful exercise.

I also estimated Fixed Effects regressions for the sample of respondents whose family income was less than or equal to $30,000 in 2004 dollars. For the PBF regressions, the only significant result was for black females with a coefficient of 0.0015 (p-value 6.8 percent), which is somewhat higher than the insignificant result reported for the entire sample of black females. For the obesity regressions, the only significant result was for white males, with a coefficient of 0.0082 (p-value 10 percent), which is just slightly higher in absolute terms than the result reported for the entire sample of white males. For the BMI regressions, there were no significant results.

V. Conclusion

The purpose of this paper is to estimate the effects of family income on body composition in the United States. Previous studies have shown both that overweight and obesity reduce wages, and that low wages and low family income cause overweight and obesity, with small effects. I analyze NLSY data, and finds through OLS, Fixed Effects and 2SLS that the effects of family income on various measures of body composition are quite small.

It could be that lower-income women are more significantly affected by low wages because they are more likely to be single, working mothers forced to consume cheap, high-calorie food and unable to engage in exercise. My study, however, provides some additional evidence that the contributory effect of family income on body composition is quite small. Previous research and Chapter 2 of this dissertation have shown that the opposite relationship, the effect of body composition on wages, is stronger for females, particularly white females, than it is for males (Averett and Korenman, 1999).

Future research should further explore the mechanisms through which low family income contributes to excess weight, particularly for low-income women. Additionally, future research should focus on strengthening the econometric models used to estimate these effects, particularly addressing the very low coefficients of determination, the potential weakness of the instrumental variables, and other mechanisms through which family income relates to body composition, for instance through education.

Chapter 4

The Heavy Cost of Healthcare: The Ex Ante Moral Hazard Effect of Health Insurance Possession on Body Composition

I. Introduction

While we generally view health insurance as essential to the financial protection of an individual and his or her family in the event of illness, it could be that the possession of health insurance causes an individual to take fewer precautions and engage in unhealthy activities as well as over-consume healthcare. We can define “moral hazard” in two ways, “ex ante moral hazard” and “ex post moral hazard”, respectively (Ehrlich and Becker 1972). Ex post moral hazard involves an individual consuming perhaps unnecessary additional healthcare because insurance has reduced the cost to the individual. Ex ante moral hazard involves an individual holding an insurance policy and engaging in riskier behaviors with the knowledge that he or she will be covered should these activities lead to illness.

The share of healthcare expenditures paid directly by consumers has been declining. Data for the Centers for Medicare and Medicaid Services (CMS) show that consumers’ share fell from 47% in 1960 to 13% in 2004. Concurrently, the cost of healthcare has increased and some individuals have lost insurance. Individuals having insurance may have less incentive to maintain their health. My study analyzes the effect of the possession of health insurance on the measures of body composition of PBF, BMI, and overweight and obesity indicators. My study is the first to analyze the moral hazard effects of health insurance on PBF.

I use a dataset comprised of the 1990 through 2002 waves of the NLSY. The dataset incorporates state-level average prices of food at home, fast food, cigarettes, and soda obtained from the Council for Community and Economic Research (C2ER). The C2ER stopped pricing cigarettes after 2003, and the NLSY began producing biennial surveys beginning in 1994. Kelly and Markowitz (2009) used 1993-2002 data from the BRFSS to study the ex ante moral hazard effect of insurance. I thus employ a similar analysis window, going back a few years prior due to the availability of C2ER data from 1990. Further, including 1990 and 1992 data partially makes up for the fact that NLSY data is available only every other year beginning in 1994.[16]

Employing the methods of OLS, 2SLS, and probit, I find that the effect of the possession of health insurance on body composition is significant and positive. I also evaluate the ex ante moral hazard effect by source of insurance. I hypothesize that the effect will be larger when an individual is covered by government health insurance, and smaller when an individual is covered by private insurance, since out-of-pockets costs are higher with private insurance. The analysis shows that the moral hazard effect is larger when Medicaid covers the individual as opposed to employer coverage, though this could be due to selection bias. When I control for individual fixed effects and endogeneity, however, the results are slim at best, and mostly insignificant. The evidence is thus inconclusive as to whether there is a significant ex ante moral hazard effect in the possession of health insurance.

Section II reviews the related economic literature. Section III discusses the dataset. Section IV describes the econometric methods and analysis. Section V concludes with suggestions for future research and policies.

II. Literature Review

Kenkel (2000) used logit regression to estimate the effects of health insurance on obesity, smoking, drinking, and prevention choices in the 1990 National Health Interview Survey (NHIS). He generally finds that people having health insurance are more likely to make healthy choices. Regarding body composition, having health insurance makes females 6.0 percent less

---

[16] NLSY did not collect insurance information in the 1991 wave.

likely to be obese. For males, however, having health insurance makes them 21.0 percent more likely to be obese.

Card et al. (2008) used 1999-2002 BRFSS surveys to study the relationships between becoming eligible for Medicare at age 65 and smoking, exercise, and obesity. The authors find no statistically significant jumps in smoking or exercise participation. There was some indication of a rise in the probability of being overweight or obese for blacks, and for minorities with a low level of education. These increases, however, seemed to be driven by downward dips in 63- and 64-year old individuals. As a result of misspecification of the age profile and sampling error, the authors dismissed the results.

Bhattacharya and Sood (2007) used the 1998 Medical Expenditure Panel Survey and the 1997 National Health Interview Survey to estimate the welfare cost of obesity. They showed that as long as insurance premiums were not risk-rated for obesity, health insurance coverage protected those covered from the full costs of physical inactivity and over-eating. The obese population imposed a negative externality on normal weight individuals because they consume more medical resources than the non-obese. The authors developed a model of weight loss and health insurance, and estimated that a health plan with a 17.5 percent coinsurance rate imposed a welfare cost of about $150 per capita.

Bhattacharya et al. (2011) used data from the Rand Health Insurance Experiment to examine the effect of the generosity of insurance coverage on body weight. Further, they used instrumental variables methods to estimate the effect of type of insurance coverage (private, public, and none) on body weight. Using 2SLS with state fixed effects, their results showed that public and private insurance coverage reduced BMI by 3.8 and 7.7 points, respectively. Using maximum likelihood estimation, however, they found that private insurance increased BMI by

1.3 points and public insurance increased BMI by 2.1 points. The authors concluded that the effect was larger in public insurance programs where premiums are not risk adjusted and smaller in private insurance markets where obese individuals might pay for incremental medical care costs in the form of lower wages.

Dave and Kaestner (2009) also used eligibility for Medicare at age 65 as an exogenous measure of variation in health insurance coverage. They found that exercise decreases, and smoking and drinking increase, as uninsured male high school dropouts become eligible for Medicare. For women, however, there were no significant effects.

Kelly and Markowitz (2009) conducted an in-depth study of the effects of ex ante moral hazard of health insurance on body composition. The authors used data from the 1993 – 2002 Behavioral Risk Factor Surveillance System (BRFSS). Similarly to Chou et al. (2004) and Rashad et al. (2006), they incorporated state-level food at home prices, fast food prices, soda prices, and cigarette prices from the previously named American Chamber of Commerce Research Association (ACCRA), now the C2ER. The authors limited the sample to those who were employed, in good health, and had no reported doctor visits in the past year in order to limit problems with reverse causality and unobserved heterogeneity. Further, the authors limited their sample to individuals between the ages of 25 and 55.

Kelly and Markowitz (2009) found through their OLS baseline that having health insurance increased BMI by 0.147 kg/m^2. Using as instruments the percentages of each state's workforce employed in firms of sizes 100 to 499 and 500+ employees, their 2SLS model estimated an insignificant result. Using Lewbel's IV method (2012) without the external employment instruments, they found that having health insurance increases BMI by 0.247 kg/m^2. Including the external instruments, their Lewbel model estimated an effect of 0.249 kg/m^2. A 0.25 kg/m^2

increase in BMI corresponded to a weight gain of about 1.8 pounds for a male who was 5'10" tall and weighed 185 lbs.

The authors utilized probit and bivariate probit methods to study the ex ante moral hazard impact of health insurance on the probability of being in various categories of overweight. Their bivariate probit results showed that health insurance increased the likelihood of being overweight or obese by 9.3 percent, and overweight by 11.1 percent. The obese result was insignificant. The authors concluded the ex ante moral hazard effect of health insurance is small and influences only the probability of being overweight, not obese.

Haque (2013) examined whether possession of health insurance contributed to obesity using a sample of American young adults ages 18 – 24 years using 2001 – 2011 BRFSS data. His set of covariates was similar to that of Kelly and Markowitz (2009); however, rather than incorporating C2ER variables, he included an alcohol-drinking dummy, a smoking dummy, a physical activity dummy, and a fruit and vegetable consumption dummy. Haque asserted that the ex post and ex ante moral hazard effects oppose and may offset one another. He employed the same sample limitations as Kelly and Markowitz (2009). His baseline OLS estimate was that possession of health insurance reduced BMI by 0.171 kg/m^2. Using the same instruments as Kelly and Markowitz, he found through 2SLS that possession of health insurance reduced BMI by 0.172 kg/m^2. Using Lewbel IV without instruments, he found that possession of health insurance reduced BMI by 0.188 kg/m^2, which meant a weight loss of 1.33 pounds. His bivariate probit results showed that health insurance reduced the likelihood of being overweight by 7.1 percent, and obese by 8.5 percent. He ruled out an ex ante moral hazard effect, and concluded that American young adults are benefiting from health insurance by engaging in preventive health behaviors.

III. Data

I use a primary dataset containing data from the 1990 through 2002 waves of the NLSY. The dataset begins in 1990 and ends in 2002 because these are the years for which all required variables are available (see discussion below regarding C2ER data). The NLSY is a panel survey conducted by the U.S. Department of Labor, Bureau of Labor Statistics. I obtained access to the restricted NLSY Geocode data to use state identifiers for the respondents. The age range for the NLSY sample is 25 to 45. I adjust income for all years to 2004 dollars according to the CPI – All Urban Consumers series.[17]

I limit the sample to individuals who are employed. The provision of health insurance is often tied to the labor market, and unemployed individuals may have characteristics different from employed individuals (Kelly and Markowitz, 2009). Further, I use state-level firm size instruments. I also limit the sample to those individuals whose health does not limit the kind or amount of work they can perform. Reverse causality, or structural endogeneity, is less likely to be a problem with these individuals. Further, I exclude observations with PBF outside three standard deviations of the mean for each race-gender group. The resulting sample includes 32,143 pooled observations. The sample does not include Hispanics because Wada and Tekin (2010) did not estimate FFM and BF equations for Hispanics.

This primary independent variable is a dichotomous indicator of whether the respondent has health insurance. The set of control variables includes the total number of biological, step and adopted children in the household; age and its square; indicator variables for high school, some college, college, and education missing; whether respondent is black; whether respondent is male; real family income and its square; whether respondent is married, widowed, or divorced; and state and year. The instruments used are the percentages of each state's workforce employed

[17] Source: http://www.bls.gov/cpi/.

in firms of sizes of 100 to 499 employees and 500+ employees. Annual workforce data come from the U.S. Small Business Administration.

Additionally, the models include state-level variables that literature has shown to be important determinants of body composition. These include state-level food at home prices, fast food prices, soft drink prices and cigarette prices, which were calculated from city-level data from the C2ER. The C2ER food-at-home-price is made up of a weighted average of 12 food prices, where the weights are determined by the average expenditure shares of these food items by consumers according to C2ER:[18] steak, beef, sausage, chicken, tuna, milk, eggs, margarine, potatoes, bananas, lettuce, and bread. The fast food price is the average price of a McDonald's hamburger, a Pizza hut pizza, and KFC fried chicken. The soda price is a 2-liter bottle of Coca Cola. The price of a carton of cigarettes is included because cigarettes are an appetite suppressant and smoking supposedly increases metabolism (Kelly and Markowitz, 2009). C2ER stopped reporting cigarette prices in 2003, and because NLSY became biennial as of 1994, my study's sample ends in 2002. C2ER reports a cost of living index for each city. I first divide each city price by the city's cost of living index to account for variation in prices across cities. Then I take quarterly averages and calculate annual averages by state. I then divide stage average prices by the CPI to generate prices in 2004 dollars (similarly to family income). Table 4.1 presents summary statistics for the full NLSY sample, including the predicted FFM, BF and PBF, along with the definitions of the variables.

[18] Food at home price = 0.131 x 0.5 x (beefc+steakc) + 0.142 x sausagec + 0.07 x frychickc + 0.047 x tunac + 0.169 x milkc+0.018 x eggsc+0.041 x margarc + 0.073 x 0.5 x (potatoc+lettucec) + 0.077x bananac + 0.232x breadc.

Table 4.1. Descriptive Statistics (Mean and Standard Deviation) of NLSY, Primary Analysis

Variables	Definitions	All respondents (n=32,143)	Without health insurance (n=4,659)	With health insurance (n=27,484)
BMI	Body mass index, measured as weight in kilograms divided by square meters	27.27 (5.482)	26.95 (5.503)	27.324 (5.477)
Overweight/obese	Dichotomous variable that equals 1 if BMI is equal to or greater than 25 kg/m^2	0.604 (0.489)	0.570 (0.495)	0.609 (0.488)
Overweight	Dichotomous variable that equals 1 if BMI is equal to or greater than 25 kg/m^2 and less than 30 kg/m2	0.353 (0.478)	0.334 (0.472)	0.356 (0.479)
Obese	Dichotomous variable that equals 1 if BMI is equal to or greater than 30 kg/m^2	0.251 (0.434)	0.236 (0.424)	0.254 (0.435)
Percentage Body Fat	Body Fat / (Fat-Free Mass + Body Fat)	0.290 (0.076)	0.277 (0.080)	0.292 (0.076)
Fat-Free Mass	Estimated fat-free mass in kilograms	56.28 (12.25)	56.56 (11.68)	56.24 (12.35)
Body Fat	Estimated body fat in kilograms	23.60 (9.863)	22.39 (9.919)	23.80 (9.839)
Health Insurance	Dichotomous variable that equals 1 if respondent has some form of health insurance coverage	0.855 (0.352)	-	1.000 (0.000)
Private Insurance	Dichotomous variable that equals 1 if respondent obtains health insurance through current employer	0.647 (0.478)	0.031 (0.173)	0.751 (0.432)
Public Insurance (Medicaid)	Dichotomous variable that equals 1 if respondent obtains health insurance through current employer	0.019 (0.135)	0.003 (0.059)	0.021 (0.144)
Employer Provided Health Insurance	Dichotomous variable that equals 1 if respondent obtains health insurance through current employer	0.647 (0.478)	0.031 (0.173)	0.751 (0.432)
Previous Employer	Dichotomous variable that equals 1 if respondent obtains health insurance through previous employer	0.009 (0.092)	0.031 (0.173)	0.010 (0.100)
Spouse's Employer	Dichotomous variable that equals 1 if respondent obtains health insurance from spouse's employer	0.133 (0.340)	0.008 (0.089)	0.155 (0.362)
Spouse's Previous Employer	Dichotomous variable that equals 1 if respondent obtains health insurance through spouse's previous employer	0.023 (0.151)	-	0.0274 (0.163)

Individually Purchased	Dichotomous variable that equals 1 if respondent purchases health insurance director from insurer	0.047 (0.212)	0.004 (0.065)	0.055 (0.227)
Medicaid	Dichotomous variable that equals 1 if respondent is covered by Medicaid	0.019 (0.135)	0.003 (0.059)	0.021 (0.144)
Other	Dichotomous variable that equals 1 if respondent obtains health insurance through another source	0.013 (0.114)	0.002 (0.044)	0.015 (0.122)
Some high school	Dichotomous variable that equals 1 if respondent completed less than 12 years of formal schooling	0.084 (0.278)	0.220 (0.415)	0.061 (0.240)
High school	Dichotomous variable that equals 1 if respondent completed exactly 12 years of formal schooling	0.428 (0.495)	0.511 (0.500)	0.414 (0.293)
Some college	Dichotomous variable that equals 1 if respondent completed at least 13 years but fewer than 16 years of formal schooling	0.238 (0.426)	0.194 (0.400)	0.245 (0.430)
College	Dichotomous variable that equals 1 if respondent graduate from college	0.250 (0.433)	0.074 (0.262)	0.279 (0.449)
Age	Age of respondent	34.34 (4.461)	33.74 (4.428)	34.44 (4.459)
Black	Dichotomous variable that equals 1 if respondent is black but not Hispanic	0.310 (0.462)	0.375 (0.484)	0.299 (0.458)
Male	Dichotomous variable that equals 1 if respondent is male	0.547 (0.498)	0.615 (0.487)	0.536 (0.499)
Number of children	Number of children in household under age 18	1.218 (1.210)	1.1011 (1.228)	1.253 (1.203)
Real family income	Real household income in thousands of 2004 dollars	65.29 (101.78)	34.44 (73.76)	70.52 (104.90)
Married	Dichotomous variable that equals 1 if respondent is married	0.593 (0.492)	0.342 (0.474)	0.636 (0.481)
Divorced	Dichotomous variable that equals 1 if respondent is divorced or separated	0.177 (0.382)	0.293 (0.455)	0.158 (0.364)
Widowed	Dichotomous variable that equals 1 if respondent is widowed	0.005 (0.070)	0.006 (0.077)	0.005 (0.069)
Food at home price	Real state C2ER food at home price divided by (the cost of living * the CPI) in 2004 dollars	1.992 (0.146)	2.004 (0.146)	1.990 (0.146)
Fast food price	Real state C2ER fast food price divided by (the cost of living x the CPI) in 2004 dollars	5.187 (0.391)	5.245 (0.373)	5.177 (0.393)
Soda price	Real state C2ER Coke home price divided by (the cost of living x the CPI) in 2004 dollars	1.423 (0.241)	1.456 (0.237)	1.417 (0.241)
Cigarette price	Real state C2ER cigarette price divided by (the cost of living x the CPI) in 2004 dollars	24.39 (6.555)	23.86 (6.152)	24.49 (6.617)

For the analysis of the effects of private and public insurance on body composition, I include unemployed individuals in the sample. By including the respondents who have public insurance, the sample size grows to 41,083 pooled observations, with 6.0 percent of respondents obtaining coverage through Medicaid. See Table 4.2.

Table 4.2. Descriptive Statistics (Mean and Standard Deviation) of NLSY, Type of Insurance

Variables	Definitions	All respondents (n=41,083)	Without health insurance (n=7,132)	With health insurance (n=33,951)
BMI	Body mass index, measured as weight in kilograms divided by square meters	27.24 (5.667)	26.97 (5.665)	27.300 (5.666)
Overweight/obese	Dichotomous variable that equals 1 if BMI is equal to or greater than 25 kg/m^2	0.595 (0.491)	0.568 (0.495)	0.601 (0.490)
Overweight	Dichotomous variable that equals 1 if BMI is equal to or greater than 25 kg/m^2 and less than 30 kg/m2	0.344 (0.475)	0.328 (0.470)	0.347 (0.476)
Obese	Dichotomous variable that equals 1 if BMI is equal to or greater than 30 kg/m^2	0.251 (0.434)	0.240 (0.427)	0.254 (0.435)
Percentage Body Fat	Body Fat / (Fat-Free Mass + Body Fat)	0.295 (0.078)	0.280 (0.082)	0.298 (0.077)
Fat-Free Mass	Estimated fat-free mass in kilograms	55.30 (12.25)	56.04 (11.85)	55.14 (12.33)
Body Fat	Estimated body fat in kilograms	23.60 (9.863)	22.53 (10.27)	24.02 (10.15)
Health Insurance	Dichotomous variable that equals 1 if respondent has some form of health insurance coverage	0.826 (0.379)	-	1.000 (0.000)
Private Insurance	Dichotomous variable that equals 1 if respondent obtains health insurance through a private (i.e., non-Medicaid) source	0.750 (0.433)	0.043 (0.204)	0.898 (0.302)
Public Insurance (Medicaid)	Dichotomous variable that equals 1 if respondent obtains health insurance through current employer	0.060 (0.238)	0.005 (0.070)	0.072 (0.259)
Employer Provided Health Insurance	Dichotomous variable that equals 1 if respondent obtains health insurance through current employer	0.542 (0.498)	0.033 (0.179)	0.649 (0.477)
Previous Employer	Dichotomous variable that equals 1 if respondent obtains health insurance through previous employer	0.012 (0.107)	0.001 (0.024)	0.014 (0.117)
Spouse's Employer	Dichotomous variable that equals 1 if respondent obtains health insurance through spouse's employer	0.148 (0.355)	0.006 (0.080)	0.178 (0.383)
Spouse's Previous Employer	Dichotomous variable that equals 1 if respondent obtains health insurance through spouse's previous employer	0.029 (0.168)	0.000 (0.012)	0.178 (0.383)

Individually Purchased	Dichotomous variable that equals 1 if respondent purchases health insurance directly from insurance company	0.046 (0.210)	0.004 (0.066)	0.055 (0.228)
Other	Dichotomous variable that equals 1 if respondent obtains health insurance through another source	0.018 (0.134)	0.003 (0.050)	0.022 (0.146)
Some high school	Dichotomous variable that equals 1 if respondent completed less than 12 years of formal schooling	0.107 (0.310)	0.239 (0.426)	0.080 (0.271)
High school	Dichotomous variable that equals 1 if respondent completed exactly 12 years of formal schooling	0.432 (0.495)	0.507 (0.500)	0.416 (0.493)
Some college	Dichotomous variable that equals 1 if respondent completed at least 13 years but fewer than 16 years of formal schooling	0.230 (0.421)	0.188 (0.391)	0.238 (0.426)
College	Dichotomous variable that equals 1 if respondent graduate from college	0.231 (0.421)	0.066 (0.248)	0.266 (0.442)
Age	Age of respondent	34.14 (4.412)	33.68 (4.409)	34.24 (4.407)
Black	Dichotomous variable that equals 1 if respondent is black but not Hispanic	0.332 (0.471)	0.421 (0.494)	0.313 (0.464)
Male	Dichotomous variable that equals 1 if respondent is male	0.497 (0.500)	0.580 (0.494)	0.480 (0.500)
Number of children	Number of children in household under age 18	1.289 (1.260)	1.017 (1.249)	1.346 (1.255)
Real family income	Real household income in thousands of 2004 dollars	61.34 (100.57)	30.36 (64.70)	67.85 (105.44)
Married	Dichotomous variable that equals 1 if respondent is married	0.575 (0.494)	0.327 (0.469)	0.627 (0.484)
Divorced	Dichotomous variable that equals 1 if respondent is divorced or separated	0.179 (0.383)	0.284 (0.451)	0.157 (0.364)
Widowed	Dichotomous variable that equals 1 if respondent is widowed	0.006 (0.077)	0.006 (0.077)	0.005 (0.072)
Food at home price	Real state C2ER food at home price divided by (the cost of living * the CPI) in 2004 dollars	1.993 (0.147)	2.004 (0.149)	1.990 (0.146)
Fast food price	Real state C2ER fast food price divided by (the cost of living x the CPI) in 2004 dollars	5.194 (0.394)	5.243 (0.374)	5.184 (0.396)
Soda price	Real state C2ER Coke home price divided by (the cost of living x the CPI) in 2004 dollars	1.431 (0.243)	1.457 (0.240)	1.426 (0.243)
Cigarette price	Real state C2ER cigarette price divided by (the cost of living x the CPI) in 2004 dollars	24.14 (6.378)	23.76 (6.068)	24.22 (6.439)

V. Econometric Methods and Analysis

A. Estimation

I use several econometric techniques to estimate the ex ante moral hazard effect of the possession of health insurance on various measures of body composition. The baseline econometric model follows:

$$PBF_{it} = \alpha + \beta_1 I_{it} + \beta_2 X_{it} + \varepsilon_{it} \tag{4.1}$$

where I_{it} is a dichotomous indicator of whether the respondent possesses health insurance in year t, and X_{it} is the set of covariates. The dependent variable is PBF. All models have standard errors that were clustered to account for both heteroskedasticity and the fact that individuals are in the sample more than once.[19]

I also estimate the ex ante moral hazard effect of health insurance using BMI and the probability of obesity as the dependent variables. In NHANES III, self-reported height and weight of NLSY-aged white females underestimate actual BMI by an average of 1.58 percent, while males underestimate BMI by an average of 1.0 percent. I multiply self-reported weight and height in the NLSY by the coefficients reported in NHANES III according to the race-gender group in order to obtain more accurate measures of body composition.

I first estimate models with PBF and BMI as the dependent variables. OLS and models provide baseline estimates. I then compare these results with models that account for the endogeneity of the possession of health insurance. The instruments are the percentages of states' workforces employed in firms with sizes of 100 to 499 employees and 500+ employees. The U.S. Small Business Administration provides this data. Because health insurance is related to employment and firm size, literature has supported the use of these instruments (Fronstin, 2006).

[19] Since these models use measures of body composition constructed form the regressions coefficients that are transferred from the NHANES to the NLSY, the standard errors will be underestimated. Therefore all of our analyses contain bootstrapped standard errors, implemented with 399 replications.

Lewbel (2012) presents an alternative IV technique when instruments are weak or unavailable. This technique relies upon the presence of heteroskedasticity in the first-stage error term. The Breusch-Pagan test (1979) confirms the existence of heteroskedasticity in our models. The method defines a set of variables, Z, which includes all of the independent variables. The set may or may not include external instruments. The Lewbel IV procedure uses $(Z - Z\text{-average})\varepsilon_2$ as identifying instruments. Lewbel shows that the instrument can provide identification when $Cov(Z, \varepsilon_2^2) \neq 0$ and $Cov(Z, \varepsilon_1\varepsilon_2) = 0$. It is possible to estimate this model using 2SLS or generalized method of moments (GMM). I use 2SLS.

Due to the panel nature of the dataset, there are individual fixed effects that I must remove, especially since I am estimating the effect of a switch from not having insurance to having insurance. I thus estimate both Fixed Effects and Fixed-Effects 2SLS models.

Because I use panel data with the same respondents tracked throughout time, there are time-invariant, unobserved factors that might be correlated with both body composition and insurance. It is especially important to remove these individual Fixed Effects because I am estimating the effect of a switch from not having insurance to having insurance. To account for these factors, for BMI and PBF, I present Fixed Effects regressions and Fixed-Effects 2SLS regressions.

I also estimate the moral hazard effect of health insurance on dichotomous indicators of weight (i.e., overweight/obese, obese only, overweight only) using the probit method. Because of the reasons stated above, I also present Fixed Effects regressions as well as Fixed-Effect 2SLS regressions for the models using dichotomous indicators of body composition.

I first present models with a single insurance variable. Then I present models that estimate how the moral hazard effect differs by source of insurance, either private or public.

B. Results from models with single insurance variable

Table 4.3 presents results from the PBF regressions. The first column presents the OLS result. The second column presents the Fixed Effects result. The third column presents the 2SLS result. The fourth column presents the Lewbel model without external instruments. Finally, the fifth column presents the Lewbel model with external instruments. OLS, 2SLS and Lewbel IV models report statistically significant, positive effects of insurance on BMI. We may, however, question the results of the OLS, 2SLS and Lewbel IV models because these models do not take into account the time-invariant, unobserved heterogeneity of the panel data.

For the instruments in the 2SLS model, the F-test of their joint significance is 96.90, significantly larger than the value of 10 suggested by Bound, Jaeger, and Baker (1995). They also pass the overidentification test and as such are uncorrelated with the error term and excludable from the second-stage equation. However, the low first-stage R^2 values indicate that the instruments are weak, and the Hausman test does not reject the consistency of OLS. Therefore, the 2SLS estimates are unreliable.

The Lewbel IV models have strong first-stage F-statistics; however, they do not pass the overidentification test as they did in Kelly and Markowitz (2009). We can estimate the moral hazard effect of health insurance by using the Lewbel IV coefficient of 0.00555. Consider an average male with a height of 5'10" and a weight of 185 lbs. His PBF is 24.8 percent and his BMI is 26.54. A switch from no insurance to having insurance implies a weight gain of 4.0 pounds.[20] Removing individual fixed effects in the panel dataset, the Fixed Effects and Fixed-Effects 2SLS results are insignificant, even though the instruments pass the first-stage F-test as well as the overidentification test.

Table 4.4 presents results from the BMI regressions. All models report statistically significant

[20] In the model, percentage body fat of 25 percent correlates with a PBF value of 0.25.

results, including Fixed Effects with a p-value of 0.065 and 2SLS with a p-value of 0.059. The Lewbel IV models have strong first-stage F-statistics; however, they do not pass the overidentification test as they did in Kelly and Markowitz (2009). Using the Lewbel coefficient of 0.545, we can estimate the effect on BMI using the average male described above. An increase in BMI by one unit translates to a weight gain of 7.0 pounds; as such, an increase in BMI by 0.545 units translates to a weight gain of 3.8 pounds.

Using the Fixed Effects result of 0.10, which is significant at the 10 percent level, the switch from no insurance to having insurance translates into a weight gain of 0.7 pounds. This result is very small; the weight of the adult human body fluctuates in weight more than 0.7 pounds over the course of a day. The Fixed-Effects 2SLS result is insignificant, even though the instruments pass the first-stage F test as well as the overidentification test. These results call into question the existence of ex ante moral hazard.

The OLS, 2SLS and Lewbel IV estimates are larger than those of Kelly and Markowitz (2009); however, the Fixed Effects result is smaller than the OLS and 2SLS results. These results are opposite to the findings of Haque (2013), which are based on a sample of youth ages 18 to 24.

Table 4.5 presents the marginal effects from the probit models estimating the effect of health insurance on the probabilities of being (1) overweight or obese, 2) overweight, or 3) obese. While Kelly and Markowitz (2009) showed that health insurance had a positive effect on being overweight/obese and overweight, but not on being obese, I find that having insurance is associated with the following marginal effects on the dichotomous indicators of body composition: a significant increase of 5.2 percentage points in the probability of being overweight or obese, a somewhat significant increase of 1.3 percentage points in the probability of being overweight, and a significant increase of 3.4 percentage points in the probability of being obese. These results are opposite to the findings of Haque (2013).

Table 4.6 presents the results from the models estimating the effect of health insurance on the dichotomous indicators of body composition using Fixed Effects and Fixed-Effects 2SLS. Fixed Effects estimates that the possession of health insurance increases PBF by 1 percentage point, however, like with BMI, this result is only significant at the 10 percent level. The instruments do not pass the first-stage F test; all statistics are below 10.

Table 4.3. Effects of Health Insurance on PBF

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Fixed Effects	2SLS	Fixed-Effects 2SLS	Lewbel IV, no instruments	Lewbel IV, with instruments
Insurance	0.00643***	0.000815	0.0220*	-0.185	0.00523***	0.00555***
	(7.21)	(1.53)	(1.99)	(-0.09)	(3.81)	(4.04)
High School	0.000454	-0.00476**	-0.00224	-0.571***	0.000662	0.000606
	(0.38)	(-2.83)	(-1.02)	(-3.51)	(0.59)	(0.54)
Some College	0.0000265	-0.00621**	-0.00333	-0.833***	0.000285	0.000216
	(0.02)	(-2.71)	(-1.28)	(-3.85)	(0.24)	(0.18)
College	-0.00648***	-0.000511	-0.0104***	-0.322	-0.00617***	-0.00626***
	(-5.32)	(-0.19)	(-3.43)	(-1.30)	(-4.88)	(-4.94)
Education Missing	-0.00378	0.0126*	0.000515	1.173	-0.00411	-0.00402
	(-0.29)	(1.98)	(0.04)	-1.73	(-0.35)	(-0.34)
Age	0.00520***	0.00223***	0.00505***	0.183**	0.00521***	0.00521***
	(5.27)	(3.36)	(4.94)	-2.94	(5.08)	(5.07)
Age Square	-0.0000594***	-0.0000308***	-0.0000576***	-0.00282***	-0.0000596***	-0.0000595***
	(-4.21)	(-4.39)	(-3.96)	(-4.42)	(-4.04)	(-4.04)
Black	-0.00517***	.	-0.00542***	.	-0.00515***	-0.00516***
	(-7.46)	.	(-7.35)	.	(-7.79)	(-7.80)
Male	-0.110***	.	-0.110***	.	-0.110***	-0.110***
	(-198.70)	.	(-147.95)	.	(-185.92)	(-185.91)
Children	0.00192***	-0.000386	0.00189***	-0.0209	0.00193***	0.00193***
	(7.13)	(-1.64)	(6.73)	(-0.90)	(7.10)	(7.10)
Real Family Income	-0.0000692***	-0.00000131	-0.0000928***	-0.0004	-0.0000673***	-0.0000678***
	(-7.56)	(-0.26)	(-4.80)	(-0.42)	(-6.98)	(-7.03)
Real Family Income Squared	4.63e-08***	1.59E-09	6.62e-08***	0.000000365	4.48e-08***	4.52e-08***
	(5.77)	(0.40)	(4.01)	-0.48	(5.22)	(5.27)
Married	-0.00102	0.00436***	-0.00251	0.441**	-0.000908	-0.000939
	(-1.18)	(5.81)	(-1.74)	-2.84	(-1.05)	(-1.08)
Widowed	0.00822	-0.00871*	0.0075	-0.747*	0.00827*	0.00826*
	(1.62)	(-2.30)	(1.46)	(-2.32)	(2.00)	(1.99)
Divorced	-0.00936***	-0.00302***	-0.00940***	-0.257**	-0.00935***	-0.00935***
	(-9.34)	(-3.48)	(-9.26)	(-3.13)	(-9.93)	(-9.93)
Food at home price	0.0031	-0.00286	0.00197	-0.381*	0.00319	0.00316
	(1.18)	(-1.84)	(0.70)	(-2.15)	(1.20)	(1.19)
Fast food	-0.00107	0.000859	-0.000689	0.105	-0.0011	-0.00109
	(-1.08)	(1.07)	(-0.62)	-1.13	(-1.05)	(-1.05)
Soda price	0.0016	0.00146	0.00251	0.169	0.00152	0.00155
	(0.69)	(0.90)	(1.09)	-0.99	(0.63)	(0.64)
Cigarette price	-0.0000113	-0.0000183	-0.0000135	-0.000635	-0.0000111	-0.0000113
	(-0.14)	(-0.58)	(-0.18)	(-0.15)	(-0.14)	(-0.15)
State	0.0000164	-0.0000482	0.0000105	-0.00315	0.0000168	0.0000167
	(0.94)	(-1.62)	(0.55)	(-0.99)	(0.94)	(0.93)
Year	0.00189***	0.00269***	0.00196***	0.263***	0.00188***	0.00189***
	(8.89)	(5.93)	(9.15)	-5.53	(8.98)	(9.00)
Constant	-3.527***	-5.110***	-3.670***	-499.7***	-3.515***	-3.520***
	(-8.42)	(-5.74)	(-8.68)	(-5.39)	(-8.50)	(-8.51)
Number of observations	32143	32143	32143	32143	32143	32143
F-test on instruments			96.90	31.96	1074.27	1071.78
			(0.00)	(0.00)	(0.00)	(0.00)

Over identification test	2.713	0.188	80.115	75.998
	(0.1236)	(0.6649)	(0.00)	(0.00)
Regression (residual) test	1.93			
	(0.165)			

t statistics in parentheses, based on bootstrapped, robust standard errors that are clustered around individuals
Instruments are the percentage of workforce in firms of sizes 100-499 and 500+ workers
^p<0.10, * p<0.05, **p<0.01, *** p<0.001

Table 4.4. Effects of Health Insurance on BMI

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Fixed Effects	2SLS	Fixed-Effects 2SLS	Lewbel IV, no instruments	Lewbel IV, with instruments
Insurance	0.625***	0.100^	2.449^	0.00719	0.523***	0.545***
	(6.81)	(1.84)	(1.89)	(0.35)	(3.71)	(3.86)
High School	0.0274	-0.572**	-0.289	-0.00479**	0.045	0.0413
	(0.22)	(-3.26)	(-1.12)	(-3.03)	(0.39)	(0.36)
Some College	-0.0207	-0.842***	-0.415	-0.00641**	0.0013	-0.0033
	(-0.16)	(-3.69)	(-1.35)	(-3.04)	(0.01)	(-0.03)
College	-0.753***	-0.326	-1.216***	-0.000611	-0.727***	-0.733***
	(-5.70)	(-1.22)	(-3.42)	(-0.25)	(-5.61)	(-5.65)
Education Missing	-0.163	1.178	0.342	0.0127	-0.191	-0.185
	(-0.14)	(1.82)	(0.280)	(1.93)	(-0.16)	(-0.15)
Age	0.478***	0.184**	0.460***	0.00224***	0.479***	0.479***
	(4.90)	(2.65)	(4.28)	(3.70)	(4.55)	(4.54)
Age Square	-0.00578***	-0.00281***	-0.00557***	-0.0000307***	-0.00580***	-0.00579***
	(-4.09)	(-3.62)	(-3.58)	(-4.93)	(-3.83)	(-3.83)
Black	1.696***	.	1.666***	.	1.698***	1.697***
	(23.32)	.	(23.49)	.	(25.05)	(25.04)
Male	0.401***	.	0.470***	.	0.397***	0.398***
	(6.80)	.	(6.05)	.	(6.54)	(6.55)
Children	0.167***	-0.0223	0.163***	-0.000418	0.167***	0.167***
	(5.87)	(-0.92)	(5.71)	(-1.85)	(6.02)	(6.02)
Real Family Income	-0.00723***	-0.000505	-0.0100***	-0.00000366	-0.00708***	-0.00711***
	(-8.08)	(-0.99)	(-4.66)	(-0.40)	(-7.15)	(-7.19)
Real Family Income Squared	0.00000500***	0.00000045	0.00000734***	3.49E-09	0.00000487***	0.00000490***
	(6.44)	-1.1	(4.05)	(0.49)	(5.54)	(5.58)
Married	-0.0945	0.422***	-0.269	0.00395**	-0.0847	-0.0868
	(-1.03)	-5.67	(-1.72)	(2.61)	(-0.95)	(-0.98)
Widowed	1.160*	-0.73	1.076	-0.00834**	1.165**	1.164**
	(2.08)	(-1.72)	(1.87)	(-2.66)	(2.74)	(2.74)
Divorced	-0.914***	-0.256**	-0.919***	-0.00299***	-0.913***	-0.913***
	(-8.65)	(-2.88)	(-8.47)	(-3.73)	(-9.45)	(-9.45)
Food at home price	0.236	-0.396*	0.103	-0.00317	0.243	0.242
	(0.90)	(-2.56)	(0.36)	(-1.83)	(0.89)	(0.88)
Fast food	-0.108	0.113	-0.0631	0.00103	-0.111	-0.11
	(-0.99)	-1.41	(-0.59)	(1.14)	(-1.03)	(-1.03)
Soda price	0.18	0.157	0.288	0.00118	0.174	0.176
	(0.75)	-0.98	(1.10)	(0.71)	(0.70)	(0.70)
Cigarette price	0.00144	-0.0003	0.00118	-0.0000108	0.00146	0.00144
	(0.19)	(-0.08)	(0.14)	(-0.26)	(0.18)	(0.18)
State	0.00135	-0.00343	0.000658	-0.0000544	0.00139	0.00138
	(0.73)	(-1.15)	(0.33)	(-1.75)	(0.75)	(0.75)
Year	0.190***	0.260***	0.198***	0.00263***	0.190***	0.190***
	(8.86)	-5.76	(8.99)	(5.69)	(8.83)	(8.83)
Constant	-362.5***	-494.9***	-379.4***	-5.003***	-361.6***	-362.0***
	(-8.52)	(-5.58)	(-8.70)	(-5.54)	(-8.52)	(-8.53)

Number of observations	32143	32143	32143	32143	32143	32143
F-test on instruments			96.897	32.12	1074.27	1071.78
			(0.00)	(0.00)	(0.00)	(0.00)
Overidentification test			1.962	0.100	78.311	75.304
			(0.1613)	(0.7515)	(0.00)	(0.00)
Regression (residual) test			2.53			
			(0.112)			

t statistics in parentheses, based on bootstrapped, robust standard errors that are clustered around individuals
Instruments are the percentage of workforce in firms of sizes 100-499 and 500+ workers
^p<0.10, * p<0.05, **p<0.01, *** p<0.001 (Fixed Effects p-value 0.065; IV p-value 0.059)

Table 4.5. Marginal Effects of Health Insurance on the Probabilities of being Overweight and Obese, Probit

	(1)	(2)	(3)
	Overweight / obese	Overweight	Obese
	Probit	Probit	Probit
Insurance	0.052***	0.0131^	0.034***
	(6.21)	(1.71)	(4.94)
High School	0.024*	0.0351***	-0.012
	(2.24)	(3.41)	(-1.32)
Some College	0.016	0.0307**	-0.0148
	(1.36)	(2.73)	(-1.46)
College	-0.402***	0.0275*	-0.070***
	(-3.44)	(2.25)	(-6.75)
Educ Missing	-.071	-0.159	0.078
	(-0.58)	(-1.43)	-0.69
Age	0.039***	0.017	0.031***
	(3.87)	(1.78)	(3.62)
Age Square	-0.00051***	-0.000264	-0.00038**
	(-3.54)	(-1.83)	(-3.19)
Black	0.134***	0.0291***	0.103***
	(19.92)	(4.52)	(18.06)
Male	0.128***	0.143***	-0.0157**
	(22.81)	(25.75)	(-3.05)
Children	0.012***	-0.00065	0.0128***
	(4.83)	(-0.25)	(5.73)
Real Family Income	-0.00028**	0.000298***	-0.0006***
	(-3.12)	(3.51)	(-6.52)
Real Family Income Squared	0.000000146	-0.000000275***	0.00000041***
	(1.79)	(-3.59)	(5.01)
Married	0.0347***	0.041***	-0.007
	(4.29)	(5.42)	(-0.92)
Widowed	0.083*	-0.0416	0.103**
	(2.06)	(-1.00)	(2.86)
Divorced	-0.0362***	0.0328***	-0.0649***
	(-4.03)	(3.75)	(-8.59)
Food at home price	0.0382	0.0093	0.0196
	(1.52)	(0.37)	(0.86)
Fast food	-0.0116	0.00116	-0.0095
	(-1.13)	(0.12)	(-1.11)
Soda price	-0.00258	-0.00741	-0.00346
	(-0.11)	(-0.31)	(-0.17)
Cigarette price	-0.000301	-0.000554	-0.000039
	(-0.39)	(-0.76)	(-0.06)
State	0.00041*	0.00039*	0.00008
	(2.55)	(2.16)	(0.53)

Year	0.0168***	0.043*	0.0115***
	(8.69)	(2.27)	(6.45)
Number of observations	32143	32143	32143

t statistics in parentheses, based on bootstrapped, robust standard errors that are
clustered around individuals

^p<0.10, * p<0.05, **p<0.01, *** p<0.001 (overweight p-value 0.088)

Table 4.6 Marginal Effects of Health Insurance on the Probabilities of being Overweight and Obese, Fixed Effects and Fixed-Effects 2SLS

	(1)	(2)	(3)	(4)	(5)	(6)
	Overweight/obese		Overweight		Obese	
	Fixed Effects	Fixed-Effects 2SLS	Fixed Effects	Fixed-Effects 2SLS	Fixed Effects	Fixed-Effects 2SLS
Insurance	0.0109^	0.426	0.00355	0.664	0.00736	-0.239
	(1.67)	(1.28)	(0.41)	(1.46)	(1.28)	(-0.85)
High School	-0.0312	-0.0331	0.00417	0.00113	-0.0354	-0.0342
	(-1.33)	(-1.30)	(0.13)	(0.03)	(-1.71)	(-1.59)
Some College	-0.0358	-0.0491	0.0528	0.0316	-0.0886***	-0.0807**
	(-1.20)	(-1.45)	(1.34)	(0.68)	(-3.38)	(-2.82)
College	-0.0013	-0.00784	0.074	0.0636	-0.0753*	-0.0714*
	(-0.04)	(-0.20)	(1.57)	(1.20)	(-2.41)	(-2.18)
Educ Missing	-0.00878	-0.00163	-0.00723	0.00416	-0.00155	-0.00579
	(-0.09)	(-0.02)	(-0.06)	(0.03)	(-0.02)	(-0.06)
Age	0.0252**	0.0257**	0.0144	0.0153	0.0108	0.0105
	(2.790	(2.64)	(1.20)	(1.15)	(1.36)	(1.27)
Age Square	-0.000419***	-0.000406***	-0.000307*	-0.000287*	-0.000112	-0.000119
	(-4.55)	(-4.06)	(-2.52)	(-2.10)	(-1.38)	(-1.41)
Black	.	.	.	.	.	.
	.	.	.	.	.	.
Male	.	.	.	.	.	.
	.	.	.	.	.	.
Children	-0.00479	-0.00684	-0.00605	-0.00932	0.00126	0.00248
	(-1.60)	(-1.89)	(-1.52)	(-1.88)	(0.48)	(0.81)
Real Family Income	0.000112	-0.0000407	0.000286**	0.0000423	-0.000174**	-0.000083
	(1.47)	(-0.28)	(2.83)	(0.21)	(-2.59)	(-0.66)
Real Family Income Squared	-9.46E-08	2.87E-08	-0.000000241**	-0.000000045	0.000000147**	7.37E-08
	(-1.52)	(0.24)	(-2.93)	(-0.28)	(2.68)	(0.73)
Married	0.0585***	0.0314	0.0370**	-0.00617	0.0215*	0.0376
	(5.81)	(1.29)	(2.77)	(-0.19)	(2.42)	(1.82)
Widowed	-0.0755	-0.0513	-0.0853	-0.0466	0.00973	-0.00467
	(-1.75)	(-1.02)	(-1.49)	(-0.68)	(0.26)	(-0.11)
Divorced	-0.00899	-0.00712	0.0142	0.0172	-0.0232*	-0.0243*
	(-0.76)	(-0.55)	(0.91)	(0.98)	(-2.22)	(-2.23)
Food at home price	0.017	-0.00356	0.0753**	0.0426	-0.0584**	-0.0462*
	(0.82)	(-0.13)	(2.74)	(1.12)	(-3.19)	(-1.96)
Fast food	-0.00668	0.00423	-0.0124	0.00501	0.00569	-0.000781
	(-0.62)	(0.29)	(-0.87)	(0.25)	(0.60)	(-0.06)
Soda price	-0.00246	-0.0207	-0.0457	-0.0747*	0.0432*	0.0540*
	(-0.12)	(-0.77)	(-1.66)	(-2.04)	(2.36)	(2.38)
Cigarette price	-0.000248	0.000238	-0.000682	0.0000934	0.000433	0.000145
	(-0.50)	(0.36)	(-1.04)	(0.10)	(0.99)	(0.26)
State	-0.000857*	-0.00125*	-0.000671	-0.0013	-0.000186	0.0000502
	(-2.40)	(-2.51)	(-1.42)	(-1.91)	(-0.59)	(0.12)
Year	0.0222***	0.0185*	0.00927	0.00341	0.0129*	0.0151*
	(3.50)	(2.49)	(1.11)	(0.34)	(2.31)	(2.39)
Constant	-43.95***	-36.96*	-18.33	-7.188	-25.62*	-29.77*
	(-3.54)	(-2.55)	(-1.12)	(-0.36)	(-2.34)	(-2.42)
Number of observations	32143	32143	32143	32143	32143	32143

F-test on instruments	8.77	3.53	9.89
	0.00	(0.00)	(0.00)

t statistics in parentheses, based on bootstrapped, robust standard errors that are clustered around individuals
^p<0.10, * p<0.05, **p<0.01, *** p<0.001 (overweight fixed-effects value 0.095)

C. Results from models with sources of insurance variables

I break down the ex ante moral hazard of health insurance by its source. Similarly to Bhattacharya et al. (2011), I compare the effects of private insurance and public insurance. Private insurance includes all non-Medicaid coverage, while public insurance is equivalent to coverage under Medicaid. Unlike the analysis in Section IV.B., I include unemployed individuals in this analysis in order to include a greater proportion of individuals obtaining coverage via Medicaid.

Table 4.7 presents results from the PBF regressions. The OLS and Lewbel IV estimates indicate that public insurance has a greater positive impact on PBF than private insurance. For the instruments in the 2SLS model, the F-test of their joint significance is 96.90, significantly larger than the value of 10 suggested by Bound, Jaeger, and Baker (1995). The model is exactly identified as there are two endogenous variables, private insurance and public insurance, and two instruments, the percentages of states' workforces employed in firms with sizes of 100 to 499 employees and 500+ employees. However, the low first-stage R^2 values indicate that the instruments are weak. The Hausman test on the public variable rejects the consistency of OLS.

The Lewbel IV models have strong first-stage F-statistics; however, they do not pass the overidentification test. We can estimate the moral hazard effect of health insurance by using rounded-off Lewbel IV coefficients of 0.007 for private insurance and 0.010 for public insurance. A switch from no insurance to having private insurance implies a 0.7 percentage point increase in PBF, and a switch from no insurance to having public insurance implies a 1.0 percentage point increase in PBF. Using the average male described above, the respective effects on body weight are 5.9 pounds and 7.9 pounds. Fixed Effects and Fixed-Effects 2SLS results are insignificant. Instruments pass the first-stage F-test. These results call into question the existence of ex ante moral hazard.

Table 4.8 presents results from the BMI regressions. The Lewbel IV coefficients are 0.638 for private insurance and 1.216 for public insurance. These results are similar to those of Bhattacharya et al. (2011) in that the moral hazard effect is greater for public insurance; however, these results are smaller than their estimates of 1.3 and 2.6 for private and public insurance, respectively. Using the average male described above, so an increase in BMI by 0.7 units translates to a weight gain of 4.5 pounds, and an increase in BMI by 1.2 units translates to a weight gain of 8.4 pounds. Fixed Effects and Fixed-Effects 2SLS results are insignificant. Instruments pass the first-stage F test.

Table 4.9 presents the marginal effects from the probit models involving the probabilities of being (1) overweight or obese; 2) overweight; or 3) obese. I find that having private insurance is associated with an increase of 5.0 percentage points in the probability of being overweight or obese, an increase of 1.5 percentage points in the probability of being overweight, and an increase of 3.2 percentage points in the probability of being obese. Having public insurance is associated with an increase of 7.4 percentage points in the probability of being overweight or obese, and an increase of 6.2 percentage points in the probability of being obese. These coefficients, however, may be overestimated as there may be additional differences between individuals with private insurance and individuals on Medicaid that are not captured by the models. See Figure 4.1.

Table 4.10 presents the results from the models involving dichotomous indicators of body composition, using Fixed Effects and Fixed-Effects 2SLS to account for individual fixed effects and endogeneity. There are no significant results. Instruments fail the F-test in the overweight/obese and overweight regressions.

Table 4.7. Effects of Private and Public Health Insurance on PBF

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Fixed Effects	2SLS	Fixed-Effects 2SLS	Lewbel IV, no instruments	Lewbel IV, with instruments
Private	0.00590***	0.000157	0.00583	0.105	0.00792***	0.00719***
	(7.91)	(0.40)	(0.40)	-0.03	(4.89)	(4.58)
Public	0.0129***	-0.00053	0.0737	13.02	0.00999***	0.00960***
	(8.06)	(-0.52)	(1.67)^	-0.23	(6.50)	(6.27)
High School	-0.000517	-0.00374*	0.00474	-0.499*	-0.00121	-0.00108
	(-0.50)	(-2.17)	(0.76)	(-1.98)	(-1.25)	(-1.12)
Some College	-0.000362	-0.00408*	0.0061	-0.0637	-0.00124	-0.00107
	(-0.34)	(-1.99)	(0.78)	(-0.03)	(-1.14)	(-0.99)
College	-0.00724***	0.00165	-0.000988	0.443	-0.00820***	-0.00800***
	(-6.23)	(0.66)	(-0.12)	-0.23	(-7.01)	(-6.88)
Education Missing	-0.00309	0.00912	-0.000544	1.711	-0.00264	-0.00286
	(-0.25)	(1.79)	(-0.04)	-0.85	(-0.26)	(-0.28)
Age	0.00482***	0.00247***	0.00501***	0.367	0.00482***	0.00481***
	(4.92)	(4.05)	(4.95)	-0.53	(5.04)	(5.04)
Age Square	-0.0000555***	-0.0000380***	-0.0000585***	-0.00545	-0.0000554***	-0.0000554***
	(-3.92)	(-5.95)	(-4.00)	(-0.70)	(-4.02)	(-4.01)
Black	-0.00606***	.	-0.00846***	.	-0.00590***	-0.00590***
	(-9.48)	.	(-3.90)	.	(-9.61)	(-9.62)
Male	-0.111***	.	-0.107***	.	-0.111***	-0.111***
	(-198.04)	.	(-39.96)	.	(-200.24)	(-200.26)
Children	0.00172***	-0.000560**	-0.000625	-0.27	0.00188***	0.00188***
	(6.59)	(-2.64)	(-0.31)	(-0.27)	(7.69)	(7.68)
Real Family Income	-0.0000752***	0.000000583	-0.0000338	0.000491	-0.0000819***	-0.0000805***
	(-8.92)	(0.11)	(-0.58)	-0.18	(-8.75)	(-8.63)
Real Family Income Squared	5.04e-08***	5.23E-10	1.58E-08	-0.000000284	5.61e-08***	5.48e-08***
	(6.78)	(0.12)	(0.32)	(-0.15)	(6.73)	(6.60)
Married	0.000365	0.00520***	0.00714	0.822	-0.000270	-0.000200
	(0.44)	(7.69)	(1.09)	-0.69	(-0.33)	(-0.25)
Widowed	0.00272	-0.00565	0.00745	-0.0207	0.00241	0.00241
	(0.60)	(-1.60)	(1.29)	(-0.01)	(0.69)	(0.69)
Divorced	-0.00827***	-0.00279***	-0.00592**	-0.38	-0.00846***	-0.00845***
	(-9.18)	(-3.31)	(-2.67)	(-0.58)	(-9.87)	(-9.86)
Food at home price	0.00276	-0.00285*	0.00651	-0.0144	0.00220	0.00231
	(1.07)	(-2.02)	(1.12)	(-0.01)	(0.89)	(0.93)
Fast food	-0.000193	0.000766	0.00151	0.316	-0.000239	-0.000263
	(-0.19)	(1.07)	(0.96)	-0.29	(-0.25)	(-0.28)
Soda price	0.000851	0.00208	0.000115	0.0582	0.000876	0.000898
	(0.38)	(1.57)	(0.05)	-0.06	(0.40)	(0.41)
Cigarette price	-0.0000147	-0.0000311	-0.0000815	0.00335	-0.00000242	-0.00000574
	(-0.21)	(-0.96)	(-0.66)	-0.09	(-0.03)	(-0.08)
State	0.0000208	-0.0000369	0.0000217	0.00396	0.0000199	0.0000202
	(1.29)	(-1.45)	(1.11)	-0.15	(1.20)	(1.21)
Year	0.00192***	0.00291***	0.00224***	0.291***	0.00188***	0.00189***
	(10.13)	(7.23)	(5.59)	-3.51	(9.69)	(9.74)
Constant	-3.581***	-5.556***	-4.261***	-562.8***	-3.495***	-3.514***
	(-9.60)	(-7.03)	(-5.21)	(-3.82)	(-9.14)	(-9.19)
Number of observations	41083	41083	41083	41083	41083	41083

F-test on instruments	11.830	18.72	289.98	281.26
	(0.00)	(0.00)	(0.00)	(0.00)
Overidentification test	(exactly identified)	(exactly identified)	142.410	156.989
			(0.00)	(0.00)
Regression (residual) test - private	1.120			
	(0.2892)			
Regression (residual) test - public	22.80			
	(0.00)			
Joint test of private and public	16.70			
	(0.00)			

t statistics in parentheses, based on bootstrapped, robust standard errors that are clustered around individuals
Instruments are the percentage of workforce in firms of sizes 100-499 and 500+ workers
^p<0.10, * p<0.05, **p<0.01, *** p<0.001 (IV public significant at 0.095 level)

Table 4.8. Effects of Private and Public Health Insurance on BMI

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	Fixed Effects	2SLS	Fixed-Effects 2SLS	Lewbel IV, no instruments	Lewbel IV, with instruments
Private	0.561***	0.039	1.259	-0.0142	0.732***	0.638***
	*(7.50)	(0.96)	(0.93)	(-0.48)	(4.44)	(3.99)
Public	1.483***	0.00623	5.595	-0.115	1.270***	1.216***
	(8.82)	(0.06)	(1.20)	(-0.22)	(8.11)	(7.80)
High School	-0.162	-0.493**	0.0377	-0.00299	-0.218*	-0.202*
	(-1.54)	(-2.92)	(0.06)	(-1.28)	(-2.21)	(-2.05)
Some College	-0.165	-0.536*	0.073	-0.00727	-0.236*	-0.215
	(-1.55)	(-2.54)	(0.09)	(-0.41)	(-2.13)	(-1.95)
College	-0.917***	-0.0568	-0.725	-0.0015	-0.995***	-0.969***
	(-8.01)	(-0.23)	(-0.87)	(-0.08)	(-8.36)	(-8.19)
Education Missing	0.307	1.268**	0.678	0.00563	0.346	0.318
	(0.21)	(3.15)	(0.47)	(0.30)	(0.33)	(0.31)
Age	0.478***	0.211***	0.491***	0.00108	0.477***	0.477***
	(4.93)	(3.30)	(4.80)	(0.17)	(4.91)	(4.90)
Age Square	-0.00580***	-0.00369***	-0.00602***	-0.0000223	-0.00579***	-0.00579***
	(-4.04)	(-5.66)	(-4.05)	(-0.31)	(-4.13)	(-4.12)
Black	1.576***	.	1.432***	.	1.589***	1.589***
	(24.58)	.	(6.52)	.	(25.43)	(25.43)
Male	0.337***	.	0.546	.	0.321***	0.320***
	(5.97)	.	(1.93)	.	(5.71)	(5.69)
Children	0.129***	-0.0369	-0.0126	0.00142	0.142***	0.142***
	(4.96)	(-1.70)	(-0.06)	(0.15)	(5.70)	(5.69)
Real Family Income	-0.00782***	-0.000435	-0.00667	-0.000000209	-0.00836***	-0.00818***
	(-9.46)	(-0.92)	(-1.17)	(-0.01)	(-8.77)	(-8.62)
Real Family Income Squared	0.00000538***	0.000000408	0.00000447	-1.94E-10	0.00000585***	0.00000569***
	(7.46)	(1.08)	(0.93)	(-0.01)	(6.90)	(6.74)
Married	0.0446	0.517***	0.393	0.00328	-0.00587	0.00274
	(0.52)	(7.13)	(0.59)	(0.30)	(-0.07)	(0.03)
Widowed	0.555	-0.411	0.845	-0.00985	0.531	0.531
	(1.31)	(-1.39)	(1.37)	(-0.56)	(1.49)	(1.49)
Divorced	-0.812***	-0.219*	-0.678**	-0.00164	-0.827***	-0.825***
	(-8.43)	(-2.48)	(-2.92)	(-0.27)	(-9.48)	(-9.46)
Food at home price	0.24	-0.398**	0.36	-0.00355	0.195	0.209
	(0.93)	(-2.94)	(0.68)	(-0.32)	(0.77)	(0.83)
Fast food	-0.0231	0.0995	0.103	-0.00185	-0.0262	-0.0294
	(-0.23)	(1.42)	(0.63)	(-0.18)	(-0.27)	(-0.30)
Soda price	0.113	0.201	0.0639	0.00501	0.115	0.117
	(0.51)	(1.39)	(0.27)	(0.55)	(0.51)	(0.52)
Cigarette price	0.00072	-0.00151	-0.000727	-0.000153	0.00173	0.00133
	(0.10)	(-0.43)	(-0.06)	(-0.44)	(0.24)	(0.18)
State	0.0013	-0.00251	0.00105	-0.0000814	0.00122	0.00126
	(0.79)	(-1.00)	(0.58)	(-0.34)	(0.72)	(0.75)
Year	0.184***	0.290***	0.198***	0.00320***	0.181***	0.182***
	(9.93)	(7.01)	(4.43)	(4.17)	(9.19)	(9.24)
Constant	-351.2***	-554.5***	-379.7***	-6.072***	-344.3***	-346.5***
	(-9.54)	(-6.83)	(-4.19)	(-4.45)	(-8.84)	(-8.90)
Number of observations	41083	41083	41083	41083	41083	41083

F-test on instruments	11.830	18.72	289.98	281.26
	(0.00)	(0.00)	(0.00)	(0.00)
Overidentification test	(exactly identified)	(exactly identified)	134.775	158.543
			(0.00)	(0.00)
Regression (residual) test - private	0.260			
	(0.609)			
Regression (residual) test - public	0.880			
	(0.348)			
Joint test of private and public	1.250			
	(0.288)			

t statistics in parentheses, based on bootstrapped, robust standard errors that are clustered around individuals
Instruments are the percentage of workforce in firms of sizes 100-499 and 500+ workers
^p<0.10, * p<0.05, **p<0.01, ***
p<0.001

Table 4.9. Marginal Effects of Private and Public Health Insurance on the Probabilities of being Overweight and Obese, Probit

	(1)	(2)	(3)
	Overweight / obese	Overweight	Obese
	Probit	Probit	Probit
Private	0.050***	0.0153*	0.032***
	(7.42)	(2.38)	(5.99)
Public	0.074***	0.010	0.062***
	(6.45)	(0.85)	(6.31)
High School	0.0101	0.037***	-0.0255***
	(1.17)	(4.31)	(-3.47)
Some College	0.0039	0.0328***	-0.0265***
	(0.41)	(3.51)	(-3.33)
College	-0.0554***	0.0248*	-0.079***
	(-5.62)	(2.55)	(-9.46)
Education Missing	-0.0968	-0.177	0.071
	(-0.95)	(-1.82)	(0.75)
Age	0.0337***	0.0082	0.033***
	(3.64)	(0.94)	(4.24)
Age Square	-0.00045***	-0.000149	-0.00041***
	(-3.38)	(-1.20)	(-3.63)
Black	0.125***	0.0297***	0.094***
	(20.22)	(5.46)	(18.96)
Male	0.120***	0.140***	-0.021***
	(25.48)	(27.46)	(-4.77)
Children	0.0125***	0.00162	0.0106***
	(5.34)	(0.80)	(5.55)
Real Family Income	-0.000384***	0.000249**	-0.00066***
	(-4.81)	(3.22)	(-8.71)
Real Family Income Squared	0.000000208**	-0.000000252***	0.00000045***
	(2.82)	(-3.73)	(6.60)
Married	0.034***	0.042***	0.00144
	(5.99)	(5.60)	(0.23)
Widowed	0.098**	0.046	0.042
	(3.09)	(1.42)	(1.53)
Divorced	-0.0282***	0.032***	-0.057***
	(-3.51)	(3.87)	(-8.07)
Food at home price	0.0293	-0.005	0.026
	(1.31)	(-0.22)	(1.35)
Fast food	-0.0042	0.000057	-0.00184
	(-0.48)	(0.01)	(-0.24)
Soda price	0.00046	0.0108	-0.0171
	(0.02)	(0.54)	(-1.01)
Cigarette price	-0.0003	-0.00056	0.0000036
	(-0.45)	(-0.84)	(0.01)

State	0.000384*	0.00038**	0.000036
	(2.56)	(2.67)	(0.26)
Year	0.0172***	0.0063***	0.01***
	(9.45)	(3.55)	(6.65)
Number of observations	41083	41083	41083

t statistics in parentheses, based on bootstrapped, robust standard errors that are clustered around individuals
^p<0.10, * p<0.05, **p<0.01, *** p<0.001

Figure 4.1. Marginal Effects of Private and Public Health Insurance on the Probabilities of being Overweight and Obese

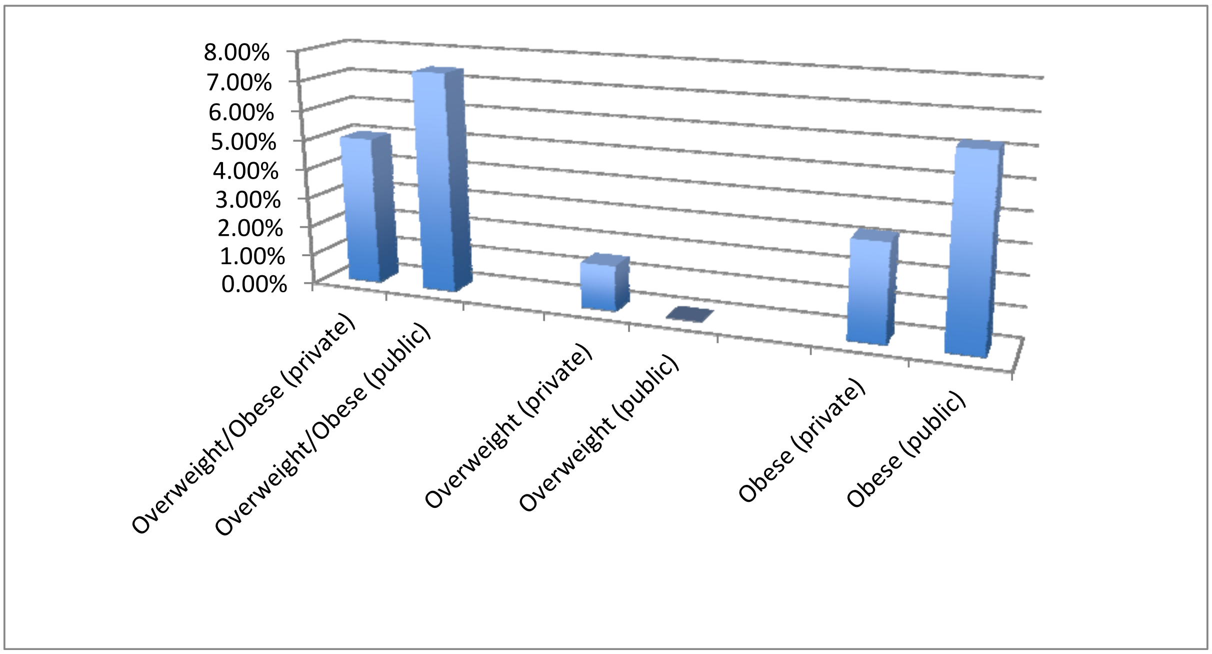


Table 4.10. Marginal Effects of Private and Public Health Insurance on the Probabilities of being Overweight and Obese, Fixed Effects and Fixed-Effects 2SLS

	(1)	(2)	(3)	(4)	(5)	(6)
	Overweight/obese		Overweight		Obese	
	Fixed Effects	Fixed-Effects 2SLS	Fixed Effects	Fixed-Effects 2SLS	Fixed Effects	Fixed-Effects 2SLS
Private	-0.00631	-3.316	-0.00294	-8.163	-0.00337	4.846
	(-0.63)	(-0.29)	(-0.22)	(-0.31)	(-0.38)	(0.31)
Public	0.00493	-0.0979	0.00193	-0.238	0.003	0.14
	(1.00)	(-0.15)	(0.30)	(-0.16)	(0.69)	(0.16)
High School	-0.0462**	-0.0403	-0.0373	-0.0235	-0.00889	-0.0168
	(-2.60)	(-0.79)	(-1.60)	(-0.20)	(-0.57)	(-0.24)
Some College	-0.0557*	-0.17	-0.0209	-0.303	-0.0349	0.133
	(-2.37)	(-0.44)	(-0.68)	(-0.35)	(-1.69)	(0.26)
College	-0.0288	-0.148	-0.0124	-0.308	-0.0165	0.16
	(-0.99)	(-0.37)	(-0.32)	(-0.34)	(-0.65)	(0.29)
Education Missing	0.0586	-0.0517	0.0103	-0.262	0.0483	0.21
	(0.77)	(-0.13)	(0.10)	(-0.28)	(0.73)	(0.38)
Age	0.0235**	-0.0164	0.0117	-0.0865	0.0118	0.0701
	(2.93)	(-0.12)	(1.12)	(-0.27)	(1.68)	(0.37)
Age Square	-0.000440***	0.00000944	-0.000295**	0.000812	-0.000145*	-0.000803
	(-5.37)	(0.01)	(-2.76)	(0.23)	(-2.02)	(-0.37)
Black	.	.	.	.	.	.
	.	.	.	.	.	.
Male	.	.	.	.	.	.
	.	.	.	.	.	.
Children	-0.00759**	0.0512	-0.00852*	0.137	0.000931	-0.0853
	(-2.95)	(0.25)	(-2.53)	(0.30)	(0.41)	(-0.31)
Real Family Income	0.0000776	-0.000112	0.000235**	-0.00024	-0.000158**	0.000128
	(1.15)	(-0.20)	(2.66)	(-0.19)	(-2.67)	(0.17)
Real Family Income Squared	-7.62E-08	5.73E-08	-0.000000212**	0.000000124	0.000000135**	-6.68E-08
	(-1.38)	(0.15)	(-2.93)	(0.14)	(2.80)	(-0.13)
Married	0.0679***	-0.0049	0.0323**	-0.148	0.0355***	0.143
	(7.44)	(-0.02)	(2.71)	(-0.27)	(4.45)	(0.44)
Widowed	0.00162	-0.103	-0.0213	-0.277	0.0229	0.175
	(0.05)	(-0.27)	(-0.45)	(-0.32)	(0.73)	(0.33)
Divorced	-0.00594	0.0333	0.00413	0.101	-0.0101	-0.0679
	(-0.56)	(0.25)	(0.30)	(0.33)	(-1.08)	(-0.37)
Food at home price	0.0125	-0.0684	0.0704**	-0.132	-0.0579***	0.0632
	(0.68)	(-0.28)	(2.95)	(-0.24)	(-3.62)	(0.19)
Fast food	-0.00203	-0.0616	-0.011	-0.157	0.00901	0.0955
	(-0.22)	(-0.28)	(-0.91)	(-0.31)	(1.11)	(0.32)
Soda price	0.000829	0.0476	-0.026	0.0877	0.0268	-0.0401
	(0.05)	(0.24)	(-1.10)	(0.19)	(1.69)	(-0.15)
Cigarette price	-0.000219	-0.00195	-0.000465	-0.00466	0.000245	0.00271
	(-0.50)	(-0.25)	(-0.81)	(-0.27)	(0.64)	(0.26)
State	-0.00102***	-0.00259	-0.000960*	-0.00484	-0.000059	0.00225
	(-3.42)	(-0.49)	(-2.46)	(-0.40)	(-0.23)	(0.31)
Year	0.0249***	0.0264	0.0117	0.0154	0.0131**	0.0111
	(4.42)	(1.56)	(1.60)	(0.40)	(2.66)	(0.48)

Constant	-49.24***	-50.82	-23.14	-26.43	-26.10**	-24.39
	(-4.47)	(-1.69)	(-1.61)	(-0.39)	(-2.70)	(-0.60)
Number of observations	41083	41083	41083	41083	41083	41083
F-test on instruments		1.57		0.73		10.79
		(0.00)		(0.00)		(0.00)

t statistics in parentheses, based on bootstrapped, robust standard errors that are clustered around individuals
^p<0.10, * p<0.05, **p<0.01, ***
p<0.001

V. Conclusion

The purpose of this paper is to estimate the ex ante moral hazard effects of health insurance possession on body composition in the United States. Most previous studies have shown that health insurance contributes to small increases in measures of body composition, while Haque (2013) estimated the opposite result with a young sample. I analyze data from the 1990 to 2002 waves of the NLSY, augmented with food and tobacco prices for C2ER as well as state firm size data from the U.S. Small Business Administration. Using methods of OLS, 2SLS, and probit, I find that there is ex ante moral hazard associated with the possession of health insurance. Unlike the results of Kelly and Markowitz (2009), I find that insurance has a positive impact on the probability of obesity.

I also estimate how the ex ante moral hazard effect differs between private and public health insurance. Public health insurance has a greater impact on waistlines, whether the measure of body composition is PBF, BMI, or the probabilities of being overweight and obese. By protecting people from the costs of obesity-related medical care expenditures, insurance coverage may causes ex ante moral hazard. These effects are larger in public insurance programs where premiums are lower and not risk adjusted, and smaller in private insurance markets where the overweight and obese might pay for medical care costs in the form of lower wages. Private insurance results in a weight gain of 4.5 pounds and the existence of public insurance results in a weight gain of 8.4 pounds. Further, private insurance increases the probability of being overweight or obese by 5.0 percent, and the existence of public insurance increases the probability of being overweight or obese by 7.4 percent.

The issue with the preliminary models is that they do not control for time-invariant, unobserved heterogeneity. With the exception of the very small effects of insurance on BMI as well as the probability of being overweight or obese, Fixed-Effects and Fixed-Effects 2SLS models estimate insignificant results. Thus, the evidence is inconclusive as to whether the possession of health insurance causes ex ante moral hazard.

Chapter 5

Discussion

The goal of this dissertation is to provide a better understanding of the economic causes and consequences of obesity. Regarding the relationships between socioeconomic status and body composition, there are two stories studied in previous literature: (1) overweight and obesity lead to lower wages; (2) low family income and low wages contribute to overweight and obesity. I study both relationships using a dataset comprised of the most recent years of data available in the National Longitudinal Survey of Youth. It also incorporates Percentage Body Fat, a newer measure of body composition that researchers consider potentially more accurate.

I estimate that there is a statistically significant wage penalty for overweight and obese individuals. A rise in Percentage Body Fat is associated with decreases in the wages of white males and females. For blacks, there is some evidence of an opposite effect. I hypothesize that the negative impact of excess weight on wages is larger at higher levels of income. A quantile regression analysis provides some evidence that, at least for females, the penalty associated with increased Percentage Body Fat is larger at higher levels of income. Higher-level positions require more education, which itself is associated with better health, as well as perhaps a slimmer figure to promote a certain image. As such, slimness commands a wage premium.

While, it could be that low wages contribute to excess weight because poorer individuals consume cheaper, high-calorie food, and exercise less because they may live in relatively unsafe neighborhoods, I find that family income is associated with small changes in measures of body composition, consistent with previous literature. While we would expect a larger income to provide families with more options in terms of diet and exercise, our analysis cannot prove that income has a sizeable impact on body composition. This is partially because approximately 70 percent of Americans are overweight or obese. The problem exists throughout the wage and income distributions.

I then turn to the relationship between health insurance and body composition. Previous literature has generally shown that the possession of health insurance creates ex ante moral hazard; however, some of the literature has estimated that possession of health insurance contributes to smaller waistlines. I analyze NLSY data, augmented with food and cigarette prices from the Council for Community and Economic Research, to study the effects of the possession of health insurance on body composition. Results show that possession of health insurance has statistically significant positive effects on body composition, measured three ways: percentage body fat, body mass index, and overweight and obesity indicators. I hypothesize that the effect is larger when an individual is covered by government health insurance, and smaller when the individual is covered by private insurance. The analysis shows that the moral hazard effect is larger when Medicaid covers the individual. When I control for individual fixed effects and endogeneity, however, results are slim at best, and in most cases, insignificant. Thus it is inconclusive whether health insurance possession causes ex ante moral hazard.

Individuals with health insurance have a safety net in the event of illness and thus may take their health for granted more than individuals without health insurance. They might exercise less and eat a less healthy diet. The reader should not conclude from my study that denying health insurance to overweight and obese individuals is a solution. Overweight and obesity have a number of significant causes, among them urban sprawl, farm subsidies, changes in home economics and the often economic necessity of having both parents work outside of the home, technology that makes both work and leisure more sedentary, the addictive nature of fast food, and declining rates of smoking. Because a vast majority of Americans are overweight and obese, we cannot simply blame individuals for their choices in terms of diet and exercise. There are societal influences on our daily lifestyles, the type of food we can afford to eat, the neighborhoods in which we can afford to live, and our socioeconomic status.

Any plan to address this problem must be multi-faceted, involving nutrition and exercise education, taxes on fuel, and perhaps taxes on junk food. People need to understand that excess body weight is associated with nearly every disease that affects the human body, as well as significant economic consequences. Employers and insurance plans can provide incentives for individuals to lose weight, ideally without overweight and obese individuals feeling that they are being discriminated against. The ultimate goal of health insurance should be the promotion of health, not insurance against poor choices in terms of diet and lifestyle.

As of December 2013, Congress is considering a redesign of the food stamp program whereby it would financially reward individuals for buying healthy food (Cook, 2013). Ultimately, financial incentives are more effective than moral guidance. This public health epidemic requires an effective governmental response. The government was heavily involved in the anti-smoking campaign. Public education regarding the harmful health effects of tobacco, as well as steep taxes on cigarettes, resulted in a steep decline in the rate of smoking. Obesity and overweight in adulthood are associated with large decreased in life expectancy and increases in early mortality, and the effects are similar to those seen with smoking (Peeters et al., 2003). Policymakers need to think along these lines when designing policies and legislation for nutrition, health, taxation, and education. The government ultimately bears much of the cost of healthcare in this country through Medicare and Medicaid. In 2012, the federal government financed 26 percent of total health spending.[21] The federal government will pay half of all

[21]Source: http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/downloads/highlights.pdf.

healthcare costs by 2020.[22] Thus, the government is responsible for implementing policies to reduce these costs. The health economics field, in addition to scientific and psychology fields, has provided a great deal of information to help us understand the economic causes and consequences of obesity. We can use this information to do something about the number one public health challenge of our time.

[22] Source: http://money.cnn.com/2011/07/28/news/economy/healthcare_spending_forecast.

Appendix 2.A. OLS Regressions - PBF

Log Wage	White Males	White Females	Black Males	Black Females
Percentage Body Fat	-0.0730	-0.664***	0.603*	-0.380*
	(-0.34)	(-4.46)	(2.31)	(-2.09)
Health Limitation	-0.208***	-0.149***	-0.339***	-0.194***
	(-6.69)	(-4.48)	(-4.72)	(-3.96)
AFQT	0.00366***	0.00402***	0.00592***	0.00712***
	(9.27)	-7.96	(8.00)	(8.80)
AFQT Missing	-0.0397	-0.0608	-0.047	0.0309
	(-1.00)	(-1.36)	(-0.62)	(0.39)
Mother's Education	0.0024	0.000176	0.0025	0.00468
	(0.54)	-0.03	(0.42)	(0.71)
Father's Education	0.00740*	0.0057	0.00247	0.00132
	(2.09)	-1.44	(0.55)	(0.29)
Children	0.0286***	-0.0638***	0.017	-0.0266**
	(3.62)	(-7.36)	(1.76)	(-2.73)
Attending School	-0.223***	-0.103**	-0.211**	-0.0864
	(-6.63)	(-2.92)	(-2.79)	(-1.92)
Marital Status	0.131***	0.0229	0.134***	0.000928
	(7.82)	-1.35	(5.64)	(0.04)
High School	0.0681**	0.103***	0.0738*	0.115**
	(2.75)	-3.71	(2.27)	(2.99)
Some College	0.183***	0.240***	0.176***	0.218***
	(5.90)	-6.97	(3.98)	(5.01)
College	0.348***	0.327***	0.391***	0.309***
	(9.84)	-8.02	(7.44)	(5.29)
Education Missing	-0.272	-0.165	0.192	.
	(-1.22)	(-1.00)	(0.99)	.
Age	0.0367***	0.0925***	0.00291	0.0494***
	(4.79)	-9.29	(0.23)	(4.14)
Age Squared	-0.000543***	-0.00143***	-0.000128	-0.000859***
	(-5.26)	(-10.68)	(-0.77)	(-5.51)
Tenure (weeks)	0.000307***	0.000415***	0.000495***	0.000426***
	(9.90)	-10.54	(11.97)	(8.80)
Urban	0.120***	0.0812***	0.0476	0.118***
	(8.94)	-5.16	(1.80)	(3.68)
Northeast	0.0990***	0.132***	0.134***	0.230***
	(4.13)	-4.78	(4.26)	(6.49)
West	0.0329	0.0986**	0.188***	0.143**
	(1.29)	-3.24	(4.10)	(2.64)
Midwest	-0.0454*	-0.0302	-0.0371	0.0277
	(-2.32)	(-1.24)	(-1.12)	(0.85)
State Unemployment Rate	-0.0032	0.0139***	-0.0123*	0.00707
	(-0.99)	-3.74	(-2.29)	(1.44)
Blue-collar	-0.0522**	-0.0705*	-0.0601*	-0.0645
	(-3.15)	(-2.51)	(-2.37)	(-1.68)
Year	0.0125**	0.0168***	0.00486	0.0177**
	(3.14)	-3.53	(0.85)	(3.06)
Constant	-23.49**	-32.79***	-7.701	-34.06**
	(-2.98)	(-3.50)	(-0.68)	(-2.99)
Number of Obs	24180	18745	8913	7837

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 2.B. Fixed Effects Regressions - PBF

Log Wage	White Males	White Females	Black Males	Black Females
Percentage Body Fat	-0.0192	-0.0567	1.004**	0.523*
	(-0.08)	(-0.29)	(3.17)	(2.25)
Health Limitation	-0.0943***	-0.0561*	-0.140**	-0.0829*
	(-4.27)	(-1.98)	(-2.78)	(-2.11)
AFQT	.	.	.	.
	.	.	.	.
AFQT Missing	.	.	.	.
	.	.	.	.
Mother's Education		.	.	.
	.	.	.	.
Father's Education	.	.	.	.
	.	.	.	.
Children	0.0235***	-0.0466***	0.0133	-0.0289**
	(4.11)	(-5.79)	(1.61)	(-3.16)
Attending School	-0.159***	-0.132***	-0.176**	-0.0805
	(-5.49)	(-4.03)	(-3.05)	(-1.89)
Marital Status	0.0444***	0.00173	0.0586***	-0.00238
	(3.67)	(0.12)	(3.44)	(-0.13)
High School	-0.196***	0.0259	0.0745	0.0553
	(-4.84)	(0.50)	(1.44)	(0.68)
Some College	-0.217***	0.174**	0.186*	0.0537
	(-4.02)	(2.98)	(2.45)	(0.56)
College	-0.145*	0.235**	0.319**	0.0292
	(-2.01)	(3.18)	(3.22)	(0.25)
Education Missing	0.10	-0.112	0.0207	.
	(0.50)	(-0.99)	(0.14)	.
Age	0.0270*	0.0943***	0.0224	0.0675**
	(2.35)	(5.70)	(1.15)	(2.90)
Age Squared	-0.000637***	-0.00110***	-0.000291*	-0.000754***
	(-8.33)	(-9.97)	(-2.26)	(-5.08)
Tenure (weeks)	0.000198***	0.000261***	0.000301***	0.000268***
	(10.90)	(10.70)	(8.95)	(7.82)
Urban	0.0221*	0.0182	0.0462*	0.0491*
	(2.22)	(1.21)	(2.13)	(2.09)
Northeast	-0.00997	0.117	0.0528	0.0255
	(-0.21)	(1.95)	(1.11)	(0.48)
West	0.0485	0.142**	-0.0167	0.0912
	(1.32)	(2.94)	(-0.26)	(1.32)
Midwest	-0.059	-0.0134	0.00241	-0.12
	(-1.76)	(-0.26)	-0.05	(-1.26)
State Unemployment Rate	-0.00894***	0.0126***	-0.0110**	0.00661
	(-4.12)	(3.61)	(-2.63)	(1.78)
Blue-collar	-0.0689***	-0.0810***	-0.0545**	-0.0179
	(-5.87)	(-3.79)	(-2.62)	(-0.49)
Year	0.0324**	-0.00544	0.000493	-0.00563
	(3.03)	(-0.35)	(0.03)	(-0.25)
Constant	-61.87**	11.32	0.759	11.94
	(-2.94)	(0.37)	(0.02)	(0.27)
Number of Obs	24180	18745	8913	7837

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 2.B. Fixed Effects Regressions – FFM/BF

Log Wage	White Males	White Females	Black Males	Black Females
Fat-Free Mass	0.0188*	0.00916	0.0202^	0.00874
	(2.13)	(0.39)	(1.73)	(0.37)
Body Fat	-0.0183*	-0.0046	-0.0137	-0.00164
	(-2.16)	(-0.38)	(-1.24)	(-0.13)
Health Limitation	-0.0939***	-0.0564	-0.140**	-0.0835*
	(-4.38)	(-1.91)	(-2.80)	(-2.29)
AFQT	.	.	.	.
	.	.	.	.
AFQT Missing	.	.	.	.
	.	.	.	.
Mother's Education	.	.	.	.
	.	.	.	.
Father's Education	.	.	.	.
	.	.	.	.
Children	0.0233***	-0.0466***	0.0135	-0.0291**
	(4.19)	(-6.16)	(1.63)	(-3.00)
Attending School	-0.158***	-0.132***	-0.176**	-0.0808
	(-5.16)	(-3.99)	(-3.00)	(-1.72)
Marital Status	0.0440***	0.00137	0.0576***	-0.00241
	(3.70)	(0.09)	(3.30)	(-0.13)
High School	-0.198***	0.0263	0.0746	0.0579
	(-5.13)	(0.51)	(1.38)	(0.68)
Some College	-0.219***	0.174**	0.187*	0.0563
	(-3.97)	(3.15)	(2.23)	(0.59)
College	-0.147*	0.235**	0.319**	0.0321
	(-2.23)	(3.18)	(2.97)	(0.26)
Education Missing	0.101	-0.112	0.0195	.
	(0.58)	(-1.03)	(0.12)	.
Age	0.0259*	0.0935***	0.0224	0.0680**
	(2.36)	(5.60)	(1.13)	(2.91)
Age Squared	-0.000605***	-0.00109***	-0.000277*	-0.000758***
	(-7.16)	(-9.10)	(-2.17)	(-4.94)
Tenure (weeks)	0.000197***	0.000261***	0.000301***	0.000267***
	(11.12)	(10.90)	(9.04)	(8.30)
Urban	0.0219*	0.0185	0.0462*	0.0488*
	(2.25)	(1.16)	(2.25)	(2.03)
Northeast	-0.00998	0.117*	0.0519	0.0258
	(-0.23)	(1.98)	(1.13)	(0.46)
West	0.0488	0.143**	-0.0149	0.0933
	(1.30)	(2.99)	(-0.24)	(1.46)
Midwest	-0.0588	-0.0132	0.00212	-0.118
	(-1.78)	(-0.26)	(0.04)	(-1.28)
State Unemployment Rate	-0.00889***	0.0126***	-0.0111**	0.0066
	(-3.75)	(3.69)	(-2.70)	(1.69)
Blue-collar	-0.0686***	-0.0810***	-0.0545**	-0.0175
	(-5.60)	(-3.92)	(-2.66)	(-0.49)
Year	0.0324**	-0.00558	0.000729	-0.00542
	(2.93)	(-0.34)	-0.04	(-0.24)
Constant	-62.56**	11.29	-0.568	11.31
	(-2.89)	(0.35)	(-0.02)	(0.26)
Number of Obs	24180	18745	8913	7837

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 2.C. Instrumental Variables Regressions - PBF

Log Wage	White Males	White Females	Black Males	Black Females
Percentage Body Fat	-3.076^	1.003	0.778	-0.908
	(-1.87)	-0.45	(0.70)	(-0.60)
Health Limitation	-0.171***	-0.180**	-0.347***	-0.135
	(-3.93)	(-2.81)	(-3.61)	(-1.90)
AFQT	0.00382***	0.00441***	0.00495***	0.00795***
	(6.38)	-6.14	(4.97)	(6.14)
AFQT Missing	-0.0716	-0.112	-0.038	0.0212
	(-1.27)	(-1.37)	(-0.31)	(0.16)
Mother's Education	-0.00024	0.00104	0.0148	-0.00997
	(-0.04)	-0.1	(1.74)	(-1.30)
Father's Education	0.00978*	0.00743	-0.00739	-0.00211
	(2.04)	-1.12	(-1.43)	(-0.35)
Children	0.0562***	-0.0722***	0.0579***	-0.0273
	-5.74	(-5.71)	(4.78)	(-1.79)
Attending School	-0.230***	-0.191***	-0.300**	-0.0208
	(-4.66)	(-3.59)	(-2.63)	(-0.36)
Marital Status	0.0115	0.0234	0.0347*	0.00904
	(1.01)	-1.14	(2.18)	(0.57)
High School	0.0619	0.0643	0.0735	0.108
	(1.52)	-1.19	(1.77)	(1.71)
Some College	0.192***	0.243***	0.197***	0.206**
	(3.71)	-4.14	(3.42)	(2.85)
College	0.317***	0.306***	0.388***	0.298***
	(5.70)	-4.61	(5.44)	(3.37)
Education Missing	-0.378	-0.00695	0.0193	.
	(-1.43)	(-0.02)	(0.09)	.
Age	0.0557***	0.0951***	-0.00707	0.0482*
	(3.66)	-4.82	(-0.41)	(2.43)
Age Squared	-0.000724***	-0.00147***	-0.000118	-0.000898**
	(-3.90)	(-5.58)	(-0.53)	(-3.27)
Tenure (weeks)	0.000324***	0.000412***	0.000464***	0.000441***
	(7.41)	-6.84	(8.05)	(6.66)
Urban	0.124***	0.0669*	0.0524	0.106**
	(6.17)	-2.38	(1.64)	(2.62)
Northeast	0.122***	0.129**	0.220***	0.258***
	(3.62)	-3.12	(5.51)	(4.60)
West	0.0209	0.120*	0.209**	0.177*
	(0.57)	-2.42	(2.92)	(2.22)
Midwest	-0.0275	-0.06	-0.032	0.0146
	(-0.96)	(-1.54)	(-0.70)	(0.32)
State Unemployment Rate	0.00115	0.0128*	-0.0130*	0.0023
	(0.24)	-2.2	(-1.99)	(0.33)
Blue-collar	-0.0399	-0.0829	-0.04	-0.114
	(-1.63)	(-1.86)	(-1.26)	(-1.73)
Year	0.0120*	0.0125	0.012	0.0225*
	(2.13)	-1.45	(1.46)	(2.25)
Constant	-22.15*	-24.91	-21.74	-43.01*
	(-2.00)	(-1.48)	(-1.34)	(-2.20)
Number of Obs	12403	9085	4816	4074

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 2.C. Instrumental Variables Regressions – FFM/BF

Log Wage	White Males	White Females	Black Males	Black Females
Fat-Free Mass	0.024^	0.0305	0.0119	-0.0196
	(1.72)	-1.18	(0.53)	(-0.85)
Body Fat	-0.0341^	-0.0203	-0.0071	0.0104
	(1.82)	(-1.28)	(-0.26)	(0.71)
Health Limitation	-0.166***	-0.140*	-0.335***	-0.137*
	(-4.21)	(-2.55)	(-3.54)	(-2.06)
AFQT	0.00370***	0.00424***	0.00493***	0.00811***
	-6.5	-5.63	(4.57)	(6.16)
AFQT Missing	-0.0685	-0.0894	-0.0503	0.0221
	(-1.24)	(-1.15)	(-0.43)	(0.20)
Mother's Education	-0.00222	-0.00447	0.0142	-0.0094
	(-0.36)	(-0.57)	(1.72)	(-1.12)
Father's Education	0.00895*	0.00779	-0.00737	-0.0018
	(2.01)	(1.29)	(-1.39)	(-0.30)
Children	0.0504***	-0.0702***	0.0578***	-0.0283
	(5.04)	(-5.84)	(4.50)	(-1.80)
Attending School	-0.222***	-0.193***	-0.304*	-0.0287
	(-4.51)	(-3.69)	(-2.57)	(-0.51)
Marital Status	0.00963	0.0102	0.0378*	0.0122
	(0.84)	(0.71)	(2.07)	(0.80)
High School	0.0447	0.0824	0.0744	0.142*
	(1.16)	(1.86)	(1.70)	(2.38)
Some College	0.177***	0.255***	0.187**	0.244***
	(3.58)	(4.84)	(2.92)	(3.77)
College	0.306***	0.301***	0.373***	0.332***
	(5.96)	(4.96)	(5.06)	(4.43)
Education Missing	-0.329	0.0213	0.0384	.
	(-1.45)	(0.10)	(0.17)	.
Age	0.0532***	0.102***	-0.00993	0.0385*
	(4.28)	(7.18)	(-0.52)	(2.08)
Age Squared	-0.000658***	-0.00154***	-0.0000976	-0.000769**
	(-4.21)	(-8.21)	(-0.41)	(-3.01)
Tenure (weeks)	0.000310***	0.000433***	0.000478***	0.000430***
	(7.54)	(7.84)	(8.08)	(6.38)
Urban	0.126***	0.0597*	0.0508	0.118**
	(6.07)	(2.31)	(1.63)	(3.03)
Northeast	0.121***	0.133**	0.230***	0.248***
	(3.57)	(3.29)	(5.12)	(4.20)
West	0.0259	0.110*	0.206**	0.184*
	(0.70)	(2.48)	(2.95)	(2.28)
Midwest	-0.0255	-0.06	-0.0333	0.0156
	(-0.93)	(-1.70)	(-0.75)	(0.35)
State Unemployment Rate	0.00132	0.0137**	-0.0115	0.00082
	(0.28)	(2.58)	(-1.59)	(0.12)
Blue-collar	-0.0456	-0.0705	-0.0372	-0.115
	(-1.92)	(-1.57)	(-1.13)	(-1.70)
Year	0.00912	0.0166*	0.0138	0.0192
	(1.67)	(2.26)	(1.43)	(1.95)
Constant	-17.85	-33.62*	-25.76	-36.11
	(-1.67)	(-2.28)	(-1.32)	(-1.84)
Number of Obs	12403	9085	4816	4074

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.A. OLS Regressions - PBF

Percentage Body Fat	White Males	White Females	Black Males	Black Females
Log Real Family Income	0.00104	-0.00621***	0.00391***	-0.00166
	(1.59)	(-6.33)	(3.38)	(-0.92)
Health Limitation	0.000446	0.0101*	0.00401	0.0102**
	(0.20)	(2.53)	(1.16)	(2.59)
AFQT	-0.0000158	0.000120*	0.0000154	-0.0000807
	(-0.44)	(2.26)	(0.20)	(-0.63)
AFQT Missing	-0.00670*	-0.00121	-0.00173	-0.00382
	(-2.19)	(-0.19)	(-0.26)	(-0.25)
Mother's Education	-0.000471	-0.00149**	-0.0000523	-0.00109
	(-1.38)	(-2.69)	(-0.08)	(-1.04)
Father's Education	0.0000816	-0.000983*	-0.000729	-0.000205
	(0.31)	(-2.34)	(-1.53)	(-0.31)
Children	-0.000386	0.000355	0.00164	0.000902
	(-0.70)	(0.39)	(1.54)	(0.67)
Attending School	-0.00221	-0.00303	-0.000619	-0.00531
	(-1.71)	(-1.40)	(-0.22)	(-1.34)
Marital Status	0.00673***	0.00811***	0.00463	-0.000645
	(5.45)	(3.95)	(1.92)	(-0.18)
High School	0.00545*	0.000938	0.00279	-0.00924
	(2.19)	(0.23)	(0.61)	(-1.27)
Some College	0.00491	-0.00225	0.00407	-0.00691
	(1.64)	(-0.50)	(0.72)	(-0.84)
College	-0.00391	-0.00603	0.00565	-0.00994
	(-1.26)	(-1.14)	(0.90)	(-1.06)
Education Missing	-0.00533	0.0246	0.0497	-0.0224
	(-0.50)	(1.80)	(1.59)	(-0.37)
Age	0.00323***	0.00350***	0.00461***	0.00866***
	(7.72)	(4.96)	(5.47)	(7.08)
Age Squared	-0.0000346***	-0.0000449***	-0.0000551***	-0.000111***
	(-8.10)	(-5.93)	(-6.71)	(-8.37)
Tenure (weeks)	0.0000021	0.00000623	-0.0000014	0.0000167**
	(1.02)	(1.65)	(-0.36)	(2.85)
Urban	-0.00121	-0.00238	0.00115	-0.00725
	(-1.18)	(-1.37)	(0.49)	(-1.90)
Northeast	0.00322	-0.000997	0.000982	0.00224
	(1.61)	(-0.35)	(0.26)	(0.38)
West	-0.00437*	0.00105	-0.0019	0.00168
	(-2.21)	(0.32)	(-0.51)	(0.23)
Midwest	-0.000479	0.00139	-0.00111	0.00213
	(-0.30)	(0.50)	(-0.32)	(0.39)
Blue-collar	0.00203	-0.000567	0.00470*	0.00392
	(1.70)	(-0.30)	(2.33)	(1.21)
Year	0.00123***	0.00258***	0.00181**	0.00244*
	(4.01)	(4.88)	(2.90)	(2.49)
Constant	-2.287***	-4.835***	-3.492**	-4.647*
	(-3.79)	(-4.65)	(-2.86)	(-2.42)
Number of Obs	27039	25316	8299	9064

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.A. OLS Regressions - Obesity

Obese	White Males	White Females	Black Males	Black Females
Log Real Family Income	-0.0093	-0.0421***	0.0181^	-0.021^
	(-1.40)	(-7.16)	(1.83)	(-1.90)
Health Limitation	0.0232	0.107***	0.033	0.0643*
	(1.26)	(5.44)	(1.10)	(2.39)
AFQT	-0.000234	0.000476	-0.000264	-0.000401
	(-0.70)	(1.53)	(-0.38)	(-0.51)
AFQT Missing	-0.0791**	0.00982	-0.00167	-0.00497
	(-2.96)	(0.32)	(-0.03)	(-0.05)
Mother's Education	-0.00141	-0.00747*	0.00131	-0.0111
	(-0.47)	(-2.31)	-0.23	(-1.80)
Father's Education	0.0000984	-0.00515*	-0.00575	0.00103
	(0.04)	(-2.04)	(-1.31)	(0.24)
Children	0.00187	-0.000708	0.00841	0.00227
	(0.32)	(-0.13)	(0.88)	(0.24)
Attending School	-0.00408	-0.00951	-0.0285	-0.0105
	(-0.30)	(-0.79)	(-1.07)	(-0.41)
Marital Status	0.0412***	0.0388**	0.0606**	0.0131
	(3.65)	(3.17)	(2.97)	(0.55)
High School	0.0221	-0.0253	0.0169	-0.0818
	(0.99)	(-0.96)	(0.49)	(-1.80)
Some College	-0.00728	-0.0284	0.0317	-0.0863
	(-0.27)	(-0.94)	(0.74)	(-1.74)
College	-0.0705*	-0.0594	0.0201	-0.0879
	(-2.47)	(-1.88)	(0.38)	(-1.50)
Education Missing	-0.0615	0.128	0.268	0.136
	(-1.22)	(1.66)	(0.87)	(0.38)
Age	0.0101*	0.0135***	0.0171*	0.0319***
	(2.43)	(3.48)	(2.42)	(3.79)
Age Squared	-0.0000875	-0.000195***	-0.000209*	-0.000415***
	(-1.74)	(-3.85)	(-2.44)	(-4.07)
Tenure (weeks)	0.00000743	0.0000363	-0.0000373	0.0000927*
	(0.31)	(1.37)	(-0.93)	(2.22)
Urban	-0.00918	-0.00532	0.0000621	-0.0391
	(-0.89)	(-0.56)	(0.00)	(-1.53)
Northeast	0.0228	-0.027	-0.0157	0.028
	(1.18)	(-1.52)	(-0.46)	(0.69)
West	-0.0251	-0.00974	-0.0273	0.00699
	(-1.50)	(-0.56)	(-0.78)	(0.15)
Midwest	0.00301	0.000595	-0.00421	0.00763
	(0.19)	(0.04)	(-0.14)	(0.21)
Blue-collar	0.0361**	0.000465	0.0535**	0.025
	(3.03)	(0.04)	(2.98)	(1.13)
Year	0.00818**	0.0128***	0.0130*	0.0136*
	(2.61)	(4.39)	(2.50)	(2.36)
Constant	-16.31**	-25.35***	-26.08*	-27.14*
	(-2.64)	(-4.41)	(-2.55)	(-2.39)
Number of Obs	27039	25316	8299	9064

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.A. Logit Regressions – Obesity

Obese	White Males	White Females	Black Males	Black Females
Log Real Family Income	-0.048	-0.260***	0.114^	-0.0895^
	(-1.12)	(-7.02)	(1.78)	(-1.69)
Health Limitation	0.128	0.590***	0.187	0.280*
	(1.08)	(5.92)	(1.19)	(2.42)
AFQT	-0.00158	0.00304	-0.00184	-0.00208
	(-0.73)	(1.40)	(-0.45)	(-0.57)
AFQT Missing	-0.597*	0.0386	-0.0271	-0.0198
	(-2.49)	(0.17)	(-0.08)	(-0.05)
Mother's Education	-0.00962	-0.0521*	0.00667	-0.0503
	(-0.45)	(-2.33)	(0.21)	(-1.79)
Father's Education	-0.00109	-0.0386*	-0.0348	0.00472
	(-0.07)	(-2.23)	(-1.40)	(0.25)
Children	0.0132	0.0166	0.0408	0.0133
	(0.40)	(0.49)	(0.82)	(0.33)
Attending School	-0.183	-0.113	-0.371	-0.0706
	(-1.38)	(-1.08)	(-1.69)	(-0.58)
Marital Status	0.303***	0.258**	0.354**	0.054
	(3.71)	(2.97)	(2.77)	(0.48)
High School	0.111	-0.193	0.118	-0.38
	(0.73)	(-1.20)	(0.50)	(-1.87)
Some College	-0.0634	-0.214	0.205	-0.398
	(-0.35)	(-1.16)	(0.75)	(-1.76)
College	-0.492*	-0.430*	0.134	-0.397
	(-2.40)	(-2.12)	(0.42)	(-1.51)
Education Missing	-0.899	0.977*	1.897	0.68
	(-0.83)	(2.31)	(1.52)	(0.41)
Age	0.167***	0.181***	0.302***	0.194***
	(5.48)	(5.75)	(5.55)	(4.78)
Age Squared	-0.00197***	-0.00254***	-0.00378***	-0.00252***
	(-6.22)	(-7.64)	(-6.63)	(-5.39)
Tenure (weeks)	0.0000225	0.000227	-0.000206	0.000396*
	(0.19)	(1.69)	(-1.11)	(2.21)
Urban	-0.0471	-0.0332	0.00639	-0.176
	(-0.74)	(-0.52)	(0.06)	(-1.51)
Northeast	0.148	-0.204	-0.0879	0.13
	(1.20)	(-1.56)	(-0.45)	(0.74)
West	-0.181	-0.0623	-0.181	0.0295
	(-1.42)	(-0.50)	(0.84)	(0.14)
Midwest	0.0253	0.0154	-0.0222	0.0325
	(0.24)	(0.15)	(-0.13)	(0.21)
Blue-collar	0.240**	-0.00782	0.331**	0.119
	(3.05)	(-0.10)	(2.82)	(1.10)
Year	0.0517**	0.0846***	0.0660*	0.0598*
	(2.65)	(4.30)	(2.20)	(2.31)
Constant	-107.7**	-171.4***	-139.2*	-122.4*
	(-2.81)	(-4.44)	(-2.37)	(-2.41)
Number of Obs	27039	25316	8299	9064

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.A. Probit Regressions – Obesity

Obese	White Males	White Females	Black Males	Black Females
Log Real Family Income	-0.0291	-0.154***	0.0646^	-0.0554^
	(-1.19)	(-7.28)	(1.76)	(-1.72)
Health Limitation	0.0822	0.348***	0.112	0.170*
	(1.15)	(5.88)	(1.20)	(2.37)
AFQT	-0.000904	0.00167	-0.00102	-0.00125
	(-0.73)	(1.35)	(-0.42)	(-0.56)
AFQT Missing	-0.324*	0.012	-0.0193	-0.00739
	(-2.48)	-0.09	(-0.10)	(-0.03)
Mother's Education	-0.00658	-0.0286*	0.00527	-0.0306
	(-0.53)	(-2.26)	(0.28)	(-1.80)
Father's Education	-0.000574	-0.0227*	-0.02	0.00287
	(-0.06)	(-2.33)	(-1.38)	(0.25)
Children	0.00823	0.00858	0.0244	0.00802
	(0.43)	(0.44)	(0.82)	(0.32)
Attending School	-0.0921	-0.0696	-0.203	-0.0468
	(-1.33)	(-1.23)	(-1.68)	(-0.64)
Marital Status	0.164***	0.148**	0.205**	0.0349
	(3.58)	(3.0)	(2.72)	(0.51)
High School	0.0682	-0.108	0.061	-0.23
	(0.79)	(-1.18)	(0.45)	(-1.86)
Some College	-0.0331	-0.118	0.111	-0.241
	(-0.32)	(-1.13)	(0.71)	(-1.75)
College	-0.275*	-0.244*	0.0661	-0.245
	(-2.38)	(-2.12)	(0.36)	(-1.52)
Education Missing	-0.405	0.543*	1.066	0.443
	(-0.81)	(2.22)	(1.41)	(0.51)
Age	0.0849***	0.0942***	0.157***	0.114***
	(5.06)	(5.50)	(5.16)	(4.66)
Age Squared	-0.000994***	-0.00134***	-0.00199***	-0.00149***
	(-5.56)	(-7.18)	(-6.11)	(-5.25)
Tenure (weeks)	0.0000199	0.000137	-0.000117	0.000245*
	(0.28)	(1.71)	(-1.05)	(2.22)
Urban	-0.0293	-0.0189	0.00355	-0.11
	(-0.80)	(-0.52)	(0.05)	(-1.56)
Northeast	0.09	-0.115	-0.0575	0.082
	(1.28)	(-1.58)	(-0.50)	(0.77)
West	-0.103	-0.0349	-0.107	0.0201
	(-1.44)	(-0.50)	(-0.86)	(0.16)
Midwest	0.0189	0.0112	-0.0163	0.0204
	(0.32)	(0.19)	(-0.16)	(0.21)
Blue-collar	0.135**	-0.00528	0.196**	0.0723
	(3.05)	(-0.12)	(2.94)	(1.11)
Year	0.0300**	0.0492***	0.0403*	0.0373*
	(2.67)	(4.41)	(2.27)	(2.35)
Constant	-62.38**	-99.54***	-84.49*	-76.21*
	(-2.83)	(-4.54)	(-2.43)	(-2.45)
Number of Obs	27039	25316	8299	9064

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.A. OLS Regressions – BMI

BMI	White Males	White Females	Black Males	Black Females
Log Real Family Income	0.076	-0.685***	0.366**	-0.241
	(1.00)	(-7.53)	(2.85)	(-1.29)
Health Limitation	0.0502	1.585***	0.541	1.308**
	(0.19)	(4.48)	(1.47)	(3.00)
AFQT	-0.00182	0.00801	0.00174	-0.00593
	(-0.45)	(1.67)	(0.19)	(-0.47)
AFQT Missing	-0.809*	0.0143	-0.23	-0.271
	(-2.48)	(0.03)	(-0.33)	(-0.16)
Mother's Education	-0.0462	-0.132*	0.00817	-0.141
	(-1.07)	(-2.50)	(0.12)	(-1.50)
Father's Education	0.00922	-0.0951*	-0.0838	-0.00663
	(0.31)	(-2.38)	(-1.63)	(-0.11)
Children	-0.0479	-0.0177	0.18	0.0796
	(-0.75)	(-0.21)	(1.59)	(0.57)
Attending School	-0.204	-0.203	-0.0803	-0.432
	(-1.29)	(-1.04)	(-0.29)	(-1.19)
Marital Status	0.762***	0.668***	0.546*	-0.122
	-5.52	(3.35)	(2.23)	(-0.30)
High School	0.595*	0.0512	0.238	-1.242
	(2.17)	(0.14)	(0.51)	(-1.55)
Some College	0.488	-0.187	0.388	-0.995
	(1.45)	(-0.42)	(0.69)	(-1.15)
College	-0.538	-0.527	0.468	-1.061
	(-1.56)	(-1.10)	(0.71)	(-1.03)
Education Missing	-0.583	2.526	5.286	-1.204
	(-0.49)	(1.72)	(1.43)	(-0.25)
Age	0.317***	0.376***	0.422***	0.665***
	(6.61)	(6.02)	(4.87)	(5.60)
Age Squared	-0.00392***	-0.00494***	-0.00528***	-0.00914***
	(-7.88)	(-7.03)	(-6.10)	(-6.72)
Tenure (weeks)	0.000232	0.000686	-0.000186	0.00166*
	(0.92)	(1.68)	(-0.42)	(2.48)
Urban	-0.13	-0.133	0.174	-0.636
	(-1.15)	(-0.89)	(0.70)	(-1.57)
Northeast	0.312	-0.129	0.0546	0.201
	(1.45)	(-0.45)	(0.15)	(0.34)
West	-0.464*	0.0633	-0.303	0.123
	(-2.09)	(0.20)	(-0.76)	(0.17)
Midwest	-0.0467	0.0807	-0.22	0.342
	(-0.24)	(0.31)	(-0.55)	-0.58
Blue-collar	0.288*	-0.129	0.523*	0.165
	(2.16)	(-0.74)	(2.5)	(0.45)
Year	0.137***	0.213***	0.180**	0.276**
	(3.81)	(4.31)	(2.76)	(3.14)
Constant	-253.1***	-402.1***	-341.5**	-529.1**
	(-3.58)	(-4.13)	(-2.67)	(-3.06)
Number of Obs				
	27039	25316	8299	9064

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.B. Fixed Effects Regressions - PBF

Percentage Body Fat	White Males	White Females	Black Males	Black Females
Log Real Family Income	-0.000163	-0.00028	0.00107*	0.00108^
	(-0.67)	(-0.74)	(2.14)	(1.73)
Health Limitation	-0.00065	0.00326***	0.000933	0.00144
	(-0.83)	(3.37)	-0.6	(0.89)
AFQT	.	.	.	.
	.	.	.	.
AFQT Missing	.	.	.	.
	.	.	.	.
Mother's Education	.	.	.	.
	.	.	.	.
Father's Education	.	.	.	.
	.	.	.	.
Children	-0.000273	-0.000508	0.000444	0.000339
	(-1.16)	(-1.18)	(0.96)	(0.50)
Attending School	0.00101	0.000619	0.00126	-0.000488
	-1.53	-0.68	(0.79)	(-0.31)
Marital Status	0.00336***	0.00831***	0.00362**	0.00494**
	-6.56	(9.37)	(3.15)	(3.07)
High School	0.000478	-0.000794	-0.000617	-0.00215
	-0.22	(-0.27)	(-0.16)	(-0.47)
Some College	0.00208	0.00122	-0.00117	0.00321
	-0.79	(0.34)	(-0.26)	(0.56)
College	0.00187	0.00287	-0.00029	0.00957
	-0.64	-0.67	(-0.05)	(1.43)
Education Missing	0.000516	0.0156	0.0338	0.0126**
	-0.12	(1.93)	(1.76)	(2.90)
Age	0.00268***	0.00145*	0.00412***	0.00745***
	-8.23	(2.53)	(5.53)	(6.81)
Age Squared	-0.0000328***	-0.0000293***	-0.0000631***	-0.000102***
	(-12.02)	(-6.03)	(-10.26)	(-12.60)
Tenure (weeks)	-0.00000022	0.00000032	0.00000386*	-0.00000239
	(-0.26)	(0.20)	(1.98)	(-0.87)
Urban	0.000904*	-0.000872	0.00211*	-0.000145
	-2.35	(-1.33)	(2.03)	(-0.10)
Northeast	0.00156	0.00222	-0.00101	0.00439
	-1.33	(0.87)	(-0.41)	(1.32)
West	-0.000638	-0.00306	-0.00318	0.00184
	(-0.53)	(-1.19)	(-1.20)	-0.45
Midwest	0.00206	0.0024	-0.000944	0.00921*
	-1.9	(1.22)	(-0.39)	(2.37)
Blue-collar	-0.000188	-0.00226**	-0.000217	0.000975
	(-0.39)	(-3.14)	(-0.21)	(0.73)
Year	0.00171***	0.00319***	0.00289***	0.00301**
	-5.41	(5.22)	(3.94)	(2.77)
Constant	0.160***	0.272***	0.100***	0.165***
	-27.19	(27.77)	(7.80)	(8.56)
Number of Obs	27039	25316	8299	9064

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.B. Fixed Effects Regressions - Obesity

Obese	White Males	White Females	Black Males	Black Females
Log Real Family Income	-0.00706*	-0.00931**	0.01	0.00261
	(-2.17)	(-2.96)	(1.36)	(0.46)
Health Limitation	0.0253*	0.0404***	-0.00172	0.0113
	(2.09)	(4.06)	(-0.08)	(0.76)
AFQT	.	.	.	.
	.	.	.	.
AFQT Missing	.	.	.	.
	.	.	.	.
Mother's Education	.	.	.	.
	.	.	.	.
Father's Education	.	.	.	.
	.	.	.	.
Children	0.00910*	-0.000967	-0.0061	-0.00272
	(2.45)	(-0.23)	(-0.89)	(-0.44)
Attending School	0.0246**	0.00453	0.00486	0.0199
	-2.82	(0.50)	(0.23)	(1.33)
Marital Status	0.0135	0.0357***	0.0560***	0.0445**
	(1.79)	(5.04)	-3.58	(3.09)
High School	0.000683	-0.0187	-0.0373	-0.0282
	(0.02)	(-0.75)	(-0.80)	(-0.88)
Some College	0.00237	-0.00078	-0.0375	-0.00281
	(0.06)	(-0.03)	(-0.59)	(-0.06)
College	0.00511	-0.0134	-0.0435	0.0268
	(0.12)	(-0.35)	(-0.58)	-0.46
Education Missing	-0.106	0.0476	0.173	0.184*
	(-1.74)	(0.85)	(0.61)	-2.09
Age	-0.00207	-0.00397	-0.0000444	0.0270*
	(-0.39)	(-0.76)	(-0.00)	-2.57
Age Squared	-0.0000257	-0.0000779	-0.000273***	-0.000297**
	(-0.59)	(-1.74)	(-3.46)	(-3.24)
Tenure (weeks)	-0.00000686	-0.00000933	-0.00000733	-0.0000233
	(-0.47)	(-0.57)	(-0.25)	(-0.83)
Urban	0.0138*	-0.00397	0.0136	0.00164
	(2.16)	(-0.63)	(0.98)	(0.11)
Northeast	0.0135	-0.00534	-0.0194	0.0782
	(0.65)	(-0.24)	(-0.51)	(1.79)
West	0.00265	-0.0155	-0.0607	-0.0025
	(0.15)	(-0.74)	(-1.63)	(-0.07)
Midwest	0.0203	0.00286	0.000565	0.0735*
	(1.22)	(0.16)	(0.01)	(2.12)
Blue-collar	0.00919	0.00329	0.0095	0.00886
	(1.26)	(0.51)	-0.68	(0.66)
Year	0.0160**	0.0207***	0.0351***	0.0103
	(3.13)	(3.85)	(3.34)	(0.94)
Constant	0.0244	0.103	-0.0494	-0.409*
	(0.27)	(1.2)	(-0.27)	(-2.28)
Number of Obs		25316	8299	9064
	27039			

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.B. Fixed Effects Regressions – BMI

BMI	White Males	White Females	Black Males	Black Females
Log Real Family Income	-0.0335	-0.0563	0.119*	0.0492
	(-1.28)	(-1.54)	(2.32)	(0.78)
Health Limitation	-0.0477	0.532***	0.159	0.346
	(-0.50)	(4.64)	(0.85)	(1.91)
AFQT	.	.	.	.
	.	.	.	.
AFQT Missing	.	.	.	.
	.	.	.	.
Mother's Education	.	.	.	.
	.	.	.	.
Father's Education	.	.	.	.
	.	.	.	.
Children	-0.0411	-0.0455	0.043	0.0171
	(-1.49)	(-1.06)	(0.84)	(0.25)
Attending School	0.153*	0.116	0.148	0.0507
	(2.01)	(1.35)	(0.90)	(0.32)
Marital Status	0.376***	0.662***	0.446***	0.545***
	(6.06)	(8.65)	(3.91)	(3.56)
High School	-0.0576	-0.192	-0.282	-0.664
	(-0.25)	(-0.67)	(-0.60)	(-1.59)
Some College	0.15	0.00126	-0.419	-0.11
	(0.51)	(0.00)	(-0.75)	(-0.19)
College	0.0917	0.0206	-0.344	0.536
	(0.27)	(0.05)	(-0.57)	(0.79)
Education Missing	-0.105	1.711	3.72	0.309
	(-0.21)	(1.71)	(1.61)	(0.26)
Age	0.243***	0.0953	0.344***	0.474***
	(6.34)	(1.94)	(4.58)	(4.53)
Age Squared	-0.00371***	-0.00326***	-0.00626***	-0.00795***
	(-11.02)	(7.17)	(-9.61)	(-8.98)
Tenure (weeks)	-0.0000373	0.0000168	0.000312	-0.000125
	(-0.36)	(0.10)	(1.36)	(0.41)
Urban	0.101*	-0.0254	0.268*	0.0803
	(2.19)	(-0.36)	(2.41)	(0.54)
Northeast	0.178	0.166	-0.185	0.56
	(1.22)	(0.78)	(-0.69)	(1.62)
West	-0.0971	-0.157	-0.498	0.0441
	(-0.70)	(-0.69)	(-1.68)	-0.11
Midwest	0.236	0.164	-0.224	0.811*
	(1.76)	(0.87)	(-0.79)	(2.04)
Blue-collar	0.0173	-0.168*	0.0153	0.0197
	(0.31)	(-2.44)	(0.13)	(0.13)
Year	0.204***	0.346***	0.331***	0.380***
	(5.45)	(6.44)	(4.57)	(3.31)
Constant	19.46***	20.64***	16.92***	15.54***
	(29.69)	(24.32)	(13.24)	(8.62)
Number of Obs	27039	25316	8299	9064

t statistics in parentheses
^p<0.10, *p<0.05, **p<0.01, ***p<0.0001

Appendix 3.C. Instrumental Variables Regressions – PBF

PBF	White Males	White Females	Black Males	Black Females
Log Real Family Income	0.102	0.261	-0.00083	-0.0271
	(0.33)	(0.66)	(-0.02)	(-0.10)
Health Limitation	0.0294	0.0632	0.00273	0.00495
	(0.32)	(0.81)	(0.25)	(0.09)
AFQT	-0.000365	-0.00119	0.0000598	0.000155
	(-0.34)	(-0.63)	(0.23)	(0.06)
AFQT Missing	-0.000813	0.0223	-0.001	-0.00987
	(-0.04)	(0.59)	(-0.12)	(-0.12)
Mother's Education	-0.0015	-0.00371	-0.0000276	-0.000938
	(-0.42)	(-0.76)	(-0.03)	(-0.30)
Father's Education	-0.000305	-0.00308	-0.000699	-0.000264
	(-0.15)	(-0.96)	(-1.26)	(-0.13)
Children	-0.0102	-0.0248	0.00363	0.00279
	(-0.29)	(-0.66)	(0.75)	(0.14)
Attending School	0.0431	0.0683	-0.00179	-0.00619
	(0.31)	(0.63)	(-0.29)	(-0.23)
Marital Status	-0.00124	0.0316	0.000475	-0.00334
	(-0.29)	(0.52)	(0.19)	(-1.04)
High School	-0.0186	-0.0768	0.00515	-0.000616
	(-0.24)	(-0.65)	(0.40)	(-0.01)
Some College	-0.0308	-0.0873	0.00711	0.00747
	(-0.28)	(-0.69)	(0.41)	(0.05)
College	-0.0607	0.064	0.0109	0.00949
	(-0.33)	(0.57)	(0.35)	(0.05)
Education Missing	0.0267	-0.159	0.0462	-0.0211
	(0.21)	(-0.72)	(1.32)	(-0.26)
Age	-0.00868	-0.0299	0.00498	0.0106
	(-0.23)	(-0.56)	(1.48)	(0.72)
Age Squared	0.000116	0.000379	-0.000059	-0.00014
	(0.25)	(0.59)	(-1.31)	(-0.59)
Tenure (weeks)	-0.0000506	-0.000138	0.00000246	0.0000339
	(-0.30)	(-0.66)	(0.09	(0.18)
Urban	-0.00995	-0.0199	0.000199	-0.00728
	(-0.40)	(-0.79)	(0.04)	(-0.44)
Northeast	-0.0109	-0.0161	0.000284	0.00182
	(-0.24)	(-0.53)	(0.07)	(0.12)
West	-0.00269	0.0135	-0.00258	0.00552
	(-0.27)	-0.63	(-0.46)	(0.09)
Midwest	0.00542	0.0259	-0.00289	-0.000958
	(0.25)	(0.76)	(-0.34)	(-0.03)
Blue-collar	-0.00429	-0.0107	0.00438	0.0126
	(-0.21)	(-0.71)	(0.66)	(0.14)
Year	0.000633	0.000599	0.00173*	0.00285
	(0.42)	(0.30)	(2.45)	(0.62)
Constant	-1.151	-1.006	-3.341*	-5.447
	(-0.40)	(-0.26)	(-2.41)	(-0.62)
Number of Obs	26270	25028	7966	8989

t statistics in parentheses
*p<0.05, **p<0.01, ***p<0.001

Appendix 3.C. Instrumental Variables Regressions – Obesity

Obese	White Males	White Females	Black Males	Black Females
Log Real Family Income	0.721	-0.476	-0.319	0.254
	(0.17)	(-0.28)	(-0.48)	(0.18)
Health Limitation	0.232	0.0234	-0.0706	0.126
	(0.20)	(0.06)	(-0.36)	(0.40)
AFQT	-0.00273	0.0026	0.00231	-0.00269
	(-0.18)	(0.30)	(0.49)	(-0.22)
AFQT Missing	-0.0384	-0.0268	-0.00951	0.0506
	(-0.15)	(-0.17)	(-0.09)	(0.16)
Mother's Education	-0.00856	-0.00415	0.00446	-0.0141
	(-0.24)	(-0.29)	(0.46)	(-0.66)
Father's Education	-0.00292	-0.00218	-0.00573	0.00294
	(-0.15)	(-0.17)	(-0.73)	(0.19)
Children	-0.0705	0.0473	0.071	-0.0162
	(-0.16)	(0.27)	(0.760	(-0.17)
Attending School	0.328	-0.137	-0.0773	0.0194
	(0.18)	(-0.28)	(-0.74)	(0.17)
Marital Status	-0.02	-0.102	0.0133	-0.0277
	(-0.25)	(-0.42)	(0.35)	(-1.43)
High School	-0.152	0.0995	0.134	-0.155
	(-0.14)	(0.20)	(0.62)	(-0.37)
Some College	-0.266	0.104	0.191	-0.221
	(-0.17)	(0.19)	(0.65)	(-0.31)
College	-0.487	0.0394	0.319	-0.299
	(-0.20)	(0.08)	(0.55)	(-0.28)
Education Missing	0.168	0.175	0.155	0.227
	(0.12)	(0.18)	(0.32)	(0.54)
Age	-0.0754	0.0726	0.0484	0.0205
	(-0.14)	(0.33)	(0.86)	(0.25)
Age Squared	0.000991	-0.000924	-0.00063	-0.000189
	(0.15)	(-0.34)	(-0.81)	(-0.14)
Tenure (weeks)	-0.00038	0.000264	0.000225	-0.000107
	(-0.16)	(0.28)	(0.44)	(-0.11)
Urban	-0.0764	0.0192	0.0146	-0.0586
	(-0.16)	(0.18)	(0.20)	(-0.63)
Northeast	-0.0823	-0.00842	-0.0302	0.0135
	(-0.15)	(-0.10)	(-0.59)	(0.14)
West	-0.015	-0.0339	-0.0135	-0.0366
	(-0.06)	(-0.27)	(-0.20)	(-0.16)
Midwest	0.0432	-0.0411	-0.0845	0.0195
	(0.13)	(-0.25)	(-0.53)	(0.12)
Blue-collar	-0.014	0.0141	0.1	-0.0756
	(-0.05)	(0.02)	(0.86)	(-0.15)
Year	0.00434	0.0157	0.0147	0.00794
	(0.26)	(1.63)	(1.79)	(0.28)
Constant	-9.082	-30.76	-29.3	-16.21
	(-0.28)	(-1.65)	(-1.83)	(-0.30)
Number of Obs	26270	25028	7966	8989

t statistics in parentheses
*p<0.05, **p<0.01, ***p<0.001

Appendix 3.C. Instrumental Variables Regressions – BMI

BMI	White Males	White Females	Black Males	Black Females
Log Real Family Income	11.51	18.0	0.0844	-3.026
	(0.24)	(0.46)	(0.02)	(-0.10)
Health Limitation	3.352	5.321	0.453	0.729
	(0.24)	(0.60)	(0.30)	(0.11)
AFQT	-0.0414	-0.0834	0.00501	0.0195
	(-0.25)	(-0.47)	(0.12)	(0.08)
AFQT Missing	-0.142	1.645	-0.137	-0.916
	(-0.04)	(0.45)	(-0.12)	(-0.24)
Mother's Education	-0.163	-0.286	0.0121	-0.123
	(-0.38)	(-0.77)	(0.13)	(-0.40)
Father's Education	-0.0348	-0.243	-0.0809	-0.0158
	(-0.15)	(-0.82)	(-1.09)	(-0.06)
Children	-1.157	-1.762	0.371	0.283
	(-0.22)	(-0.48)	(0.50)	(0.13)
Attending School	4.943	4.765	-0.144	-0.562
	(0.23)	(0.43)	(-0.13)	(-0.18)
Marital Status	-0.157	2.032	0.029	-0.346
	(-0.22)	(0.35)	(0.11)	(-0.56)
High School	-2.135	-5.405	0.406	-0.318
	(-0.19)	(-0.44)	(0.22)	(-0.04)
Some College	-3.557	-6.179	0.605	0.556
	(-0.21)	(-0.49)	(0.24)	(0.04)
College	-6.987	5.218	0.835	1.061
	(-0.25)	(0.29)	(0.18)	(0.05)
Education Missing	3.048	-11.33	4.975	-1.093
	(0.16)	(-0.49)	(1.16)	(-0.16)
Age	-1.033	-1.951	0.453	0.875
	(-0.18)	(-0.39)	(0.89)	(0.64)
Age Squared	0.0131	0.0246	-0.0056	-0.0123
	-0.18	(0.41)	(-0.81)	(-0.55)
Tenure (weeks)	-0.00575	-0.00943	0.0000481	0.00355
	(-0.23)	(-0.42)	(0.01)	(0.16)
Urban	-1.129	-1.373	0.0569	-0.604
	(-0.28)	(-0.45)	(0.11)	(-0.30)
Northeast	-1.297	-1.203	-0.0271	0.168
	(-0.20)	(-0.53)	(-0.06)	(0.13)
West	-0.278	0.927	-0.392	0.539
	(-0.14)	(0.53)	(-0.50)	(0.11)
Midwest	0.618	1.793	-0.37	0.0195
	(0.19)	(0.49)	(-0.30)	(0.01)
Blue-collar	-0.433	-0.852	0.465	1.125
	(-0.14)	(-0.71)	(0.46)	(0.11)
Year	0.0696	0.074	0.174*	0.324
	(0.36)	(0.35)	(2.26)	(0.75)
Constant	-125	-133.2	-329.0*	-622.3
	(-0.34)	(-0.32)	(-2.20)	(-0.75)
Number of Obs	26270	25028	7966	8989

t statistics in parentheses
*p<0.05, **p<0.01, ***p<0.001

References

Averett, S., and S. Korenman. 1996. "The Economic Reality of the Beauty Myth." *Journal of Human Resources* 31(2):304-30.

Averett, S., and S. Korenman. 1999. "Black-White Differences in Social and Economic Consequences of Obesity." *International Journal of Obesity* 23:166-73.

Baum, C. L. and W. F. Ford. 2004. "The wage effects of obesity: a Longitudinal study." *Health Economics* 13: 885-89.

Bhattacharya, J. and M. K. Bundorf. 2009. "The Incidence of the Healthcare Costs of Obesity." *Journal of Health Economics* 28(3):649-658.

Bhattacharya, J., and N. Sood. 2007. "Health Insurance and the Obesity Externality. *Advances in Health Economics and Health Services Research.* 17: 279-318.

Bhattacharya, J., K. Bundorf, N. Pace and N. Sood. 2011. "Does Health Insurance Make You Fat?" In M. Grossman and N. Mocan (eds), *Economic Aspects of Obesity*, Chicago, IL: University of Chicago Press, pp. 35-64.

Board of the American Society of Bariatric Physicians. Nov. 2009. "Overweight and Obesity Evaluation and Management."

Bound, J., D. A. Jaeger, and R. M. Baker. 1995. "Problems with Instrumental Variables Estimation When the Correlation between the Instruments and the Endogenous Explanatory Variable is Weak." *Journal of the American Statistical Association.* 90(430): 443-450.

Breusch, T., and A. Pagan. 1979. "A Simple Test for Heteroscedasticity and Random Coefficient Variation." *Econometrica.* 47(5): 1287-1294.

Brozek, J., F. Grande, J. T. Anderson, and A. Keys. 1963. Densitometric analysis of body composition: revision of some quantitative assumptions. *Annals of the New York Academy of Science* 110:113-140.

Burkhauser, R. and J. Cawley. 2008. "Beyond BMI: the value of more accurate measures of fatness and obesity in social science research." *Journal of Health Economics*, 27(2):519-529.

Card, D., C. Dobkin and N. Maestas. 2008. "The Impact of Nearly Universal Insurance Coverage on Health Care Utilization and Health: Evidence from Medicare." *American Economic Review,* 98(5):2242-2258.

Cawley, J. 2004. "The Impact of Obesity of Wages." *Journal of Human Resources*, 39(2):451-74.

Cawley, J. and C. Meyerhoefer. 2012. "The medical care costs of obesity: An instrumental variables approach." *Journal of Human Resources*, 31(1):219-30.

Chou, S., M. Grossman and H. Saffer. 2004. "An economic analysis of adult obesity: results from the Behavioral Risk Factor Surveillance System." *Journal of Health Economics.* 23(3): 565-587.

Cook, N. "Paying Food-Stamp Recipients to Eat Healthier Fare." *National Journal* Dec. 5, 2013.

Dave, D. and R. Kaestner. 2009. "Health Insurance and Ex Ante Moral Hazard: Evidence from Medicare." *International Journal of Healthcare Finance and Economics.* Published online March 11, 2009.

Ehrlich, I. T., and G. Becker. 1972. "Market Insurance, Self-Insurance and Self-Protection." *Journal of Political Economy 80(4): 623-648.*

Fryar, C., M. Carroll, M. and C. Ogden. 2012. "Prevalence of Overweight, Obesity, and Extreme Obesity Among Adults: United States, Trends 1960-1962 through 2009-2010." Centers for Disease Control and Prevention, National Center for Health Statistics. http://www.cdc.gov/NCHS/data/hestat/obesity_adult_09_10/obesity_adult_09_10.pdf

Gallagher, D., S. B. Heymsfield, M. Heo, S. A. Jebb, P. R. Murgatroyd, and Y. Sakamoto. 2000. "Health percentage body fat ranges: an approach for developing guidelines based on body mass index." *American Journal of Clinical Nutrition* 72(3):694-701.

Greve, J. 2008. "Obesity and Labor Market Outcomes in Denmark." *Economics and Human Biology* 6(3) December: 350-362.

Grossman, M. 2004. "The demand for health, 30 years later: a very personal retrospective and prospective reflection." *Journal of Health Economics.* 23(4): 629-636.

Haque, M. M. 2013. "Does Possession of Health Insurance Contribute to Obesity? An Empirical Study among American Young Adults." Working Paper, Dept. of Economics, The University of Memphis.

Heckman, J. J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47(1):520-537.

Heyward, V. H. and D. R. Wagner. 2004. Applied Body Composition Assessment, 2nd ed. Human Kinetics, Champaign, IL.

Johannsson, E., P. Bockerman, U. Kiiskinen, and M. Heliovaara. 2009. "Obesity and Labor Market Success in Finland: The Difference between having a High BMI and Being Fat." *Economics and Human Biology,* Elsevier, vol. 7(1) March,: 36-45.

Kelly, I. R. and S. Markowitz. 2009/2010. “Incentives in Obesity and Health Insurance.” *Inquiry.* 46(4): 418-432.

Kenkel, D. S. 2000. “Prevention.” In *Handbook of Health Economics,* Vol. 1B., A. J. Cuyler and J. P. Newhouse, eds. Amsterdam: Elsevier.

Kim, D. and Leigh, J. P. 2010 “Estimating the Effects of Wages on Obesity.” *Journal of Occupational and Environmental Medicine* 52(5): 495-500.

Lempert, D. 2007. “Women’s Increasing Wage Penalties from Being Overweight and Obese.” BLS Economic Working Paper No. 414.

Lewbel, A. 2012. “Using Heteroscedasticity to Identify and Estimate Mismreasured and Endogenous Regressor Models.” *Journal of Business and Economic Statistics.* 30: 67-80.

Loh, E. S. 1993. “The Economic Effects of Physical Appearance.” *Social Science Quarterly* 74(2):420-38.

Lohman, S. T.G. 1992. Advances in Body Composition Assessment. Current Issues in Exercise Science, Monograph No. 3. Human Kinetics, Champaign, IL.

Morris, S. 2006. “Body Mass Index and Occupational Attainment.” *Journal of Health Economics* 25(2): 347-365.

Morris, S. 2007. “The Impact of Obesity on Employment.” *Labour Economics* 14: 413-433.

National Institutes of Health, 1994. Bioelectrical impedance analysis in body composition measurement. In: National Institutes of Health Technology Assessment Conference Statement, December 12-14, http://consensus.nih.gov/1994/1994BioelectricImpedance-Bodyta015PDF.pdf.

Pagan, J. and A. Davila. 1997. “Obesity, Occupational Attainment, and Earnings.” *Social Science Quarterly* 78:3 (September), 756-70.

Panel Study of Income Dynamics. An Overview of the Panel Study of Income Dynamics. Ann Arbor, MI. Available: http://psidonline.isr.umich.edu/Guide/Overview.html Accessed Sept. 14, 2009.

Peeters, A., J. Barendregt, F. Willekends, J. P. Mackenbach, A. A. Mamun, L. Bonneux. 2003. *Annals of Internal Medicine.* 138:1 (January), 24-32.

Rashad, I., M. Grossman and S. Chou. 2006. “The Super Size of America: An Estimation of Body Mass Index and Obesity in Adults.” *Eastern Economic Journal.* 32(1):133-148.

Register, C. A. and D. R. Williams. 1990. "Wage Effects of Obesity Among Young Workers." *Social Science Quarterly* 71(1):130-41.

Shen, W., M. Punyanita, J. Chen, Gallagher, D., J. Albu, X. Pi-Sunyer, C. E. Lewis, C. Grunfield, S. Heshka, S. B. Heymsfield. 2006. "Waist Circumference Correlates with Metabolic Syndrome Indicators Better Than Percentage Fat." *Obesity* 14(4):727-36.

Siri, W. E. 1961. "Body composition from fluid space and density." In: Brozek, J., Hanschel, A. (eds). Techniques for Measuring Body Composition. National Academy of Science, Washington, DC, pp. 223-244.

Smith, T., C. Stoddard M. Barnes. 2009. "Why the Poor Get Fat: Weight Gain and Economic Insecurity." *Forum for Health Economics and Policy.* 12(2): Article 5.

Sun, S. S. , W. C. Cameron, W., S. B. Heysfield, H. C. Lukaski, D. Schoeller, K. Friedl, R. J. Kuczmarski, K. M. Flegal, C. L. Johnson, V. S. Hubbard. 2003. "Development of bioelectrical impedance analysis prediction equations for body composition with the use of a multi-component model for use in epidemiologic surveys. *American Journal of Clinical Nutrition* 77:331-340.

U.S. Department of Health and Human Services, 1996. National Center for HealthStatistics. The Third National Health and Nutrition Examination Survey (NHANES III, 1988–1994) Center for Disease Control, Washington, DC(CDROM).

U.S. Department of Health and Human Services. 2001. "The Surgeon General's 2001 Call to Prevent and Decrease Overweight and Obesity." http://www.surgeongeneral.gov/library/calls/obesity/toc.html.

Wada, R. and E. Tekin. 2010. "Body composition and wages." *Economics and Human Biology* 8: 242-254.

World Health Organization. 1997. *Obesity: Preventing and managing the global epidemic report of a WHO consultation on obesity.* Geneva, Switzerland: World Health Organization.