THREE ESSAYS ON HEALTH AND LABOR ECONOMICS

BY

Hussain Zakir

A Dissertation Submitted to the Graduate School at Middle Tennessee State University in Partial Fulfillment of the Requirement for the Degree Doctor of Philosophy/Economics

Murfreesboro, TN

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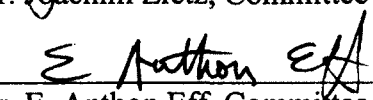

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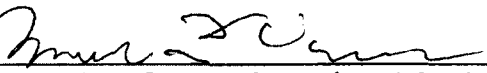

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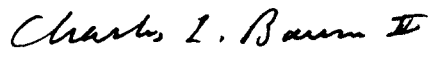

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DEDICATED TO MY WIFE, TASNEEM AND DAUGHTER, KHADIJA.

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ABSTRACT

This dissertation consists of three chapters, each providing useful information of current economic issues. The first chapter, "Does Financial Stress Lead to Weight Gain? An Empirical Analysis on the Effects of Net Worth on Body Weight" examines the effects of financial stress caused due to variations in net worth on the respondents body weight. The results indicate that net worth variation is a significant contributor to increases in body weight. Further examination reveals that individuals from indebted households and households with modest net worth are most likely to be gaining body weight. In the second chapter, "Does Walking or Riding a Bike to School Reduce Obesity? Evidence from the NLSY 1979 using Propensity Score Matching." I use the appropriate methodology to select a sample comparable to a treatment consisting of individuals who choose to walk or bike to school and find that those who walk or bike to school are likely to have significantly lower body weight measures. In the third chapter, I use nationally representative longitudinal data from 1986 to 2008 to consider the financial stress caused to mothers due to the variations in their net worth and analyze the effects that it has on the behavioral aspects of their children.

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CHAPTER I

INTRODUCTION

This dissertation consists of three essays that separately analyze economic issues within the United States.

The first essay uses the National Longitudinal Survey of Youth (1979 cohort) data from 1985 to 2008 to analyze the effects of financial stress determined by household net worth on measures of body weight of the respondents. These estimates use individual and time fixed effects to account for unobserved heterogeneity and a regional housing price index as an instrument to control for endogeneity. The estimates also control for family income and poverty status of the respondents. The results indicate that there exists a statistically significant inverse relationship between net worth and body weight. A more detailed analysis reveals that the body weight of individuals from indebted or modestly well off households reacts positively to changes in net worth, while the body weight of individuals from high net worth households is negatively associated with net worth. The results are robust to changes in the definition of these dichotomous categories of net worth.

The second essay assesses whether walking or riding a bike to school reduces obesity. High school and college students who walk or ride a bike to school are compared to those students who could have walked or ridden a bike to school but did not. The analysis employs Propensity Score Matching (PSM). Using the NLSY 1979 cohort, I find statistically significant evidence that students who walk or ride a bike to school have lower levels of BMI and obesity and are less overweight than those in the control group. When college students are included in the sample, the effect continues to remain statistically significant.

The third essay uses information on mothers from the National Longitudinal Survey of Youth - 1979 cohort and the subsequent children of these mothers from 1986 to 2008 to analyze the effects of financial stress caused due to variations in net worth of

mothers on child behavioral outcomes. The analysis employs between-effects estimation to capture the variation between individuals and fixed-effects estimation to capture the variation across time. The between-effects results indicate that children of low net worth mothers are significantly more likely to report behavioral issues while the fixed-effects results suggest that an increase in net worth over time leads to an overall increase in behavioral issues among children. The fixed-effects results also suggest that, when mothers become wealthier, females and older children are most likely to develop behavioral issues, with increases in maternal wealth leading to children, overall, becoming significantly more headstrong. The between-effects results suggest that both male and female children of mothers with low net worth report developing behavioral problems, that younger children are more likely to be antisocial and hyperactive and that older children are more depressed, dependent and report greater peer conflicts.

CHAPTER II

DOES FINANCIAL STRESS LEAD TO WEIGHT GAIN? AN EMPIRICAL ANALYSIS OF THE EFFECTS OF NET WORTH ON BODY WEIGHT.

2.1. INTRODUCTION

There has been a rapid upsurge in obesity levels in the United States within the last few decades (Flegal et al., 2010; Ogden et al., 2006). A few recent studies try to explain the causes of obesity in terms of income.[1] However, households may be affected by financial strains that go beyond income. This study argues that the value of a household's net worth may better represent its financial stress levels and analyzes the effects it has on the body weight of individuals within the household. While income is a flow variable, net worth is a stock variable. It is the difference between the assets and liabilities of a household and is an important aspect of a household's financial resources.

Research for the United States suggests that the net worth of households has increased rapidly over the last few decades. At the same time, however, the distribution of net worth has become significantly more concentrated (Wolff, 2010; Kennickell, 2006; Keister and Moller, 2000). The mean net worth of households in 2007 is twice as large as what it was in 1983 (Wolff, 2010). However, over this time period, the top 20 percent of the wealthiest households have experienced an increase in their mean net worth of 107 percent, while the bottom 40 percent witnessed a decrease in their mean net worth of 63

1 Cawley et al. (2010) finds an insignificant relationship between the income of elderly Americans and their obesity levels. Schmeiser (2009) analyzes low income households and finds that the family income of a female has a positive and significant effect on her weight, but that the effect is insignificant for males. A few studies also analyze the effect of obesity on net worth. Fonda et al. (2004) use OLS estimates on a sample of retired or near retired households to suggest that BMI has a negative effect on net worth but the results are larger for females than males. Zagorski (2004) uses NLSY (1979) data from 1985 to 2000 and estimates the effects of BMI on net worth using OLS and Granger causality. He finds a negative relationship between BMI and net worth but cannot establish reverse causality. Zagorski (2005) again uses the same data to analyze the effects of BMI on net worth separately by race and gender. He finds that the effect of BMI on net worth is negative; the effect is largest for white females and somewhat smaller for white males and black females; there is no effect for black males.

percent (Wolff, 2010).[2]

Given the growing disparity in net worth, it is important to understand the effects it has on a household. Those households who own assets enjoy several benefits. To list a few, the income generated through asset holdings, unlike earned income, has no trade off in terms of leisure (Spilerman, 2010); owner occupied homes may save households rent or mortgage payments, thus providing them with additional disposable income. However, asset prices tend to be highly correlated with business cycles (Fisher, 1933). An economic boom would raise the price of assets whereas a bust would lead to a fall in the price of these assets. The recent recession in 2008 shows that when asset prices deflate, household savings evaporates and the market price of homes significantly drops. Home owners are unable to sell their properties unless they accept a big financial loss. This makes households immobile and unable to relocate to find work.

In addition to the above arguments, during an economic crisis, a household experiencing lost earnings may want to use its assets to meet its consumption needs. Due to a general drop in asset prices, assets may become poor collateral security and fail to help a household in securing loans. As a consequence, the household may be prevented from borrowing to satisfy its perceived consumption needs, which can cause significant social stress, which often tends to be relieved by overeating, especially of convenient but unhealthy foods (Oliver et al., 2000).[3]

2 During the same time period, the top 20 percent of the wealthiest households and the bottom 40 percent of the wealthiest households experienced an increase in income of 62 percent and 7 percent, respectively (Wolff, 2010), which suggests that the disparity is much wider in terms of net worth than income.

3 The consumption needs are often driven by what is perceived as necessary to attain the social status of an aspiration group, although the financial means may not be adequate.

A drop in asset prices may also result in a household experiencing a situation of negative net worth, where the value of its assets is less than the value of its liabilities. A family with negative net worth may be subject to effects not captured by measures of earnings, such as insecurity (Dubois and Anderson, 2010), strained social relations (Carpentier and Van den Bosch, 2008) and absenteeism at work (Kim et al, 2006). Debt has been shown to lead to stress (Drentea and Lavrakas, 2000), anxiety (Drentea, 2000) and even depression (Bridges and Disney, 2010). Such stress may lead to unhealthy eating habits (Adam and Epel, 2007; Greeno and Wing, 2004), which can ultimately cause an individual to gain weight.

Considering these factors, this paper attempts to empirically analyze the effects of financial stress as proxied by net worth on obesity levels by utilizing the 1979 cohort of the National Longitudinal Survey of Youth (NLSY). Obesity is measured using four variables: body weight, Body Mass Index (BMI) and two dichotomous variables that identify whether a person is obese or overweight. In order to deal with omitted variable bias arising due to unobserved heterogeneity, I use a fixed-effects estimator for the analysis. Additionally, I use a regional housing price index as an instrument to account for the possible endogeneity of net worth in its effect on body weight. I explicitly allow net worth to have a nonlinear impact on the outcome variables. My results suggest that there exists an inverse relationship between net worth and measures of body weight. However, the threshold effects reveal that the relationship is positive for individuals in debt and those with a modest level of net worth but strongly negative for individuals with high net worth.

I present a brief literature review in Section 2, detail the data in Section 3, and discuss the empirical strategy in Section 4. The empirical results are provided in Section 5. Some policy implications are given in Section 6.

2.2. LITERATURE REVIEW

The economic causes and consequences of obesity have been studied extensively in the literature. I present a brief literature review emphasizing the causes of obesity.

Ruhm (2000) explains the relationship between economic cycles and health and concludes that a stronger economy leads to greater obesity along with increased smoking, a reduction in physical activity and an increase in consumption of unhealthy food.

Cawley et al. (2010) concentrate on elderly Americans in the National Health Interview Survey to show that there is no significant effect of income on the weight of men and women in the analysis. Schmeiser (2009) employs the same data as this study but concentrates on low income households. He applies the generosity of the benefits of the Earned Income Tax Credit program as an instrument to show that family income significantly raises the BMI of women but not of men. Both these studies use family income as an explanatory variable but they do not control for the net worth of these households.

Keese and Schmitz (2010) use the German Socio Economic Panel data to analyze the effect of household debt burden on the health of the respondents. They find that those households with higher debt burden happen to be significantly less satisfied with their

health and have significantly poorer mental health status as well. Their OLS estimates suggest a strong positive correlation between consumer debt burden and obesity. However, when they control for unobserved heterogeneity, these effects are no longer significant. More to the point, after controlling for unobserved heterogeneity and reverse causality they suggest that the relationship between their measures of health and debt burden is not causal.[4] Buttenheim et al. (2010) analyze the 2000 Mexican National Health survey data and find that household wealth is positively related to obesity for all groups except urban women. However, they do not control for income or the poverty of households.

The studies by Keese and Schmitz (2010) and Buttenheim et al. (2010) suggest contradictory and ambiguous results on the impact of wealth on obesity. Prior to this study, there is no research that analyzes the effects of net worth on obesity within the United States. Hence, this study attempts to fill this gap within the literature.

2.3. DATA

I use the 1979 cohort of the National Longitudinal Survey of Youth (NLSY) for the purpose of this analysis. The NLSY is a nationally representative data and has been widely employed for the analysis of various economics issues related to obesity (eg. Baum and Ruhm, 2009; Bhattacharya and Bundorf, 2009; Cawley, 2004; Lakdawalla and Philipson, 2007; Schmeiser, 2008). The survey began in 1979 with individuals in the age

4 Keese and Schmitz (2010) argue that poor health may prevent an individual from reporting to work. To rule out reverse causality, they estimate the same equation on a sample of employed individuals only.

range of fourteen to twenty-two. The respondents were interviewed annually up until 1994, after which, it continues being held biennially. For the purpose of this study I include data from 1985, 1986, 1988, 1989, 1990, 1992, 1993, 1994, 1996, 1998, 2000, 2004 and 2008. The other years are excluded from the analysis since certain key variables are missing for those years.[5]

I measure adiposity through the body weight and BMI of the respondents. The NLSY has data on body weight for all the years selected in this analysis. Since height remains constant in adulthood, I use height in 1985 along with body weight in deriving the BMI of the respondents.[6] I also use the probabilities of being obese, defined as BMI over thirty and being overweight, defined as BMI over twenty-five, as other measures of adiposity.[7]

For all the years selected in this study, NLSY seeks information on several variables related to the assets and liabilities of the respondents and their spouses. From these variables NLSY derives net worth using the method suggested by Zagorsky (1999). In particular, net worth is the sum of the value of the home (+), the outstanding mortgage (-), property debt (-), cash savings (+), stock holdings (+), trusts (+), business, farm, or real estate equity (+), business, farm, or real estate debt (-), the value of any car (+), any

5 The years prior to 1985 and the years 1991, 2002 and 2006 do not have information on net worth, the years 1987 and 1991 do not have information on body weight. Hence, these years have not been used for the analysis.} The youngest respondents are twenty years of age in 1985, while the oldest respondents are fifty-one by 2008.

6 Since the youngest respondents are at least 20 years old by this year, I expect height to remain constant. BMI is defined as (Pounds/(inches)^2)*703 where 703 is the conversion factor to convert the units of measure into SI units.

7 The definitions of BMI, obese, and overweight are standard definitions used by organizations such as the Center of Disease Control (CDC), National Institute of Health (NIH) and the World Health Organization (WHO).

car debt (-), the value of personal possessions (+), other debt (-), the value of IRAs (+), 401K savings (+), and certificates of deposit (+), where a negative sign in parenthesis indicates that a value is subtracted and vice versa for a positive sign. In order to account for increases in the general price level, I convert the values of net worth into 1985 dollars.

Any regression explaining the impact of net worth on weight needs to control for age. To gauge the importance of age as a determinant of weight, I plot the relationship between net worth and measures of body weight by the age of the respondent. In particular, Figure 1 plots body weight by age and Figure 2 the probabilities of being obese and overweight by age. The figures illustrate that body weight increases rapidly with age. As a result, the likelihood of being overweight or obese also rises. Figure 3 shows how net worth and income vary by age. It is apparent that net worth follows an upward trend while income remains virtually flat. This graph underscores the idea that income may not be as useful a measure for understanding the causes of obesity as net worth may be.

The other demographic variables used in the analysis include the respondent's race, gender, marital status, and the highest grade completed by the respondent. To control for geographical constraints, the covariates include the region of residence and whether the respondent resides in an urban area (with rural area as the base) or a metropolitan area (with a non-metropolitan area as the base). To control for the household's financial status the covariates include the household's net family income[8], whether the household is under the poverty limit, whether it has any savings, and whether it owns a home.

8 Family income is measured in constant 1985 dollars.

In Table 1, I present the demographics of the respondents, overall, and by those who are obese and overweight.[9] The demographics in Table 1 suggest that blacks[10] and Hispanics are more likely to be obese by six and two percentage points and overweight by three and one percentage points than the overall sample. Obese individuals are less likely to be single than the overall sample (22% versus 25%) and are more likely to have children (63% versus 56%). When compared to the overall sample, obese and overweight individuals are less likely to have a college education (16% and 19% versus 23%). It is, therefore, not surprising that obese individuals are more likely to live in poverty (14% versus 11%) and are less likely to have savings (72% versus 75%).

2.4. EMPIRICAL STRATEGY

I exploit the panel nature of the data to estimate a regression equation of the form

$$W_{it} = \alpha + \beta_1 NW_{it} + \beta_2' X_{it} + \gamma_i + \tau_t + \epsilon_{it} \quad (1)$$

where i indexes individuals and t indexes years from the NLSY data. W is the body weight of the individual in each year of the analysis. As an alternative to weight as the dependent variable, I also use *BMI* and the probability of being obese or overweight. NW is the net worth of the individual i at time t, γ_i is the fixed effect for the respondent i and τ_t represents time fixed effects. X is an appropriately dimensioned vector containing the

9 Throughout the analysis, appropriate sampling weights provided by the NLSY are used to adjust for the oversampling of blacks and Hispanics. Since pregnant females are encouraged to gain weight, they have been excluded throughout the analysis and are not affecting the statistics being presented here.

10 Following other studies within the literature, I refer to African Americans as *blacks* for the sake of brevity.

control variables including demographic characteristics such as age, gender, race, educational background.

In addition to controlling for unobserved heterogeneity using the fixed effects estimator, described in equation (1), I also control for the potential endogeneity of net worth by using an instrumental variable approach. I use the Federal Housing Price Agency's (FHFA) Housing Price Index (HPI) as my instrument. The index is widely used in the housing literature[11] and is constructed of all repeat sales single family homes whose mortgages are inspected by Fannie Mae and Freddie Mac. The index is available by census division. The exogenous variation in net worth is identified using the regional variation in the housing price index as an instrument for my estimates. Since the census divisions are not fully consistent with the regional definitions of the NLSY, I use the population of each division within a census region to construct a weighted average regional index for each NLSY region. Additionally, I scale the index to constant 1985 dollars to keep it comparable with the rest of the data.

The previous literature on the impact of net worth on weight is contradictory. This may signal that the relationship between net worth and body weight is nonlinear or driven by threshold effects and cannot easily be identified by a simple regression on continuous variables. To check for this possibility, I create the dichotomous variables *indebted*, *breaking even*, *modest net worth*, and *high net worth*. They indicate whether the individual is in debt (net worth below zero), breaking even (net worth of zero), is reasonably well off, or is truly well off. Since there is no predefined break point between

11 This index was formally known as the Office of Federal Housing Enterprise Oversight (OFHEO) index and is available from the following link: http://www.fhfa.gov/webfiles/1280/4q09hpi.pdf

these variables, I try multiple alternative break points for this analysis. Using the four dichotomous variables, I can identify to what extent net worth affects weight differently across different net worth classes. Given the contradictory results of the previous studies, one would conjecture that the signs of the dichotomous variables are significantly different. As a consequence, the overall relationship between weight and net worth may be either positive or negative depending on the number of observations associated with each net worth class.

2.5. ESTIMATION RESULTS

The objective of this research is to analyze the effect of net worth on several measures of body weight. Table 2 presents OLS estimates of the effect of net worth on (a) body weight (model 1), (b) BMI (model 2), on (c) being obese or not (model 3) and (d) on being overweight or not (model 4). The results suggest that there is a negative and statistically significant relationship between net worth and weight. An increase in net worth of $10,000 is predicted to reduce body weight by 0.0856 pounds, BMI by 0.0155 index points, the probability of being both obese and overweight by 0.11 percentage points.

The estimates of Table 2 use pooled data, but do not incorporate any fixed effects. Table 3 shows the results using the individual and time fixed effects estimator.[12] These results confirm those of Table 2 that the effect of net worth on weight is negative. The

12 I estimate both fixed effects and random effects models and conduct the Hausman test thereafter. Results from the Hausman test reject the null hypothesis and accept the alternative hypothesis, which means that the fixed effects estimates are appropriate.

marginal effects tend to be lower, 0.0495 pounds for weight, 0.0081 for BMI and 0.07 percentage points for the probability of being obese. The probability of being overweight turns statistically insignificant.

Some of the other estimation results in Tables 2 and 3 are also of interest. The effect of family income on measures of body weight remains statistically insignificant. Other variables such as *age* and being from the southern United States has a positive and significant effect on measures of body weight, which is consistent with the literature.

The fixed effects estimates of net worth on measures of body weight presented above absorb the effects of unobserved heterogeneity. However, it could be that reverse causality between these variables may be involved. While an increase in body weight is not likely to lead to any increase in net worth, it may be possible that it would lead to a reduction in net worth. In order to take into account any reverse causality involved, I use a region specific housing price index as an instrument for net worth. The instrumental variable estimates are conducted for a sample that includes only those individuals who own a home. The estimation results are presented in Table 4. I find that for the sub-sample of home owners, the effect of net worth on body weight, BMI and the probability of being overweight is negative and statistically significant at the one percent level. The marginal effects tend to be higher than those reported in Table 3, 0.4095 pounds for weight, 0.0662 for BMI and 0.53 percentage points for the probability of being overweight. The probability of being obese turns statistically insignificant. It should be noted, however, that the number of observations are smaller than before. Hence, when conducting robustness check (discussed later), I continue using the fixed effects

estimator.

The results presented in Tables 2, 3 and 4 only provide an average response of weight and similar measures to the impact of net worth. A nonlinear response through threshold effects is excluded. To allow for a nonlinear response, I create three dichotomous variables, one for individuals being in debt (net worth is negative), one for modestly well-off individuals (net worth is greater than zero but not more than $200,000), and one for high net worth individuals (net worth greater than $200,000). I keep those who just break even (net worth equal to zero) in the base category.[13] The corresponding estimation results are presented in Table 5. They suggest that being in debt has a significantly positive effect on body weight at the 1% level, on BMI at the 1% level, on being overweight at the 10% level, while the probability of being obese is insignificant. This positive effect remains similar for those who are modestly well off. For both categories of individuals, the average body weight exceeds that of those in the base category (zero net worth) by about 2 pounds; the BMI index is larger by 0.32 index points.

The effects of being a high net worth individual under the fixed effects model remains insignificant. It could be that the definition of breaking-even as those individuals whose net worth is exactly zero is too narrow. Hence, I expand the range of this variable in increments of $500 from exactly zero to $5,000 and estimate the effects of the categorical variables of net worth on measures of weight. The results for those with a

13 All amounts are in 1985 Dollars. The numbers of observations in these categories are: those who are indebted 16,911, those breaking even, 10,783, those modestly well off 85,191 and those who are of high net worth are 50,394.

negative or those with fair net worth remain consistent in terms of signs when compared with the strict definition of those breaking even at exactly zero. However, the high net worth individuals have now a statistically significant negative effect on body weight and BMI. I present the estimates with *breaking even* defined to lie between $0 to $500 in appendix Tables A1 and the estimates with *breaking even* defined to lie between $0 to $5,000 in appendix Tables A2.[14]

The effect of being truly well off on weight is very different from that in the other three categories. The variable identifying a person as being truly well off has a statistically significant negative effect on three of the four weight measures I estimate models for. Being truly well off reduces the body weight by 1.13 pounds, BMI by 0.19 index points and the probability of being obese by 1.7 percentage points.

Since there is no perfect definition for classifying an individual as of modest or high net worth, I verify the robustness of these results by varying the cut-off point at which an individual is not considered modestly well off any longer but of high net worth. For that purpose, I increase the upper limit of the category that I classify as modestly well off individuals by $10,000 for each regression. I start with a lower limit of $10,000 and continue to an upper limit of $200,000.[15] I estimate the results using the fixed effects estimator and plot the coefficients of these estimates in Figure 4. This figure indicates that the coefficient estimates of the dichotomous variable representing individuals who

14 In Table A11 the observations classified as *breaking even* are 15,275 while those classified as modestly well off are 80,699. In Table A12, those classified as *breaking even* are 38,815 while those who are modestly well off are reduced to 57,159. The other estimates are omitted for the sake of brevity but can be obtained from the author by request.

15 Again, these numbers are in 1985 dollars.

are modestly well off remains constant and similar to those presented in Table 5. The estimates of the dichotomous variable that represents those categorized as high net worth households decrease significantly as this category is conditioned on ever higher levels of net worth. I note that the coefficient turns negative only for net worth levels beyond $140,000. Overall, Figure 4 confirms the result that increases in net worth lower the likelihood of being overweight, obese, or having a larger weight or BMI.

In addition to the estimates described above, I conduct several checks to verify the sensitivity of the results. First, since *age* is an important co-variate and is otherwise controlled for by a continuous variable, I replace *age* with a set of dichotomous variables to check whether using categories of age changes the impact of net worth on measures of body weight. The results, presented in the Appendix in Table A3, suggest that the effect of net worth is largely unaffected in spite of a different age co-variate. When dichotomous variables of net worth are used in the analysis (Table A4), those observations associated with households in debt and the those classified as modestly well off have a positive and significant effect on body weight and BMI, which is similar to the results presented earlier (Table 5).

In Tables A5 and A6 of the appendix, I present the effects of net worth and its dichotomous categories by race and gender. These results suggest that the effect of net worth on body weight, BMI and the probability of being obese is negative and significant for white males and also for females of all races. In terms of dichotomous categories, both white and black females show a statistically significant negative effect for high net worth on BMI, while both black and Hispanic females reveal a positive and significant

effect for the negative net worth and the modest net worth categories on body weight and BMI. Among males, those of Hispanic background with a modest net worth are likely to have positive coefficients for body weight and BMI measures.

Finally, since the instrumental variables estimates in Table 4 are only for a sample of those who own a house, I also follow the approach taken by Keese and Schmitz (2010) to rule out reverse causality, which may arise from the fact that an increase in obesity is leading to health problems and medical costs and thus reduces net worth. In particular, I eliminate those individuals from the sample who have a disability that affects the kind of job they are able to do (Tables A7 and A8). I also drop those individuals who are suffering from high blood pressure, diabetes or heart ailments (Tables A9 and A10) and those who have a member in their family with a disability (Tables A11 and A12). The associated reductions in sample sizes do not materially affect the results. This affirms the robustness of the estimates.

2.6. CONCLUSIONS

This study analyzes the effects of financial stress measured by household net worth on body weight. Studies such as Keese and Schmitz (2010), Drentea (2000) and Drentea and Lavrakas (2000) attempt to identify the impact of financial stress induced by individual debt items such as consumer debt (in the former study) or credit card debt (in the latter two studies). However, these studies fail to capture the financial stress that is caused by general asset price deflation as seen recently for the housing sector of the United States. By using net worth and subsequently creating dichotomous categories of

net worth, this study provides a more detailed analysis of the impact of financial stress on body weight.

I use longitudinal data from 1985 to 2008 for this analysis. Initially, I estimate the relationship between net worth and measures of body weight using least squares. In a next step, I account for time invariant unobserved heterogeneity by using individual and time specific fixed effects and the possible endogeneity of net worth by using a regional housing price index as an instrument for net worth. The results suggest that, overall, net worth has a negative effect on measures of body weight. To allow for nonlinear or threshold effects, I break up net worth into dichotomous variables that classify respondents as in debt, breaking even (base category), those being modestly well off and those with high net worth. I find that the respondents in debt and those who are fairly well off have on average a higher weight than those with a net worth of zero or those who are of high net worth.

My estimates show that the stress of having a negative net worth leads to an increase in body weight. These findings are similar to Brenner and Mooney (1983), who claim that recessions may cause psychosocial stress, which would lead to an increase in smoking, drinking and illegal drug usage as well as distorted eating habits. Additionally, Keese and Schmitz (2010), Drentea (2000) and Drentea and Lavrakas (2000) also show that debt has adverse health effects.

In all but my instrumental variables estimates, family income remains statistically insignificant, which is consistent with the findings of Cawley et al. (2010). Schmeiser (2009) shows that family income significantly raises the BMI of females and my

estimates by race and gender suggest that indebted and modest net worth has a negative and statistically significant effect on females as well. In short, these results encompass results from numerous previous studies.

The results have policy relevance since they show that asset price fluctuations may have consequences that go beyond the realm of finance. In particular, asset price deflation may cause financial stress and subsequently lead to increases in body weight, which ultimately causes health problems.

The results have policy relevance since they show that asset price fluctuations may have consequences that go beyond the realm of finance. In particular, asset price deflation may cause financial stress and subsequently lead to increases in body weight, which ultimately causes health problems.

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Table 1: Demographics of the NLSY from 1985 to 2008.

Variable	Overall	Overweight	Obese
Race (%)			
Black	12.80	15.39	18.97
Hispanic	6.31	7.45	8.32
White	80.90	77.16	72.71
Gender (%)			
Male	51.89	61.24	51.02
Female	48.11	38.76	48.98
Marital status (%)			
Single	25.41	22.33	22.59
Married	58.49	61.83	60.74
Divorced	11.88	11.47	11.20
Separated	3.71	3.75	4.42
Widowed	0.51	0.62	1.05
Children (%)			
No children	43.95	40.42	37.20
One child	19.31	19.70	20.24
Two children	24.13	25.40	26.21
Three children	9.33	10.72	12.09
More than three children	3.29	3.76	4.27
Highest grade completed (%)			
Grades 0 to 8	2.21	2.41	3.04
Grades 9 to 11	7.69	7.52	8.64
Grade 12	43.57	46.31	48.98
Grade 13 to 15	22.76	22.88	22.75
Grade 16	14.76	12.95	10.42
Beyond college	9.01	7.93	6.17
Mean net worth ($ 0,000)	6.93 (0.0783)	7.15 (0.1101)	6.01 (0.1512)
Mean family income ($ 0,000)	3.72 (0.0271)	3.60 (0.0331)	3.17 (0.0416)
In poverty (%)	11.67	11.41	14.33
Have savings (%)	75.83	75.59	72.22
Own a house (%)	51.85	55.52	54.64
Average age (years)	33.21 (0.0284)	34.91 (0.0404)	36.25 (0.0673)
Region of residence (%)			
North east	17.73	17.50	16.08
North central	27.79	27.58	28.93
South	34.68	35.80	38.08
West	19.81	19.12	16.92
Urban area (%)	71.65	69.69	68.90
Metropolitan area (%)	49.30	51.79	55.06
Number of observations	140,305	48,233	17,411

Note: Standard deviation in parenthesis. Survey weights have been used to overcome oversampling of minorities. Whites include all other non-black and non-Hispanic individuals. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars.

Table 2: OLS estimates of the impact of net worth on measures of body weight

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Net worth ($ 0,000)	**-0.0856 *****	**(0.0079)**	**-0.0155 *****	**(0.0011)**	**-0.0011 *****	**(0.0001)**	**-0.0011 *****	**(0.0001)**
Hispanic	-0.7558 *	(0.3364)	1.3207 ***	(0.0518)	0.1176 ***	(0.0052)	0.0648 ***	(0.0042)
Black	7.5569 ***	(0.3150)	1.4546 ***	(0.0485)	0.1192 ***	(0.0046)	0.0712 ***	(0.0038)
Male	37.6989 ***	(0.2468)	1.2857 ***	(0.0367)	0.2008 ***	(0.0038)	-0.0020	(0.0028)
North east	0.3712	(0.3810)	0.3179 ***	(0.0570)	0.0326 ***	(0.0062)	0.0188 ***	(0.0044)
North central	3.1233 ***	(0.3657)	0.4082 ***	(0.0537)	0.0202 ***	(0.0057)	0.0368 ***	(0.0041)
South	2.6017 ***	(0.3390)	0.4100 ***	(0.0507)	0.0309 ***	(0.0054)	0.0337 ***	(0.0038)
Single	-2.8770	(2.0678)	-0.8244 *	(0.3339)	-0.0356	(0.0241)	-0.0677 **	(0.0243)
Married	-2.2971	(2.0574)	-0.9013 **	(0.3330)	-0.0118	(0.0239)	-0.0784 **	(0.0242)
Separated	-4.6197 *	(2.1233)	-1.2026 ***	(0.3434)	-0.0457	(0.0252)	-0.0949 ***	(0.0249)
Divorced	-8.2946 ***	(2.0776)	-1.8449 ***	(0.3357)	-0.0841 ***	(0.0242)	-0.1389 ***	(0.0244)
No children	-3.9308 ***	(0.7027)	-0.5465 ***	(0.1120)	-0.0547 ***	(0.0110)	-0.0212 *	(0.0087)
One child	-2.2511 **	(0.7058)	-0.1916	(0.1130)	-0.0223 *	(0.0111)	-0.0100	(0.0088)
Two children	-2.0822 **	(0.6942)	-0.2676 *	(0.1113)	-0.0233 *	(0.0109)	-0.0118	(0.0087)
Three children	-0.6229	(0.7603)	0.0936	(0.1205)	0.0142	(0.0118)	0.0127	(0.0096)
In poverty	-0.5737	(0.4185)	0.0437	(0.0660)	-0.0093	(0.0061)	0.0067	(0.0047)
Urban area	-1.2620 ***	(0.3039)	-0.1495 ***	(0.0448)	-0.0205 ***	(0.0047)	-0.0058	(0.0036)
Metro area	-0.9892 ***	(0.2753)	-0.1898 ***	(0.0409)	-0.0131 **	(0.0043)	-0.0069 *	(0.0032)
Own a house	-1.0080 ***	(0.3053)	-0.1981 ***	(0.0455)	-0.0051	(0.0047)	-0.0191 ***	(0.0035)
Family income ($ 0,000)	-0.0434 *	(0.0183)	-0.0131 ***	(0.0027)	-0.0013 ***	(0.0003)	-0.0009 ***	(0.0002)
Have savings	0.6062	(0.3189)	-0.0359	(0.0482)	0.0071	(0.0049)	-0.0057	(0.0037)
Age (years)	1.3036 ***	(0.0212)	0.2144 ***	(0.0032)	0.0180 ***	(0.0003)	0.0123 ***	(0.0003)
Grades 0 to 8	1.1732	(0.8407)	1.5123 ***	(0.1407)	0.1150 ***	(0.0143)	0.1100 ***	(0.0113)
Grades 9 to 11	2.3380 ***	(0.6067)	0.9002 ***	(0.0890)	0.0796 ***	(0.0097)	0.0794 ***	(0.0069)
Grade 12	5.5718 ***	(0.4450)	1.1333 ***	(0.0648)	0.1074 ***	(0.0073)	0.0751 ***	(0.0049)
Grade 13 to 15	4.8631 ***	(0.4722)	0.8268 ***	(0.0688)	0.0846 ***	(0.0076)	0.0537 ***	(0.0052)
Grade 16	3.0785 ***	(0.4851)	0.3036 ***	(0.0702)	0.0294 ***	(0.0081)	0.0180 ***	(0.0052)
R-Square	0.3137		0.1258		0.1195		0.0638	
Observations	95,846		93,537		93,537		93,537	

Note: Net worth and Family Income are in $0,000. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Survey weights are used for this estimation.

Table 3: Fixed Effects estimates of the impact of net worth on measures of body weight

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Net worth ($ 0,000)	**-0.0495 *****	**(0.0055)**	**-0.0081 *****	**(0.0008)**	**-0.0002**	**(0.0001)**	**-0.0007 *****	**(0.0001)**
North east	0.9004	(0.5639)	0.1585	(0.0886)	0.0268	(0.0146)	0.0053	(0.0118)
North central	1.4433 *	(0.5694)	0.2610 **	(0.0885)	0.0179	(0.0131)	0.0259 *	(0.0101)
South	1.5734 **	(0.4865)	0.2558 ***	(0.0761)	0.0283 *	(0.0116)	0.0252 **	(0.0092)
Single	-1.0473	(1.5474)	-0.1831	(0.2496)	-0.0083	(0.0306)	-0.0387	(0.0228)
Married	1.7557	(1.5143)	0.2131	(0.2447)	0.0455	(0.0297)	-0.0167	(0.0223)
Separated	-1.8682	(1.5441)	-0.3463	(0.2498)	-0.0147	(0.0305)	-0.0449 *	(0.0227)
Divorced	-1.3611	(1.5404)	-0.2800	(0.2488)	0.0033	(0.0305)	-0.0500 *	(0.0226)
No children	-1.8820 **	(0.6187)	-0.2641 **	(0.1002)	-0.0402 **	(0.0125)	-0.0148	(0.0116)
One child	-0.8519	(0.6007)	-0.1136	(0.0975)	-0.0232	(0.0121)	-0.0109	(0.0114)
Two children	-0.8962	(0.5781)	-0.1384	(0.0939)	-0.0203	(0.0117)	-0.0098	(0.0110)
Three children	-0.5845	(0.5552)	-0.1091	(0.0900)	-0.0110	(0.0115)	-0.0077	(0.0106)
In poverty	-0.3281	(0.2512)	-0.0620	(0.0409)	-0.0083	(0.0055)	0.0014	(0.0042)
Urban area	0.5560 *	(0.2320)	0.0739 *	(0.0368)	0.0029	(0.0055)	0.0057	(0.0044)
Metro area	-0.7646 ***	(0.1817)	-0.1204 ***	(0.0288)	-0.0127 **	(0.0044)	-0.0016	(0.0034)
Own a house	0.4526 *	(0.2033)	0.0814 *	(0.0321)	0.0109 *	(0.0048)	-0.0030	(0.0036)
Family income ($ 0,000)	0.0048	(0.0082)	0.0006	(0.0013)	0.0000	(0.0002)	-0.0003 *	(0.0001)
Have savings	1.1074 ***	(0.1788)	0.1639 ***	(0.0283)	0.0124 **	(0.0040)	0.0096 **	(0.0032)
Age (years)	1.2874 ***	(0.0180)	0.2015 ***	(0.0029)	0.0173 ***	(0.0004)	0.0116 ***	(0.0003)
Grades 0 to 8	-2.3238	(1.9227)	-0.3566	(0.3047)	-0.0437	(0.0517)	0.0173	(0.0306)
Grades 9 to 11	-1.4375	(1.0709)	-0.2879	(0.1739)	-0.0394	(0.0228)	0.0164	(0.0185)
Grade 12	-2.3579 **	(0.8535)	-0.3965 **	(0.1372)	-0.0438 *	(0.0178)	-0.0025	(0.0149)
Grade 13 to 15	-1.0545	(0.7412)	-0.1465	(0.1182)	-0.0309 *	(0.0147)	0.0046	(0.0120)
Grade 16	0.1280	(0.6156)	0.0173	(0.0975)	-0.0095	(0.0128)	0.0108	(0.0098)
R-Square	0.3371		0.3319		0.1538		0.0961	
Observations	95,846		93,537		93,537		93,537	

Note: Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table 4: Fixed Effects estimates of the impact of net worth of those who own a house on measures of body weight using regional housing price index as an instrument.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Net worth ($ 0,000)	**-0.4095 *****	**(0.0585)**	**-0.0662 *****	**(0.0095)**	**-0.0053 *****	**(0.0013)**	**-0.0025 ***	**(0.0010)**
North east	-0.4672	(1.4316)	-0.0720	(0.2209)	-0.0128	(0.0303)	-0.0131	(0.0249)
North central	-0.3880	(1.2179)	-0.0671	(0.1869)	-0.0152	(0.0274)	0.0101	(0.0209)
South	-0.7247	(1.1654)	-0.1217	(0.1813)	-0.0120	(0.0246)	-0.0007	(0.0219)
Single	-2.8110	(2.1190)	-0.5615	(0.3582)	-0.0657	(0.0449)	-0.0651	(0.0372)
Married	0.8679	(1.9867)	-0.0393	(0.3395)	0.0090	(0.0414)	-0.0282	(0.0353)
Separated	-4.4856 *	(2.1139)	-0.8774 *	(0.3581)	-0.0711	(0.0445)	-0.0623	(0.0377)
Divorced	-3.9967	(2.0636)	-0.8043 *	(0.3509)	-0.0484	(0.0432)	-0.0783 *	(0.0366)
No children	-3.1124 ***	(0.8387)	-0.4634 ***	(0.1348)	-0.0593 **	(0.0182)	-0.0055	(0.0148)
One child	-1.0570	(0.7343)	-0.1316	(0.1175)	-0.0277	(0.0158)	0.0048	(0.0128)
Two children	-0.4662	(0.6813)	-0.0540	(0.1092)	-0.0198	(0.0146)	0.0100	(0.0118)
Three children	-0.1939	(0.6661)	-0.0244	(0.1069)	-0.0100	(0.0144)	0.0117	(0.0117)
In poverty	-1.2445 *	(0.5386)	-0.1974 *	(0.0868)	-0.0123	(0.0121)	-0.0098	(0.0095)
Urban area	-0.4077	(0.3231)	-0.0763	(0.0512)	-0.0133	(0.0072)	0.0032	(0.0058)
Metro area	0.3109	(0.2760)	0.0501	(0.0439)	0.0031	(0.0063)	0.0039	(0.0051)
Family income ($ 0,000)	0.0854 ***	(0.0178)	0.0133 ***	(0.0028)	0.0013 ***	(0.0004)	0.0002	(0.0002)
Have savings	1.2930 ***	(0.3027)	0.1913 ***	(0.0479)	0.0213 **	(0.0069)	0.0088	(0.0058)
Age (years)	1.5282 ***	(0.0532)	0.2398 ***	(0.0086)	0.0204 ***	(0.0012)	0.0130 ***	(0.0010)
Grades 0 to 8	-0.0797	(2.9617)	0.0687	(0.4450)	0.0194	(0.0698)	0.0301	(0.0569)
Grades 9 to 11	-0.2217	(1.5180)	-0.1193	(0.2453)	0.0047	(0.0321)	0.0184	(0.0283)
Grade 12	-2.9135 **	(1.0654)	-0.5194 **	(0.1703)	-0.0313	(0.0243)	-0.0083	(0.0182)
Grade 13 to 15	-3.6415 ***	(0.9559)	-0.5630 ***	(0.1514)	-0.0409 *	(0.0208)	-0.0124	(0.0152)
Grade 16	-1.0463	(0.7223)	-0.1857	(0.1146)	-0.0332	(0.0171)	-0.0022	(0.0127)
R-Square	0.0851		0.0713		0.0312		0.0634	
Observations	39,752		38,984		38,984		38,984	

Note: Regional housing price index is used as an instrument in these estimates. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table 5: Fixed effects estimates of the impact of dichotomous measures of net worth on measures of body weight

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Indebted	**2.0056 *** **	**(0.4054)**	**0.3366 *** **	**(0.0640)**	**0.0130 ***	**(0.0066)**	**0.0077**	**(0.0082)**
Modest net worth	**1.8717 *** **	**(0.3783)**	**0.3161 *** **	**(0.0594)**	**0.0129 ***	**(0.0060)**	**0.0102**	**(0.0077)**
High net worth	**-0.8379**	**(0.4869)**	**-0.1353**	**(0.0762)**	**-0.0194 ***	**(0.0084)**	**-0.0122**	**(0.0105)**
North east	0.8620	(0.5672)	0.1537	(0.0891)	0.0045	(0.0119)	0.0278	(0.0146)
North central	1.4558 *	(0.5714)	0.2626 **	(0.0888)	0.0263 **	(0.0101)	0.0175	(0.0131)
South	1.5624 **	(0.4893)	0.2553 ***	(0.0765)	0.0255 **	(0.0093)	0.0282 *	(0.0116)
Single	-1.0670	(1.5537)	-0.1858	(0.2508)	-0.0391	(0.0228)	-0.0089	(0.0305)
Married	1.6809	(1.5210)	0.2011	(0.2460)	-0.0177	(0.0223)	0.0448	(0.0296)
Separated	-1.8840	(1.5503)	-0.3481	(0.2510)	-0.0455 *	(0.0226)	-0.0152	(0.0305)
Divorced	-1.3746	(1.5461)	-0.2823	(0.2499)	-0.0501 *	(0.0226)	0.0028	(0.0304)
No children	-1.8038 **	(0.6150)	-0.2520 *	(0.0997)	-0.0134	(0.0116)	-0.0409 **	(0.0124)
One child	-0.8121	(0.5974)	-0.1075	(0.0970)	-0.0102	(0.0113)	-0.0240 *	(0.0121)
Two children	-0.8742	(0.5746)	-0.1350	(0.0933)	-0.0096	(0.0110)	-0.0210	(0.0117)
Three children	-0.6034	(0.5521)	-0.1125	(0.0896)	-0.0079	(0.0106)	-0.0121	(0.0115)
In poverty	-0.2436	(0.2499)	-0.0473	(0.0407)	0.0019	(0.0042)	-0.0078	(0.0055)
Urban area	0.5523 *	(0.2325)	0.0724 *	(0.0369)	0.0058	(0.0044)	0.0025	(0.0055)
Metro area	-0.7405 ***	(0.1814)	-0.1164 ***	(0.0288)	-0.0015	(0.0034)	-0.0122 **	(0.0044)
Own a house	0.3398	(0.2032)	0.0631 *	(0.0322)	-0.0046	(0.0036)	0.0102 *	(0.0048)
Family income ($ 0,000)	0.0027	(0.0082)	0.0003	(0.0013)	-0.0004 **	(0.0001)	0.0000	(0.0002)
Have savings	0.9251 ***	(0.1782)	0.1333 ***	(0.0282)	0.0081 *	(0.0033)	0.0112 **	(0.0040)
Age (years)	1.2806 ***	(0.0178)	0.2005 ***	(0.0028)	0.0115 ***	(0.0003)	0.0173 ***	(0.0004)
Grades 0 to 8	-2.4442	(1.9135)	-0.3759	(0.3029)	0.0150	(0.0305)	-0.0424	(0.0516)
Grades 9 to 11	-1.4156	(1.0691)	-0.2834	(0.1736)	0.0159	(0.0185)	-0.0384	(0.0228)
Grade 12	-2.3676 **	(0.8543)	-0.3979 **	(0.1373)	-0.0027	(0.0149)	-0.0446 *	(0.0177)
Grade 13 to 15	-1.0887	(0.7436)	-0.1524	(0.1186)	0.0046	(0.0121)	-0.0318 *	(0.0146)
Grade 16	0.0784	(0.6180)	0.0091	(0.0980)	0.0106	(0.0099)	-0.0105	(0.0128)
R-Square	0.3374		0.3323		0.0954		0.1541	
Observations	96,023		93,712		93,712		93,712	

Note: Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

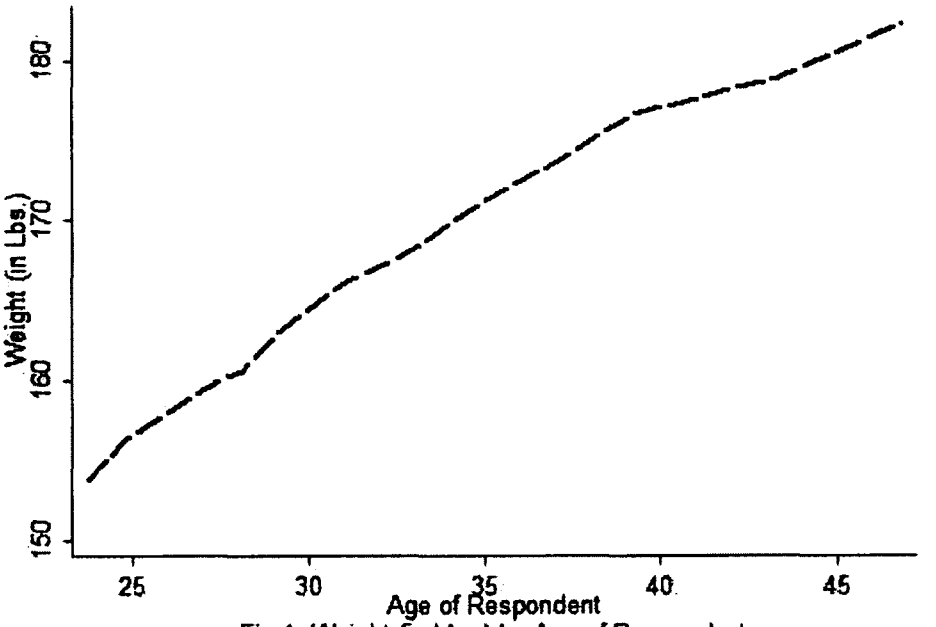

Fig 1. Weight (in Lbs.) by Age of Respondent

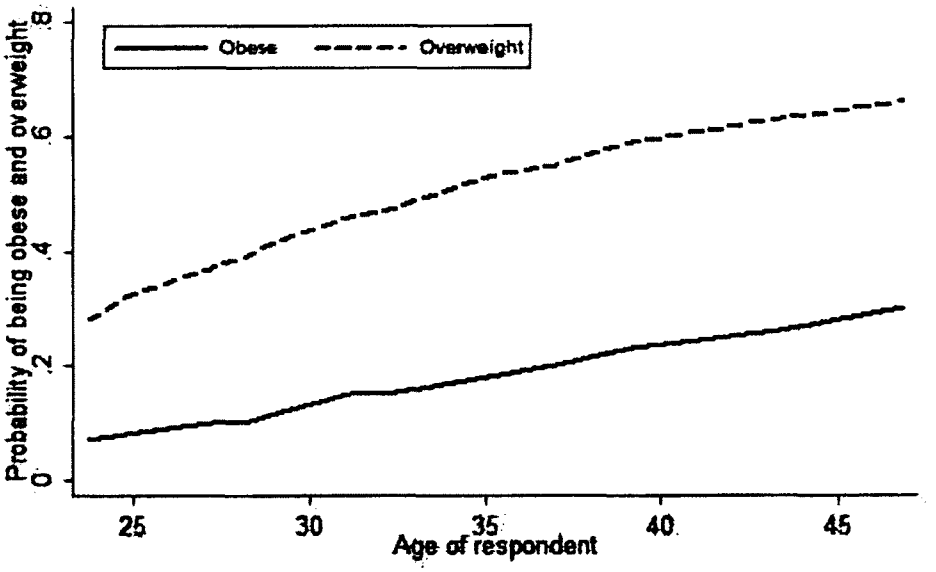

Fig 2. Probabilities of being obese and overweight by age of respondent

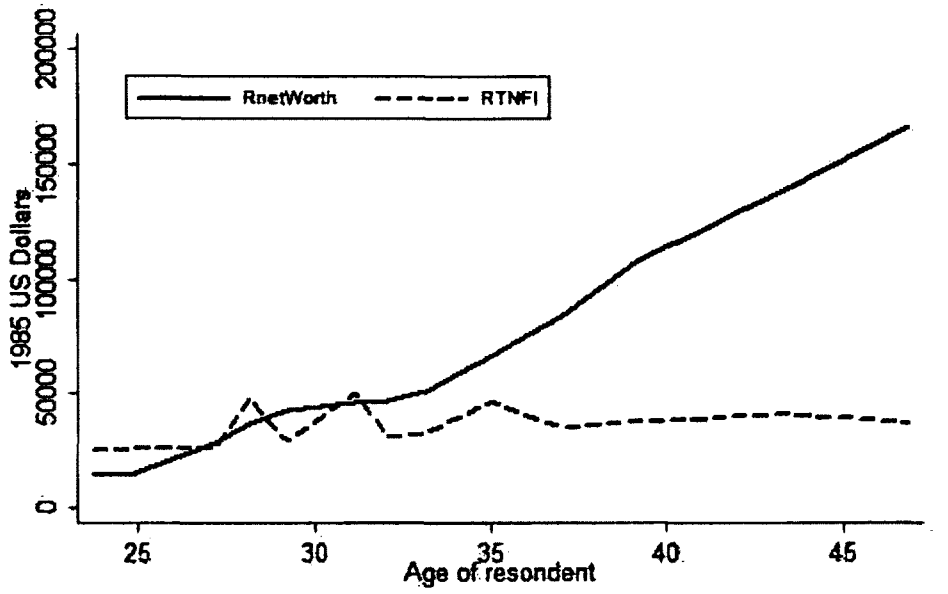

Fig 3. Net worth and family income by age

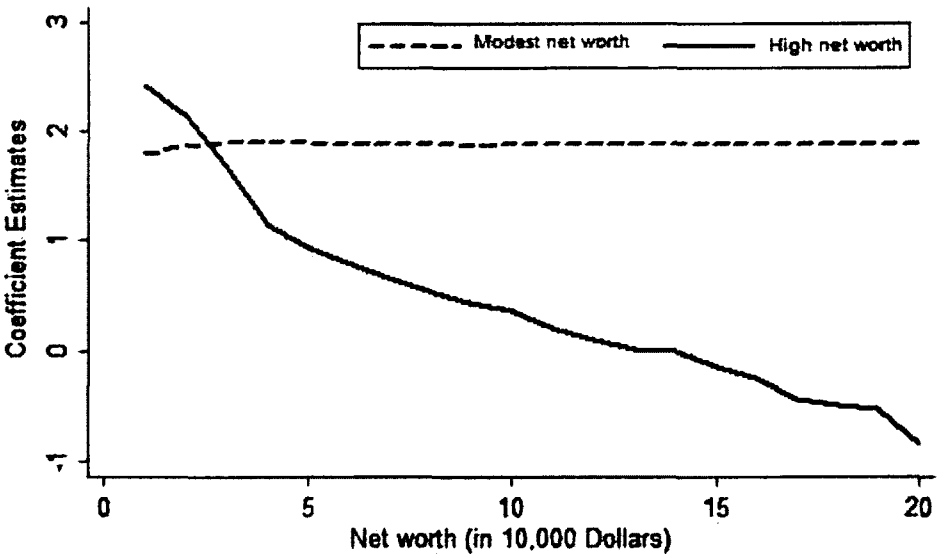

Fig4. Coefficient Estimates (fixed effects). Dichotomous net worth measures on body weight.

Note: Debt, write used for estimation has not been used in the plot. Breazing even is used as the base variable

APPENDIX

Table A1: Fixed effects estimates of the impact of dichotomous measures of net worth on measures of body weight with even (base category) ranging from 0 to $500.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Indebted	**1.4100 *****	**(0.3115)**	**0.2449 *****	**(0.0496)**	**0.0016**	**(0.0067)**	**0.0129 ***	**(0.0053)**
Modest net worth	**1.3187 *****	**(0.2840)**	**0.2335 *****	**(0.0450)**	**0.0038**	**(0.0062)**	**0.0139 ****	**(0.0047)**
High net worth	**-1.3872 *****	**(0.4197)**	**-0.2172 *****	**(0.0658)**	**-0.0186 ***	**(0.0095)**	**-0.0183 ***	**(0.0076)**
North east	0.8638	(0.5671)	0.1542	(0.0891)	0.0277	(0.0146)	0.0046	(0.0119)
North central	1.4825 **	(0.5712)	0.2676 **	(0.0888)	0.0175	(0.0131)	0.0266 **	(0.0101)
South	1.5693 **	(0.4890)	0.2564 ***	(0.0764)	0.0283 *	(0.0116)	0.0256 **	(0.0093)
Single	-1.0744	(1.5539)	-0.1868	(0.2509)	-0.0090	(0.0305)	-0.0391	(0.0228)
Married	1.6634	(1.5215)	0.1978	(0.2461)	0.0448	(0.0297)	-0.0180	(0.0223)
Separated	-1.8726	(1.5504)	-0.3459	(0.2511)	-0.0153	(0.0305)	-0.0453 *	(0.0226)
Divorced	-1.3784	(1.5467)	-0.2828	(0.2501)	0.0028	(0.0304)	-0.0500 *	(0.0226)
No children	-1.8316 **	(0.6147)	-0.2566 *	(0.0996)	-0.0411 ***	(0.0124)	-0.0135	(0.0116)
One child	-0.8346	(0.5972)	-0.1111	(0.0969)	-0.0242 *	(0.0121)	-0.0103	(0.0113)
Two children	-0.8914	(0.5745)	-0.1377	(0.0933)	-0.0211	(0.0117)	-0.0097	(0.0110)
Three children	-0.6148	(0.5521)	-0.1143	(0.0895)	-0.0122	(0.0115)	-0.0080	(0.0106)
In poverty	-0.2425	(0.2499)	-0.0466	(0.0406)	-0.0081	(0.0055)	0.0022	(0.0042)
Urban area	0.5513 *	(0.2324)	0.0722	(0.0369)	0.0025	(0.0055)	0.0058	(0.0044)
Metro area	-0.7377 ***	(0.1814)	-0.1158 ***	(0.0288)	-0.0122 **	(0.0044)	-0.0015	(0.0034)
Own a house	0.3110	(0.2032)	0.0577	(0.0321)	0.0102 *	(0.0048)	-0.0050	(0.0036)
Family income ($ 0,000)	0.0027	(0.0082)	0.0003	(0.0013)	0.0000	(0.0002)	-0.0004 **	(0.0001)
Have savings	0.9890 ***	(0.1767)	0.1430 ***	(0.0280)	0.0118 **	(0.0040)	0.0082 *	(0.0032)
Age (years)	1.2796 ***	(0.0178)	0.2003 ***	(0.0028)	0.0173 ***	(0.0004)	0.0114 ***	(0.0003)
Grades 0 to 8	-2.3899	(1.9163)	-0.3665	(0.3034)	-0.0421	(0.0516)	0.0153	(0.0305)
Grades 9 to 11	-1.3861	(1.0687)	-0.2781	(0.1735)	-0.0383	(0.0228)	0.0163	(0.0185)
Grade 12	-2.3361 **	(0.8538)	-0.3925 **	(0.1372)	-0.0445 *	(0.0177)	-0.0024	(0.0149)
Grade 13 to 15	-1.0641	(0.7433)	-0.1481	(0.1186)	-0.0317 *	(0.0146)	0.0048	(0.0121)
Grade 16	0.0725	(0.6178)	0.0079	(0.0979)	-0.0105	(0.0128)	0.0105	(0.0099)
R-Square	0.3373		0.3322		0.1541		0.0955	
Observations	96,023		93,712		93,712		93,712	

Note: The definition of *breaking even* (base category) is now a range from 0 to $500, thus reducing the sample of observations classified as fair. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A2: Fixed effects estimates of the impact of dichotomous measures of net worth on measures of body weight with even (base category) ranging from 0 to $5,000.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Indebted	**0.7099 ****	**(0.2161)**	**0.1160 *****	**(0.0346)**	**0.0006**	**(0.0049)**	**0.0037**	**(0.0040)**
Modest net worth	**0.7813 *****	**(0.1895)**	**0.1289 *****	**(0.0300)**	**0.0042**	**(0.0047)**	**0.0048**	**(0.0036)**
High net worth	**-1.9186 *****	**(0.3585)**	**-0.3209 *****	**(0.0560)**	**-0.0182 ***	**(0.0085)**	**-0.0274 *****	**(0.0069)**
North east	0.8423	(0.5680)	0.1502	(0.0892)	0.0277	(0.0146)	0.0044	(0.0119)
North central	1.4711 **	(0.5709)	0.2652 **	(0.0887)	0.0176	(0.0131)	0.0264 **	(0.0101)
South	1.5759 **	(0.4889)	0.2575 ***	(0.0764)	0.0283 *	(0.0116)	0.0256 **	(0.0093)
Single	-1.0183	(1.5517)	-0.1782	(0.2507)	-0.0087	(0.0305)	-0.0389	(0.0227)
Married	1.6602	(1.5183)	0.1970	(0.2458)	0.0447	(0.0297)	-0.0179	(0.0222)
Separated	-1.8696	(1.5477)	-0.3465	(0.2508)	-0.0152	(0.0305)	-0.0454 *	(0.0226)
Divorced	-1.3537	(1.5438)	-0.2797	(0.2498)	0.0029	(0.0305)	-0.0500 *	(0.0225)
No children	-1.8498 **	(0.6149)	-0.2598 **	(0.0996)	-0.0411 ***	(0.0124)	-0.0137	(0.0116)
One child	-0.8427	(0.5975)	-0.1127	(0.0970)	-0.0242 *	(0.0121)	-0.0104	(0.0113)
Two children	-0.8998	(0.5750)	-0.1394	(0.0934)	-0.0211	(0.0117)	-0.0098	(0.0110)
Three children	-0.6203	(0.5525)	-0.1154	(0.0896)	-0.0122	(0.0115)	-0.0081	(0.0106)
In poverty	-0.2936	(0.2506)	-0.0560	(0.0408)	-0.0081	(0.0055)	0.0015	(0.0042)
Urban area	0.5441 *	(0.2325)	0.0711	(0.0369)	0.0025	(0.0055)	0.0058	(0.0044)
Metro area	-0.7342 ***	(0.1813)	-0.1153 ***	(0.0288)	-0.0122 **	(0.0044)	-0.0015	(0.0034)
Own a house	0.1946	(0.2062)	0.0394	(0.0325)	0.0094	(0.0049)	-0.0054	(0.0037)
Family income ($ 0,000)	0.0024	(0.0082)	0.0002	(0.0013)	0.0000	(0.0002)	-0.0004 **	(0.0001)
Have savings	1.0217 ***	(0.1782)	0.1497 ***	(0.0282)	0.0117 **	(0.0040)	0.0088 **	(0.0032)
Age (years)	1.2760 ***	(0.0179)	0.1997 ***	(0.0028)	0.0173 ***	(0.0004)	0.0114 ***	(0.0003)
Grades 0 to 8	-2.2840	(1.9278)	-0.3477	(0.3057)	-0.0415	(0.0516)	0.0161	(0.0306)
Grades 9 to 11	-1.3618	(1.0688)	-0.2741	(0.1735)	-0.0380	(0.0228)	0.0162	(0.0185)
Grade 12	-2.2896 **	(0.8533)	-0.3852 **	(0.1371)	-0.0442 *	(0.0177)	-0.0022	(0.0149)
Grade 13 to 15	-1.0053	(0.7430)	-0.1389	(0.1185)	-0.0314 *	(0.0146)	0.0051	(0.0121)
Grade 16	0.0818	(0.6176)	0.0096	(0.0979)	-0.0105	(0.0128)	0.0106	(0.0099)
R-Square	0.3372		0.3321		0.1541		0.0954	
Observations	96,023		93,712		93,712		93,712	

Note: The definition of *breaking even* (base category) is now a range from 0 to $5,000, thus reducing the sample of observations classified as fair. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A3: Fixed Effects estimates of the impact of net worth on measures of body weight with age being a categorical variable instead of continuous.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Net worth ($ 0,000)	**-0.0346 *****	**(0.0055)**	**-0.0058 *****	**(0.0008)**	**0.0000**	**(0.0001)**	**-0.0007 *****	**(0.0001)**
North east	0.8440	(0.5752)	0.1489	(0.0903)	0.0272	(0.0147)	0.0039	(0.0118)
North central	1.0050	(0.5675)	0.1921 *	(0.0880)	0.0120	(0.0130)	0.0228 *	(0.0101)
South	1.1131 *	(0.4883)	0.1847 *	(0.0764)	0.0224	(0.0116)	0.0218 *	(0.0093)
Single	-2.3487	(1.5423)	-0.3993	(0.2492)	-0.0234	(0.0296)	-0.0536 *	(0.0228)
Married	0.6304	(1.5102)	0.0249	(0.2445)	0.0279	(0.0287)	-0.0243	(0.0224)
Separated	-2.9051	(1.5412)	-0.5199 *	(0.2498)	-0.0323	(0.0296)	-0.0497 *	(0.0227)
Divorced	-2.2829	(1.5383)	-0.4364	(0.2488)	-0.0131	(0.0296)	-0.0534 *	(0.0227)
No children	-0.9211	(0.6304)	-0.1147	(0.1019)	-0.0225	(0.0128)	-0.0150	(0.0119)
One child	-0.1319	(0.6088)	-0.0019	(0.0987)	-0.0105	(0.0124)	-0.0107	(0.0115)
Two children	-0.4504	(0.5793)	-0.0706	(0.0940)	-0.0130	(0.0118)	-0.0094	(0.0111)
Three children	-0.3998	(0.5552)	-0.0811	(0.0899)	-0.0086	(0.0115)	-0.0070	(0.0106)
In poverty	-0.3142	(0.2536)	-0.0609	(0.0413)	-0.0076	(0.0055)	0.0006	(0.0042)
Urban area	0.1970	(0.2342)	0.0185	(0.0371)	-0.0046	(0.0055)	0.0056	(0.0045)
Metro area	0.1052	(0.1864)	0.0153	(0.0296)	0.0026	(0.0044)	0.0013	(0.0035)
Own a house	0.6429 **	(0.2029)	0.1109 ***	(0.0321)	0.0121 *	(0.0047)	0.0004	(0.0036)
Family income($ 0,000)	0.0055	(0.0082)	0.0007	(0.0013)	0.0000	(0.0002)	-0.0003 *	(0.0001)
Have savings	1.1276 ***	(0.1792)	0.1674 ***	(0.0284)	0.0124 **	(0.0040)	0.0101 **	(0.0032)
Age (20-25 years)	-29.3187 ***	(0.4643)	-4.5856 ***	(0.0738)	-0.4052 ***	(0.0098)	-0.2594 ***	(0.0086)
Age (26-30 years)	-21.9575 ***	(0.4075)	-3.4349 ***	(0.0646)	-0.2889 ***	(0.0086)	-0.2137 ***	(0.0078)
Age (31-35 years)	-15.1130 ***	(0.3835)	-2.3616 ***	(0.0609)	-0.1914 ***	(0.0081)	-0.1573 ***	(0.0073)
Age (36-40 years)	-8.6826 ***	(0.3536)	-1.3540 ***	(0.0561)	-0.1165 ***	(0.0074)	-0.0926 ***	(0.0069)
Age (41-45 years)	-4.2121 ***	(0.3427)	-0.6526 ***	(0.0542)	-0.0585 ***	(0.0069)	-0.0451 ***	(0.0066)
Grades 0 to 8	-4.0984 *	(1.9242)	-0.6319 *	(0.3053)	-0.0573	(0.0503)	-0.0094	(0.0306)
Grades 9 to 11	-3.3614 **	(1.0723)	-0.5867 ***	(0.1739)	-0.0576 *	(0.0226)	-0.0086	(0.0184)
Grade 12	-3.3335 ***	(0.8595)	-0.5478 ***	(0.1380)	-0.0506 **	(0.0178)	-0.0182	(0.0148)
Grade 13 to 15	-1.7180 *	(0.7461)	-0.2493 *	(0.1188)	-0.0352 *	(0.0147)	-0.0064	(0.0120)
Grade 16	0.0657	(0.6204)	0.0089	(0.0983)	-0.0091	(0.0129)	0.0092	(0.0098)
R-Square	0.3259		0.3210		0.1508		0.0924	
Observations	95,846		93,537		93,537		93,537	

Note: These estimates use age as a categorical variable rather than as a continuous variable. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A4: Fixed effects estimates of the impact of dichotomous measures of net worth on measures of body weight with age being a categorical variable instead of continuous.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Indebted	**2.0794 *** **	**(0.4066)**	**0.3476 *** **	**(0.0642)**	**0.0080**	**(0.0082)**	**0.0144 ***	**(0.0066)**
Modest net worth	**1.9279 *** **	**(0.3792)**	**0.3257 *** **	**(0.0596)**	**0.0104**	**(0.0077)**	**0.0141 ***	**(0.0060)**
High net worth	**0.1208**	**(0.4880)**	**0.0138**	**(0.0764)**	**0.0032**	**(0.0105)**	**-0.0148**	**(0.0085)**
North east	0.8059	(0.5784)	0.1438	(0.0908)	0.0280	(0.0147)	0.0031	(0.0119)
North central	1.0183	(0.5690)	0.1938 *	(0.0883)	0.0115	(0.0130)	0.0233 *	(0.0101)
South	1.0909 *	(0.4907)	0.1823 *	(0.0767)	0.0222	(0.0116)	0.0220 *	(0.0093)
Single	-2.3535	(1.5472)	-0.3996	(0.2501)	-0.0241	(0.0295)	-0.0538 *	(0.0228)
Married	0.5779	(1.5157)	0.0165	(0.2454)	0.0276	(0.0287)	-0.0251	(0.0224)
Separated	-2.8997	(1.5464)	-0.5182 *	(0.2507)	-0.0324	(0.0296)	-0.0502 *	(0.0227)
Divorced	-2.2764	(1.5430)	-0.4353	(0.2496)	-0.0132	(0.0295)	-0.0535 *	(0.0227)
No children	-0.8616	(0.6273)	-0.1059	(0.1014)	-0.0236	(0.0128)	-0.0136	(0.0118)
One child	-0.0995	(0.6062)	0.0027	(0.0983)	-0.0116	(0.0123)	-0.0099	(0.0115)
Two children	-0.4264	(0.5769)	-0.0670	(0.0936)	-0.0137	(0.0118)	-0.0091	(0.0110)
Three children	-0.4079	(0.5532)	-0.0830	(0.0897)	-0.0095	(0.0115)	-0.0072	(0.0106)
In poverty	-0.2312	(0.2524)	-0.0464	(0.0410)	-0.0072	(0.0055)	0.0011	(0.0042)
Urban area	0.2011	(0.2344)	0.0183	(0.0371)	-0.0048	(0.0055)	0.0057	(0.0045)
Metro area	0.1133	(0.1862)	0.0166	(0.0296)	0.0028	(0.0044)	0.0012	(0.0035)
Own a house	0.5488 **	(0.2028)	0.0955 **	(0.0320)	0.0118 *	(0.0047)	-0.0012	(0.0036)
Family income($ 0,000)	0.0039	(0.0082)	0.0005	(0.0013)	0.0000	(0.0002)	-0.0003 *	(0.0001)
Have savings	0.9464 ***	(0.1788)	0.1369 ***	(0.0283)	0.0113 **	(0.0041)	0.0086 **	(0.0033)
Age (20-25 years)	-29.1683 ***	(0.4603)	-4.5622 ***	(0.0731)	-0.4058 ***	(0.0097)	-0.2555 ***	(0.0085)
Age (26-30 years)	-21.8568 ***	(0.4046)	-3.4196 ***	(0.0642)	-0.2903 ***	(0.0086)	-0.2105 ***	(0.0077)
Age (31-35 years)	-15.0422 ***	(0.3811)	-2.3515 ***	(0.0605)	-0.1927 ***	(0.0081)	-0.1547 ***	(0.0073)
Age (36-40 years)	-8.6309 ***	(0.3521)	-1.3467 ***	(0.0557)	-0.1176 ***	(0.0074)	-0.0907 ***	(0.0069)
Age (41-45 years)	-4.1666 ***	(0.3417)	-0.6454 ***	(0.0539)	-0.0591 ***	(0.0069)	-0.0439 ***	(0.0066)
Grades 0 to 8	-4.2265 *	(1.9155)	-0.6531 *	(0.3035)	-0.0569	(0.0503)	-0.0113	(0.0306)
Grades 9 to 11	-3.3367 **	(1.0707)	-0.5824 ***	(0.1736)	-0.0571 *	(0.0226)	-0.0087	(0.0184)
Grade 12	-3.3450 ***	(0.8601)	-0.5499 ***	(0.1382)	-0.0519 **	(0.0177)	-0.0182	(0.0148)
Grade 13 to 15	-1.7613 *	(0.7482)	-0.2569 *	(0.1192)	-0.0365 *	(0.0147)	-0.0064	(0.0120)
Grade 16	0.0216	(0.6226)	0.0014	(0.0987)	-0.0100	(0.0129)	0.0090	(0.0099)
R-Square	0.3263		0.3215		0.1510		0.0919	
Observations	96,023		93,712		93,712		93,712	

Note: These estimates use age as a categorical variable rather than as a continuous variable. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A5: Fixed Effects estimates of the impact of net worth on measures of body weight by race and gender.

	Body Weight	BMI	Overweight	Obese
	(Model 1)	(Model 2)	(Model 3)	(Model 4)
Males – Whites				
Net worth ($ 0,000)	-0.0283 *** (0.0054)	-0.0041 *** (0.0008)	0.0000 (0.0001)	-0.0006 *** (0.0001)
R-Square	0.3607	0.3628	0.1632	0.0960
Observations	26,777	26,141	26,141	26,141
Males – Blacks				
Net worth ($ 0,000)	-0.0372 * (0.0181)	-0.0046 (0.0027)	0.0007 (0.0004)	-0.0005 (0.0004)
R-Square	0.4011	0.4000	0.1865	0.1384
Observations	12,432	12,059	12,059	12,059
Males – Hispanics				
Net worth ($ 0,000)	-0.0385 ** (0.0149)	-0.0054 * (0.0023)	0.0001 (0.0004)	-0.0001 (0.0003)
R-Square	0.3504	0.3533	0.1571	0.1167
Observations	8,552	8,202	8,202	8,202
Females – Whites				
Net worth ($ 0,000)	-0.0526 *** (0.0064)	-0.0092 *** (0.0011)	-0.0004 ** (0.0001)	-0.0006 *** (0.0001)
R-Square	0.2971	0.2997	0.1329	0.0786
Observations	26,701	26,240	26,240	26,240
Females – Blacks				
Net worth ($ 0,000)	-0.0920 *** (0.0244)	-0.0166 *** (0.0042)	-0.0002 (0.0005)	-0.0015 *** (0.0004)
R-Square	0.3664	0.3688	0.1743	0.1412
Observations	12,861	12,669	12,669	12,669
Females – Hispanics				
Net worth ($ 0,000)	-0.0851 *** (0.0188)	-0.0160 *** (0.0034)	-0.0002 (0.0004)	-0.0014 *** (0.0004)
R-Square	0.3621	0.3671	0.1717	0.1185
Observations	8,523	8,226	8,226	8,226

Note: Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. All dollar amounts have been adjusted to 1985 dollars. For the sake of brevity only the key coefficients are presented here.

Table A6: Fixed Effects estimates of the impact of dichotomous measures of net worth on measures of body weight by race and gender.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Males – Whites								
Indebted	0.2620	(0.5432)	0.0796	(0.0780)	-0.0144	(0.0146)	0.0098	(0.0112)
Modest net worth	0.1596	(0.5148)	0.0633	(0.0739)	-0.0024	(0.0139)	0.0067	(0.0107)
High net worth	-1.1119	(0.6118)	-0.1264	(0.0876)	-0.0071	(0.0164)	-0.0079	(0.0126)
R-Square	0.3606		0.3627		0.1635		0.0952	
Observations	26,808		26,172		26,172		26,172	
Males – Blacks								
Indebted	1.4866 **	(0.5556)	0.1931 *	(0.0810)	0.0185	(0.0131)	-0.0058	(0.0112)
Modest net worth	0.9849 *	(0.4747)	0.1217	(0.0694)	0.0236 *	(0.0112)	0.0005	(0.0096)
High net worth	-1.9402	(1.1630)	-0.3063	(0.1698)	0.0085	(0.0274)	-0.0743 **	(0.0234)
R-Square	0.4016		0.4006		0.1870		0.1393	
Observations	12,450		12,077		12,077		12,077	
Males – Hispanics								
Indebted	1.5382 *	(0.7767)	0.2410 *	(0.1201)	0.0188	(0.0184)	0.0150	(0.0171)
Modest net worth	2.4192 ***	(0.6916)	0.3722 ***	(0.1073)	0.0268	(0.0165)	0.0301 *	(0.0153)
High net worth	-0.0869	(1.1059)	-0.0064	(0.1699)	0.0152	(0.0261)	-0.0013	(0.0242)
R-Square	0.3517		0.3548		0.1575		0.1175	
Observations	8,557		8,207		8,207		8,207	
Females – Whites								
Indebted	1.3155 *	(0.6442)	0.1820	(0.1099)	0.0057	(0.0147)	-0.0008	(0.0114)
Modest net worth	1.1187	(0.6207)	0.1396	(0.1059)	0.0023	(0.0142)	0.0002	(0.0109)
High net worth	-1.9529 **	(0.7325)	-0.3870 **	(0.1247)	-0.0326	(0.0167)	-0.0330 *	(0.0129)
R-Square	0.2974		0.2999		0.1332		0.0783	
Observations	26,770		26,308		26,308		26,308	
Females – Blacks								
Indebted	2.1883 ***	(0.5976)	0.3736 ***	(0.1026)	0.0167	(0.0118)	0.0091	(0.0108)
Modest net worth	2.5735 ***	(0.5429)	0.4240 ***	(0.0933)	0.0102	(0.0107)	0.0224 *	(0.0099)
High net worth	-3.6931 **	(1.4078)	-0.6268 **	(0.2403)	-0.0470	(0.0277)	-0.0522 *	(0.0254)
R-Square	0.3688		0.3710		0.1757		0.1423	
Observations	12,897		12,705		12,705		12,705	
Females – Hispanics								
Indebted	2.3706 **	(0.7494)	0.4269 **	(0.1369)	0.0099	(0.0177)	0.0172	(0.0154)
Modest net worth	2.7200 ***	(0.6817)	0.4665 ***	(0.1248)	-0.0088	(0.0161)	0.0093	(0.0140)
High net worth	-1.0675	(1.1146)	-0.1943	(0.2030)	-0.0476	(0.0262)	-0.0445	(0.0228)
R-Square	0.3640		0.3685		0.1731		0.1183	
Observations	8,541		8,243		8,243		8,243	

Note: Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. All dollar amounts have been adjusted to 1985 dollars. For the sake of brevity only the key coefficients are presented here.

Table A7: Fixed Effects estimates of the impact of net worth on measures of body weight after dropping respondents whose health limits the kind of work that they do.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Net worth ($ 0,000)	**-0.0537 *****	**(0.0060)**	**-0.0086 *****	**(0.0009)**	**-0.0004 ****	**(0.0001)**	**-0.0008 *****	**(0.0001)**
North east	0.7248	(0.6092)	0.1238	(0.0948)	0.0242	(0.0168)	-0.0013	(0.0129)
North central	1.1755	(0.6557)	0.2284 *	(0.1009)	0.0088	(0.0153)	0.0191	(0.0115)
South	1.5275 **	(0.5301)	0.2612 **	(0.0818)	0.0215	(0.0137)	0.0247 *	(0.0106)
Single	-2.0877	(2.1450)	-0.3105	(0.3398)	-0.0061	(0.0386)	-0.0351	(0.0308)
Married	0.3649	(2.1178)	0.0295	(0.3360)	0.0505	(0.0376)	-0.0203	(0.0304)
Separated	-3.3157	(2.1329)	-0.5356	(0.3382)	-0.0137	(0.0386)	-0.0453	(0.0306)
Divorced	-2.6956	(2.1353)	-0.4524	(0.3383)	0.0011	(0.0383)	-0.0556	(0.0307)
No children	-1.5289 *	(0.7182)	-0.2202	(0.1166)	-0.0295	(0.0157)	-0.0069	(0.0136)
One child	-0.7528	(0.6957)	-0.1018	(0.1130)	-0.0150	(0.0154)	-0.0040	(0.0133)
Two children	-0.7431	(0.6706)	-0.1209	(0.1093)	-0.0162	(0.0148)	-0.0029	(0.0130)
Three children	-0.5580	(0.6513)	-0.1133	(0.1058)	-0.0086	(0.0146)	-0.0014	(0.0125)
In poverty	-0.6650 *	(0.2814)	-0.1215 **	(0.0452)	-0.0082	(0.0070)	-0.0034	(0.0050)
Urban area	0.4751	(0.2484)	0.0575	(0.0389)	-0.0024	(0.0063)	0.0039	(0.0051)
Metro area	-0.6967 ***	(0.1999)	-0.1001 **	(0.0314)	-0.0118 *	(0.0051)	0.0015	(0.0038)
Own a house	0.1675	(0.2253)	0.0375	(0.0352)	0.0088	(0.0055)	-0.0061	(0.0042)
Family income ($ 0,000)	0.0030	(0.0089)	0.0003	(0.0014)	-0.0001	(0.0002)	-0.0003 *	(0.0001)
Have savings	1.0258 ***	(0.1983)	0.1472 ***	(0.0307)	0.0143 **	(0.0048)	0.0091 *	(0.0037)
Age (years)	1.2839 ***	(0.0200)	0.1989 ***	(0.0032)	0.0177 ***	(0.0005)	0.0115 ***	(0.0004)
Grades 0 to 8	-3.9279	(2.1899)	-0.5736	(0.3220)	-0.0364	(0.0647)	-0.0081	(0.0481)
Grades 9 to 11	-2.4092	(1.2305)	-0.4182 *	(0.1972)	-0.0507	(0.0279)	0.0097	(0.0217)
Grade 12	-2.3426 *	(0.9754)	-0.3940 *	(0.1553)	-0.0440 *	(0.0208)	-0.0019	(0.0169)
Grade 13 to 15	-1.2189	(0.8607)	-0.1751	(0.1359)	-0.0305	(0.0165)	0.0008	(0.0133)
Grade 16	-0.2386	(0.6856)	-0.0532	(0.1079)	-0.0138	(0.0140)	0.0116	(0.0109)
R-Square	0.3606		0.3568		0.1596		0.0973	
Observations	69,841		68,192		68,192		68,192	

Note: These results are estimated after dropping those respondents who report that health limits the kind of work that they do. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A8: Fixed effects estimates of the impact of dichotomous measures of net worth on measures of body weight after dropping respondents whose health limits the kind of work that they do.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Indebted	**1.5550 ****	**(0.4826)**	**0.2674 *****	**(0.0749)**	**0.0086**	**(0.0105)**	**0.0168 ***	**(0.0081)**
Modest net worth	**1.4017 ****	**(0.4504)**	**0.2485 *****	**(0.0701)**	**0.0090**	**(0.0100)**	**0.0167 ***	**(0.0074)**
High net worth	**-1.3657 ***	**(0.5664)**	**-0.2040 ***	**(0.0880)**	**-0.0199**	**(0.0127)**	**-0.0176**	**(0.0100)**
North east	0.6497	(0.6152)	0.1137	(0.0957)	0.0250	(0.0167)	-0.0026	(0.0131)
North central	1.1768	(0.6580)	0.2288 *	(0.1013)	0.0085	(0.0152)	0.0195	(0.0116)
South	1.5245 **	(0.5347)	0.2616 **	(0.0824)	0.0221	(0.0137)	0.0251 *	(0.0108)
Single	-2.0351	(2.1634)	-0.3012	(0.3429)	-0.0060	(0.0386)	-0.0350	(0.0308)
Married	0.3775	(2.1369)	0.0316	(0.3391)	0.0503	(0.0376)	-0.0205	(0.0305)
Separated	-3.2332	(2.1510)	-0.5220	(0.3411)	-0.0132	(0.0385)	-0.0448	(0.0306)
Divorced	-2.6217	(2.1531)	-0.4408	(0.3412)	0.0014	(0.0383)	-0.0549	(0.0308)
No children	-1.4042 *	(0.7129)	-0.2008	(0.1158)	-0.0296	(0.0157)	-0.0046	(0.0136)
One child	-0.6847	(0.6912)	-0.0906	(0.1124)	-0.0154	(0.0154)	-0.0028	(0.0132)
Two children	-0.6951	(0.6663)	-0.1126	(0.1086)	-0.0167	(0.0148)	-0.0024	(0.0129)
Three children	-0.5578	(0.6482)	-0.1130	(0.1054)	-0.0095	(0.0146)	-0.0015	(0.0125)
In poverty	-0.6056 *	(0.2812)	-0.1103 *	(0.0452)	-0.0077	(0.0070)	-0.0029	(0.0050)
Urban area	0.4857	(0.2493)	0.0585	(0.0390)	-0.0025	(0.0063)	0.0042	(0.0051)
Metro area	-0.6883 ***	(0.1995)	-0.0985 **	(0.0314)	-0.0115 *	(0.0051)	0.0015	(0.0038)
Own a house	0.0606	(0.2255)	0.0204	(0.0353)	0.0080	(0.0055)	-0.0077	(0.0042)
Family income ($ 0,000)	0.0001	(0.0089)	-0.0002	(0.0014)	-0.0001	(0.0002)	-0.0004 **	(0.0001)
Have savings	0.8887 ***	(0.1980)	0.1231 ***	(0.0306)	0.0133 **	(0.0049)	0.0073 *	(0.0037)
Age (years)	1.2748 ***	(0.0199)	0.1976 ***	(0.0031)	0.0177 ***	(0.0005)	0.0113 ***	(0.0004)
Grades 0 to 8	-4.0907	(2.1671)	-0.5971	(0.3170)	-0.0346	(0.0645)	-0.0112	(0.0479)
Grades 9 to 11	-2.4021	(1.2272)	-0.4152 *	(0.1966)	-0.0497	(0.0278)	0.0095	(0.0217)
Grade 12	-2.3470 *	(0.9757)	-0.3938 *	(0.1554)	-0.0444 *	(0.0207)	-0.0021	(0.0170)
Grade 13 to 15	-1.2410	(0.8627)	-0.1793	(0.1362)	-0.0312	(0.0165)	0.0009	(0.0134)
Grade 16	-0.2723	(0.6879)	-0.0593	(0.1083)	-0.0146	(0.0140)	0.0115	(0.0109)
R-Square	0.0964		0.3564		0.1599		0.0964	
Observations	69,968		68,319		68,319		68,319	

Note: These results are estimated after dropping those respondents who report that health limits the kind of work that they do. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A9: Fixed Effects estimates of the impact of net worth on measures of body weight after further dropping those respondents suffering from health issues such as diabetes, high blood sugar or heart ailments

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Net worth ($ 0,000)	**-0.0533 *****	**(0.0060)**	**-0.0085 *****	**(0.0009)**	**-0.0004 ****	**(0.0001)**	**-0.0008 *****	**(0.0001)**
North east	0.8586	(0.6085)	0.1451	(0.0947)	0.0261	(0.0168)	-0.0005	(0.0129)
North central	1.2142	(0.6603)	0.2352 *	(0.1016)	0.0062	(0.0153)	0.0198	(0.0116)
South	1.5069 **	(0.5339)	0.2569 **	(0.0823)	0.0224	(0.0137)	0.0236 *	(0.0107)
Single	-1.6595	(2.2644)	-0.2753	(0.3640)	-0.0154	(0.0398)	-0.0249	(0.0306)
Married	0.8377	(2.2390)	0.0712	(0.3606)	0.0410	(0.0387)	-0.0087	(0.0302)
Separated	-2.8905	(2.2545)	-0.5031	(0.3626)	-0.0248	(0.0396)	-0.0351	(0.0306)
Divorced	-2.2844	(2.2564)	-0.4195	(0.3629)	-0.0099	(0.0394)	-0.0443	(0.0305)
No children	-1.4174	(0.7328)	-0.2066	(0.1191)	-0.0249	(0.0160)	-0.0068	(0.0138)
One child	-0.6592	(0.7099)	-0.0895	(0.1155)	-0.0104	(0.0157)	-0.0045	(0.0134)
Two children	-0.6416	(0.6851)	-0.1079	(0.1117)	-0.0133	(0.0151)	-0.0026	(0.0131)
Three children	-0.4681	(0.6656)	-0.1024	(0.1083)	-0.0056	(0.0149)	-0.0015	(0.0127)
In poverty	-0.6351 *	(0.2835)	-0.1167 *	(0.0456)	-0.0067	(0.0071)	-0.0033	(0.0050)
Urban area	0.4741	(0.2499)	0.0584	(0.0391)	-0.0013	(0.0064)	0.0048	(0.0051)
Metro area	-0.6653 ***	(0.2007)	-0.0950 **	(0.0316)	-0.0116 *	(0.0051)	0.0018	(0.0038)
Own a house	0.1674	(0.2255)	0.0361	(0.0354)	0.0086	(0.0055)	-0.0066	(0.0042)
Family income($ 0,000)	0.0033	(0.0089)	0.0003	(0.0014)	-0.0001	(0.0002)	-0.0003 *	(0.0001)
Have savings	1.0593 ***	(0.1983)	0.1515 ***	(0.0307)	0.0152 **	(0.0048)	0.0091 *	(0.0037)
Age (years)	1.2818 ***	(0.0202)	0.1987 ***	(0.0032)	0.0179 ***	(0.0005)	0.0114 ***	(0.0004)
Grades 0 to 8	-3.9332	(2.1925)	-0.5683	(0.3225)	-0.0341	(0.0647)	-0.0082	(0.0482)
Grades 9 to 11	-2.3557	(1.2398)	-0.4024 *	(0.1985)	-0.0498	(0.0282)	0.0124	(0.0219)
Grade 12	-2.3575 *	(0.9818)	-0.3927 *	(0.1561)	-0.0432 *	(0.0209)	-0.0008	(0.0171)
Grade 13 to 15	-1.1666	(0.8645)	-0.1643	(0.1363)	-0.0285	(0.0166)	0.0002	(0.0134)
Grade 16	-0.2168	(0.6902)	-0.0489	(0.1086)	-0.0101	(0.0139)	0.0107	(0.0110)
R-Square	0.3616		0.3579		0.1605		0.0967	
Observations	68,773		67,124		67,124		67,124	

Note: These results are estimated after dropping those respondents who report that health limits the kind of work that they do as well as those respondents suffering from health issues such as diabetes, high blood sugar or heart ailments. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A10: Fixed effects estimates of the impact of dichotomous measures of net worth on measures of body weight after further dropping those respondents suffering from health issues such as diabetes, high blood sugar or heart ailments.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Indebted	**1.4518 ****	**(0.4840)**	**0.2505 *****	**(0.0750)**	**0.0083**	**(0.0107)**	**0.0150**	**(0.0081)**
Modest net worth	**1.3259 ****	**(0.4528)**	**0.2346 *****	**(0.0704)**	**0.0088**	**(0.0101)**	**0.0162 ***	**(0.0074)**
High net worth	**-1.3545 ***	**(0.5682)**	**-0.2050 ***	**(0.0882)**	**-0.0198**	**(0.0129)**	**-0.0167**	**(0.0100)**
North east	0.7795	(0.6148)	0.1343	(0.0957)	0.0269	(0.0167)	-0.0019	(0.0131)
North central	1.2146	(0.6628)	0.2355 *	(0.1020)	0.0059	(0.0152)	0.0202	(0.0117)
South	1.5033 **	(0.5386)	0.2572 **	(0.0830)	0.0230	(0.0137)	0.0240 *	(0.0108)
Single	-1.6103	(2.2849)	-0.2664	(0.3673)	-0.0154	(0.0397)	-0.0249	(0.0307)
Married	0.8470	(2.2602)	0.0729	(0.3640)	0.0408	(0.0387)	-0.0090	(0.0303)
Separated	-2.8056	(2.2745)	-0.4891	(0.3659)	-0.0244	(0.0396)	-0.0347	(0.0307)
Divorced	-2.2089	(2.2762)	-0.4076	(0.3661)	-0.0095	(0.0394)	-0.0437	(0.0306)
No children	-1.2899	(0.7275)	-0.1868	(0.1183)	-0.0250	(0.0160)	-0.0045	(0.0137)
One child	-0.5894	(0.7054)	-0.0781	(0.1148)	-0.0108	(0.0157)	-0.0033	(0.0134)
Two children	-0.5937	(0.6809)	-0.0996	(0.1111)	-0.0138	(0.0151)	-0.0020	(0.0131)
Three children	-0.4686	(0.6624)	-0.1022	(0.1078)	-0.0066	(0.0149)	-0.0017	(0.0127)
In poverty	-0.5806 *	(0.2834)	-0.1064 *	(0.0455)	-0.0062	(0.0071)	-0.0029	(0.0050)
Urban area	0.4887	(0.2508)	0.0600	(0.0393)	-0.0014	(0.0063)	0.0052	(0.0051)
Metro area	-0.6588 **	(0.2004)	-0.0936 **	(0.0315)	-0.0113 *	(0.0051)	0.0017	(0.0038)
Own a house	0.0602	(0.2258)	0.0191	(0.0355)	0.0078	(0.0055)	-0.0082	(0.0042)
Family income ($ 0,000)	0.0001	(0.0089)	-0.0002	(0.0014)	-0.0001	(0.0002)	-0.0004 **	(0.0001)
Have savings	0.9278 ***	(0.1979)	0.1285 ***	(0.0307)	0.0142 **	(0.0049)	0.0074 *	(0.0037)
Age (years)	1.2721 ***	(0.0200)	0.1973 ***	(0.0032)	0.0179 ***	(0.0005)	0.0112 ***	(0.0004)
Grades 0 to 8	-4.1026	(2.1711)	-0.5928	(0.3177)	-0.0323	(0.0645)	-0.0115	(0.0480)
Grades 9 to 11	-2.3616	(1.2366)	-0.4014 *	(0.1979)	-0.0488	(0.0281)	0.0120	(0.0219)
Grade 12	-2.3645 *	(0.9822)	-0.3929 *	(0.1562)	-0.0436 *	(0.0209)	-0.0011	(0.0171)
Grade 13 to 15	-1.1888	(0.8666)	-0.1686	(0.1367)	-0.0291	(0.0165)	0.0003	(0.0135)
Grade 16	-0.2478	(0.6927)	-0.0547	(0.1090)	-0.0109	(0.0139)	0.0106	(0.0110)
R-Square	0.3610		0.3573		0.1608		0.0957	
Observations	68,900		67,251		67,251		67,251	

Note: These results are estimated after dropping those respondents who report that health limits the kind of work that they can do as well as those respondents suffering from health issues such as diabetes, high blood sugar or heart ailments. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A11: Fixed Effects estimates of the impact of net worth on measures of body weight after further dropping those respondents who report family members with severe disabilities.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Net worth ($ 0,000)	**-0.0555 *****	**(0.0062)**	**-0.0087 *****	**(0.0009)**	**-0.0005 *****	**(0.0001)**	**-0.0008 *****	**(0.0001)**
North east	0.8764	(0.6239)	0.1441	(0.0973)	0.0288	(0.0174)	0.0026	(0.0133)
North central	1.2365	(0.6665)	0.2332 *	(0.1027)	0.0074	(0.0155)	0.0183	(0.0118)
South	1.6352 **	(0.5467)	0.2781 ***	(0.0842)	0.0237	(0.0141)	0.0273 *	(0.0110)
Single	-2.3745	(2.3208)	-0.4103	(0.3737)	-0.0352	(0.0394)	-0.0233	(0.0318)
Married	0.2148	(2.2937)	-0.0444	(0.3702)	0.0210	(0.0383)	-0.0068	(0.0314)
Separated	-3.4340	(2.3140)	-0.6062	(0.3731)	-0.0451	(0.0393)	-0.0351	(0.0318)
Divorced	-3.0288	(2.3131)	-0.5528	(0.3728)	-0.0317	(0.0390)	-0.0457	(0.0317)
No children	-1.3375	(0.7571)	-0.1938	(0.1234)	-0.0246	(0.0166)	-0.0086	(0.0142)
One child	-0.5740	(0.7329)	-0.0780	(0.1195)	-0.0092	(0.0163)	-0.0063	(0.0138)
Two children	-0.5212	(0.7081)	-0.0874	(0.1158)	-0.0127	(0.0156)	-0.0064	(0.0135)
Three children	-0.4615	(0.6905)	-0.1018	(0.1128)	-0.0040	(0.0154)	-0.0073	(0.0131)
In poverty	-0.6393 *	(0.2919)	-0.1168 *	(0.0468)	-0.0059	(0.0073)	-0.0043	(0.0050)
Urban area	0.4260	(0.2572)	0.0517	(0.0402)	-0.0009	(0.0066)	0.0047	(0.0052)
Metro area	-0.6589 **	(0.2058)	-0.0932 **	(0.0324)	-0.0122 *	(0.0052)	0.0010	(0.0039)
Own a house	0.1337	(0.2317)	0.0300	(0.0363)	0.0100	(0.0057)	-0.0068	(0.0043)
Family income($ 0,000)	0.0058	(0.0090)	0.0007	(0.0014)	0.0000	(0.0002)	-0.0003 *	(0.0001)
Have savings	1.0391 ***	(0.2024)	0.1502 ***	(0.0313)	0.0151 **	(0.0050)	0.0090 *	(0.0037)
Age (years)	1.2771 ***	(0.0208)	0.1977 ***	(0.0033)	0.0178 ***	(0.0005)	0.0114 ***	(0.0004)
Grades 0 to 8	-2.9835	(2.2065)	-0.4201	(0.3273)	-0.0188	(0.0656)	-0.0072	(0.0499)
Grades 9 to 11	-1.9455	(1.2647)	-0.3150	(0.2017)	-0.0533	(0.0290)	0.0211	(0.0223)
Grade 12	-1.8838	(0.9955)	-0.3085	(0.1580)	-0.0429 *	(0.0215)	0.0071	(0.0171)
Grade 13 to 15	-1.0503	(0.8797)	-0.1371	(0.1383)	-0.0313	(0.0170)	0.0046	(0.0133)
Grade 16	-0.0732	(0.7019)	-0.0242	(0.1100)	-0.0108	(0.0143)	0.0140	(0.0111)
R-Square	0.3609		0.3572		0.1594		0.0967	
Observations	65,425		63,823		63,823		63,823	

Note: These results are estimated after dropping those respondents who report that health limits the kind of work that they do, those respondents suffering from health issues such as diabetes, high blood sugar or heart ailments as well as those respondents who report family members with severe disabilities. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

Table A12: Fixed effects estimates of the impact of dichotomous measures of net worth on measures of body weight after further dropping those respondents who report family members with severe disabilities.

	Body Weight		BMI		Overweight		Obese	
	(Model 1)		(Model 2)		(Model 3)		(Model 4)	
Indebted	**1.5209 ****	**(0.5109)**	**0.2607 *****	**(0.0789)**	**0.0053**	**(0.0111)**	**0.0162 ***	**(0.0080)**
Modest net worth	**1.3653 ****	**(0.4759)**	**0.2403 ****	**(0.0738)**	**0.0065**	**(0.0105)**	**0.0183 ***	**(0.0075)**
High net worth	**-1.4574 ***	**(0.5883)**	**-0.2173 ***	**(0.0913)**	**-0.0257**	**(0.0132)**	**-0.0157**	**(0.0101)**
North east	0.8262	(0.6310)	0.1381	(0.0984)	0.0298	(0.0173)	0.0017	(0.0135)
North central	1.2303	(0.6686)	0.2325 *	(0.1031)	0.0071	(0.0155)	0.0186	(0.0119)
South	1.6398 **	(0.5518)	0.2797 ***	(0.0849)	0.0245	(0.0141)	0.0278 *	(0.0112)
Single	-2.3285	(2.3441)	-0.4022	(0.3774)	-0.0350	(0.0394)	-0.0235	(0.0319)
Married	0.2227	(2.3180)	-0.0430	(0.3740)	0.0209	(0.0383)	-0.0074	(0.0315)
Separated	-3.3463	(2.3370)	-0.5920	(0.3767)	-0.0445	(0.0393)	-0.0347	(0.0319)
Divorced	-2.9598	(2.3358)	-0.5421	(0.3764)	-0.0313	(0.0390)	-0.0452	(0.0318)
No children	-1.2088	(0.7517)	-0.1740	(0.1225)	-0.0246	(0.0166)	-0.0063	(0.0141)
One child	-0.5045	(0.7284)	-0.0668	(0.1188)	-0.0096	(0.0163)	-0.0052	(0.0137)
Two children	-0.4760	(0.7037)	-0.0795	(0.1150)	-0.0134	(0.0156)	-0.0058	(0.0135)
Three children	-0.4713	(0.6875)	-0.1031	(0.1123)	-0.0052	(0.0154)	-0.0075	(0.0131)
In poverty	-0.5802 *	(0.2914)	-0.1058 *	(0.0466)	-0.0054	(0.0073)	-0.0037	(0.0050)
Urban area	0.4437	(0.2582)	0.0538	(0.0404)	-0.0010	(0.0065)	0.0051	(0.0052)
Metro area	-0.6483 **	(0.2056)	-0.0911 **	(0.0323)	-0.0119 *	(0.0052)	0.0010	(0.0039)
Own a house	0.0247	(0.2320)	0.0127	(0.0364)	0.0091	(0.0057)	-0.0084	(0.0043)
Family income($ 0,000)	0.0029	(0.0090)	0.0002	(0.0014)	0.0000	(0.0002)	-0.0003 **	(0.0001)
Have savings	0.9049 ***	(0.2014)	0.1268 ***	(0.0312)	0.0142 **	(0.0050)	0.0071	(0.0037)
Age (years)	1.2672 ***	(0.0207)	0.1963 ***	(0.0033)	0.0178 ***	(0.0005)	0.0112 ***	(0.0004)
Grades 0 to 8	-3.1695	(2.1842)	-0.4467	(0.3222)	-0.0170	(0.0653)	-0.0106	(0.0496)
Grades 9 to 11	-1.9576	(1.2609)	-0.3147	(0.2010)	-0.0526	(0.0289)	0.0206	(0.0223)
Grade 12	-1.8874	(0.9956)	-0.3080	(0.1581)	-0.0434 *	(0.0214)	0.0068	(0.0172)
Grade 13 to 15	-1.0742	(0.8819)	-0.1417	(0.1387)	-0.0318	(0.0169)	0.0046	(0.0134)
Grade 16	-0.1084	(0.7044)	-0.0306	(0.1104)	-0.0116	(0.0143)	0.0138	(0.0111)
R-Square	0.3602		0.3566		0.1597		0.0957	
Observations	65,547		63,945		63,945		63,945	

Note: These results are estimated after dropping those respondents who report that health limits the kind of work that they can do, those respondents suffering from health issues such as diabetes, high blood sugar or heart ailments as well as those respondents who report family members with severe disabilities. Standard errors are in parenthesis. *** represents p-value < 0.01, ** represents p-value < 0.05 and * represents p-value < 0.1. Pregnant females have been excluded from the analysis. All dollar amounts have been adjusted to 1985 dollars. Race and gender variables are omitted since they are time invariant. Survey weights are used for this estimation.

CHAPTER 3

DOES WALKING OR RIDING A BIKE TO SCHOOL REDUCE OBESITY? EVIDENCE FROM THE NLSY 1979 USING PROPENSITY SCORE MATCHING

3.1. INTRODUCTION

Changes in production methods and lifestyles have reduced the amount of physical activity both during work and leisure hours (Lakdawalla and Phillipson, 2007; Phillipson and Lakdwalla, 2006). Concurrently, obesity in the U.S. has increased by about 100% in the last 25 years with about 33.8% of the population being obese (Flegal et al., 2010; Ogden et al. 2006). Obesity has been linked to a multitude of medical problems (Malnick and Knobler, 2006) and to early death.[16] In the United States, 112,000 deaths per year are directly linked to obesity (Flegal et al., 2005). The economic costs that obesity is imposing on society are large and rising rapidly (Caterson, et al., 2004). These costs create a strong rationale for investigating ways to stop this trend from continuing.[17]

Studies suggest that the rate of obesity increases concurrently with the change in the mode of transportation to get to school and work; 42% of the students in the United States walked or biked to school in 1969, but this number decreased to less than 15% by 2001 (Beschen, 1972; McDonald, 2007, 2008). By 2000, the average distance walked per person in the United States stood at 140 km per person per year, the average distance biked at 40 km. This distance is considerably lower than that of the average European, who walks and bikes 388 km and 182 km per person per year, respectively (Bassett et al.,

16 Malnick and Knobler (2006) provide a detailed list of ailments associated with obesity, which includes but is not limited to diabetes, hypertension, heart disease, respiratory diseases and cancer.

17 Apart from the social costs, there are also private costs associated with obesity, such as getting lower wages (Baum and Ford, 2004; Cawley, 2004) or not getting a job at all (Rooth, 2010). A recent report by Dor et al. (2010), estimates the individual cost of obesity to be $8,365 and $6,518 for women and men, respectively. Those who are obese bear an individual cost that is nine times (for women) and six times (for men) more than that of a comparable overweight individual (Dor et al., 2010).

2008). The White House Task Force on Childhood Obesity Report to the President (May 2010) suggests that only 20% of current high school students are involved in one hour of daily physical activity. Instead, they spend, on average, more than 7 hours per day in non-physical activities, such as watching television or movies, using a computer, or a mobile device. The report also suggests that younger children are more physically active than older adolescents and that among older adolescents; males are more physically active than females.

In order to encourage greater physical activity among children, several states and the federal government have launched programs to encourage walking or riding a bike to school (Pedestrian and Bicycle Information Center, 2010). Much of the money has been spent on creating safer routes to school. The federal government's "Safe Accountable Flexible Efficient Transportation Equity Act" (SAFETEA-LU) has devoted over $600 million towards the development of safer modes of transportation (McDonald, 2008). Section 1404(f)(2) of the SAFETEA-LU Act reads:

> not less than 10 percent and not more than 30 percent of the amount apportioned to each State shall be used for the following non-infrastructure-related activities: the encouragement of walking and bicycling to school, including public awareness campaigns and outreach to press and community leaders; traffic education and enforcement in the vicinity of schools; student sessions on bicycle and pedestrian safety, health, and environment; and funding for training, volunteers, and managers of safe routes to school programs.

At the same time, the Centers of Disease Control has launched the 'Kids Walk-to-School' program to encourage younger children to walk to school. The current first lady, Michelle Obama has also initiated the 'Let's Move' campaign, which addresses the issue of obesity among children by recommending an increase in physical activities, such as walking and biking to school.[18]

Given the considerable amount of attention that is being given to encourage walking and biking, it is of significant interest to identify whether and to what extent walking or riding a bike to school affects obesity. Since no prior statistical evidence appears to exist at the level of the individual, this study represents the first attempt at this task. The study is based on Propensity Score Matching (PSM) to more precisely estimate the causal treatment effect of walking or biking to school. The estimation results suggests that walking or biking to school does indeed lower all measures of obesity that are considered in a statistically highly significant manner.

The outline of this paper is as follows. Section II presents a brief literature review in this area of study. Section III discusses the methodology. Section IV discusses the data, section V presents the empirical results, and section VI concludes with some policy implications.

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18 There are several other measures to encourage walking and biking, which are implemented at a state or city level and are reported by the popular press. For instance, The New York Times (3rd August 2010) article "Obesity Rates Keep Rising, Troubling Health Officials" (http://www.nytimes.com/2010/08/04/health/nutrition/04fat.html_r=1&src=me&ref=health) reports that Colorado has spent state lottery money on building walking and biking trails, which may have lead to a reduction in obesity rates in that state by 20%. The Salt Lake Tribune (13th August 2010) article "Planned Communities promote walking to school, U. study finds" reports that certain Utah communities have constructed planned communities with a 'pedestrian-oriented landscape' which encourages children to walk to school.

3.2. LITERATURE REVIEW

The economic factors that lead to obesity are analyzed in various studies throughout the literature.[19] Some articles analyze obesity amongst children. For example, Anderson and Butcher (2006) find that the availability of vending machines increases BMI by 2.2 percentage points in children with obese parents. Schanzenbach (2010) uses the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K) and concludes that those children who carry their own lunch to school are less obese than those who consume school lunches.

In a separate study, Lakdawalla and Phillipson (2007) use the National Longitudinal Survey of Youth (NLSY) data to analyze the effect of on-the-job exercise on weight. They classify jobs as strength demand and fitness demand jobs. Their findings suggest that work related exercise has a causal effect on the weight of males: Males in the most physical fitness demanding jobs tend to be 14% lighter and those in the most strength demanding jobs 15% heavier than the males in the control group. Chou et al. (2004) use the Behavioral Risk Factor Surveillance System (BRFSS) data from 1984 to 1999 to show that various state level characteristics, such as availability of restaurants, types of restaurants, price of meals, food consumed at home and the availability of cigarettes and alcohol, have the expected effects on obesity.

Studies related to modes of transportation and obesity are limited. McDonald (2008) uses a multinomial logit model to analyze the factors that play a role in deciding which mode of transportation to use to get to school. Her findings suggest that distance to

19 For a detailed discussion see Cutler et al.(2003); Rosin (2008); and Finkelstein et al. (2005).

school plays an important role in determining whether one walks to school with an estimated direct elasticity of -0.75. She uses the National Household Travel Survey (NHTS) data for her analysis. While the author emphasizes the importance of the role of walking to school on obesity, she does not address the issue of obesity directly. Bassett et al. (2008) use country level variables from Europe, North America and Australia and analyze the effects that different levels of active transportation have on obesity. They find that countries with higher levels of active transportation had lower obesity rates. In a recent study, Pucher et al. (2010) use aggregate level data from US cities and states and fourteen other countries. The authors suggest that there exists a negative and significant correlation between active travel and rates of obesity. These studies are aggregate in nature and do no estimate the effects of walking or riding a bike on obesity at the level of the individual. This is where this study adds to the literature.

3.3. METHODOLOGY

The objective of this study is to analyze whether walking or biking to school has any effect on the obesity levels of high school and college students. In order to test the hypothesis that walking or riding a bike to school reduces obesity, levels of obesity among those high school and college students who walk or ride a bike to school should be significantly lower than for those individuals who could walk or ride a bike to school but do not do so.

The data set used in this study is observational in nature rather than the outcome of a random experiment. It includes about 700 respondents who select to walk or bike to

school. The lack of randomness in the assignment to the treatment "walking or biking to school" generates a self-selection problem. This problem combined with the fact that only a relatively small number of students receive the treatment suggests the use of Propensity Score Matching (PSM) for the analysis. PSM can effectively deal with both of these problems.

PSM is a non-parametric alternative to regression for estimating the causal effects of a treatment (Heckman and Vytlacil, 2007; Imbens and Wooldridge, 2009; and Blundell and Dias, 2009).[20] Both PSM and regression rely on the assumption that the observed variables capture the key aspects of both the treatment and the outcome variable. Relative to regression, however, PSM has a number of important advantages. The list of advantages includes the following: not all observations receive the same weight; the functional form of the equation determining the outcome does not have to be specified; no distinction is needed between the variables entering the outcome equation and those entering the equation predicting the treatment; model specification searches and model testing can be separated; the conditioning variables entering the analysis do not necessarily have to be exogenous (Heckman and Vytlacil, 2007, chapter 8). The advantage of particular interest for this paper is that not all observations receive necessarily the same weight. In fact, it is possible that an observation receives a weight of zero; it does not enter the analysis at all. This routinely happens if an observation (individual) from the group that is not subject to the treatment (the control group) is not comparable in a meaningful way to any of the observations (individuals) in the treatment

20 The key methods for identifying causal effects for problems involving treatments are discussed in Heckman and Vytlacil (2007); Imbens and Wooldridge (2009); and Blundell and Dias (2009).

group. In short, PSM limits the comparison of treated and untreated individuals to those who are truly comparable. In doing so, it approximates the outcome of a random experiment. Since random assignment to the treatment is not possible, PSM accomplishes the approximation by comparing only treated and untreated individuals who are truly comparable.[21] This matching of cases makes it possible to generate reliable results even if the number of treated individuals is not very large, as in the present case. As the matching of cases is done independently of the outcome variable of interest, PSM has the additional benefit over regression that the key modeling process (the matching) is independent of the hypothesis testing on the outcome variable; in other words, data mining is much less of an issue than with regression analysis.

PSM uses a single index variable, the propensity score, to match treated individuals with comparable individuals who are not treated. In this application, the propensity score is the predicted value of a logit regression with all of the individual pre-treatment characteristics that may predict the treatment or the outcome entering as determining variables. Matching on the propensity score is necessary because it is difficult to match individuals on the basis of all their available characteristics, especially if the known characteristics are very large, as in this application.[22]

The average treatment effect on the treated (ATT) is derived in this study simply as the difference in the weighted means of the outcome variables of the individuals who choose to receive the treatment and those who could have received the treatment but

21 As a consequence, any difference in the outcome variable can be assigned to the treatment variable.

22 As shown by Rosenbaum and Rubin (1983), matching on the propensity score is equivalent to matching on all covariates under some very general conditions.

remained untreated and are in the control group by the result of the matching process.

For the purpose of estimating the propensity score, I use the standard logit model. Only observations in the common support are employed for the matching analysis.[23] I test whether the means of the characteristics entering the analysis do not differ between the treatment and control in each of the intervals generated. Matching individuals from the control group to those of the treatment group takes place when the balancing property is satisfied.

I use the Caliper and Radius matching techniques to conduct matching for this study.[24] In this method if the propensity score of the control unit *C(i)* lies within the radius r from the propensity score of the treated unit, p_i , then the matching is performed. Hence, *C(i)* is defined as $C(i) = \{p_j \mid \| p_i - p_j \| < r\}$, which is interpreted as those control units whose propensity scores lie within the radius r from the propensity score of the treated unit. The formula for the matching estimator is defined as

$$\tau^{ATT} = \frac{1}{N^T} \sum_{i \varepsilon T} Y_i^T - \frac{1}{N^T} \sum_{j \varepsilon C(i)} \frac{1}{N_i^C} Y_j^C. \qquad (1)$$

Here, Y_i^T and Y_j^C are the outcomes for treatment group T and control group C, respectively, and N^T and N_i^C are the number of units in the treated group and number of controls matched with individual i, respectively (Becker and Ichino, 2002).

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23 "Common support" refers to the range of predicted propensity scores that includes both treated and untreated individuals. Observations with predicted treatment probabilities outside of this range are dropped from the analysis. The common support condition ensures that only those treated and untreated individuals who are highly comparable enter the analysis. For instance, of the 393 individuals who walk or bike to high school, 177 lie within the common support region. These 177 individuals are those who are highly comparable to a similar set of untreated individuals. We use the STATA add-on package pscore.ado for this analysis.

24 Caliper and Radius Matching is implemented with the STATA add-on package psmatch2.

Caliper matching allows the user to set different radii while matching. Since there is no consensus in the literature on what radii have to be used, estimation requires trying various radii in order to check for robustness. However, the radius should not be too small because there may not be any control units remaining within a very small radius around the treatment units (Becker and Ichino, 2002). Radius matching is a variant of Caliper matching, which is proposed by Dahejia and Wahba (2002). This method uses both the nearest neighbor within the caliper and all other comparison members within the caliper (Caliendo and Kopeinig, 2008).[25] By doing so, this method overcomes the risk of bad matches and, at the same time, allows for a sufficiently large sample to conduct the matching (Caliendo and Kopeinig, 2008).

For my analysis, I use both Caliper and Radius matching, in particular the default Radius matching suggested by Dahejia and Wahba (2002) as well as various alternative ones for the Caliper matching. The results are summarized in section 5.

3.4. DATA

The analysis employs the 1979 cohort of the National Longitudinal Survey of Youth (NLSY) data. The NLSY is a panel data set based on interviews conducted annually from 1979 to 1994 and biennially thereafter. It started with 12,686 respondents who were between 14 to 22 years of age in 1979. The sample is nationally representative and a large number of variables are available in the data set.

25 Radius matching is a special case of Kernel matching under a uniform distribution and restricted to a specified bandwidth. By using a uniform distribution, radius matching assumes that all observables within a radius are assigned an equal weight.

The NLSY data set is particularly useful for this study because it is the only data set that asks respondents both whether they walked or used a bike to get to school and their height and weight. This makes it possible to connect walking or biking to measures of obesity. Unfortunately, information on walking and biking to school is only available for the year 1981, when most of the respondents were high school or college students. Hence, the panel nature of the data set cannot be exploited. As there are relatively few individuals walking or biking to school, it is not feasible to conduct a separate analysis for walking and biking. Hence, the treatment includes all cases of walking and biking as long as the respondent is a high school student. Since college students are similar in many respects to high school students, a second set of estimates also includes students who walk or bike to college.

The data set has information on height and weight, both recorded in 1981, the year in which walking or biking to school is recorded. The key outcome variable, the Body Mass Index (BMI) of the respondents, is estimated from the information on height and weight.[26] From the BMI of the respondent I create two dummy variables, *obese* and *overweight*, separately for each year. The variable *obese* is equal to one when BMI is over 30 and *overweight* is set to one if the BMI is between 25 and 30.[27] Figures 1-1 and 1-2 present the BMI of the respondents in 1981; those who walk or bike to high school or college are depicted in Figure 1-1, the overall sample is represented in Figure 1-2. The

26 BMI is calculated by dividing weight in pounds (lbs) by height in inches (in) squared and then by multiplying the result by a conversion factor of 703 for measurements in metric units. BMI is used instead of weight percentiles as two thirds of the respondents are over eighteen years of age by 1981.

27 This practice is standard in the literature and followed by institutions such as the U.S. National Institutes of Health, the World Health Organization and the International Obesity Task Force.

figures suggest that those who walk or bike to school are less likely to be obese or overweight than the overall sample.

For the purpose of this analysis, I control for several variables related to individual, regional, neighborhood and school characteristics. I begin with describing the individual characteristics. The respondents' gender and race are controlled for by the variables *male*, African-Americans (to be referred to as '*black*' from here onwards) and *Hispanic*. I use females as the base category for gender and all non-blacks, non-Hispanics (henceforth referred to as '*whites*') as the base category for race.

In order to capture the individual's leisure time behavior, I create a *leisure index*, which runs from zero to one hundred. This index captures the individual's time spent in watching television, reading, and sleeping in 1981, the year of the treatment. While hours spent watching television and hours spent sleeping are measured on a weekly basis, hours spent reading is measured on a twenty-four hour basis. These variables, when included in the index, are standardized to account for differences in their measurement metrics.

In order to have a better understanding of each individual' characteristics, I also create a zero to hundred *crime index*. It captures an individual's involvement in a set of sixteen illegal activities as a minor by 1980.[28] Since these illegal activities are captured on a 0 to 6 scale in the data set, zero being no involvement at all and 6 representing more

28 A detailed list of these activities is provided in Table I. Some of the activities listed, such as running away from home, are not classified as illegal by law. However, I follow NLSY's definition in classifying them as illegal. I convert certain non-responses to zero in deriving this index. However, I verify that these non-responses are small and do not bias the distribution of the index. I also try using each component of the index as a separate variable. However, due to severe multicollinearity the number of observations available for estimation is reduced significantly. Hence, I use an index, which absorbs all type of deviant behavior, although this comes at the cost of arbitrarily assigning equal weights. I consider this cost minor relative to the advantage of capturing variation in some otherwise left-out control variables.

than 50 occurrences, I create the index by summing up an individual's score for all of the sixteen illegal activities, divide it by 96 and multiply by 100 to create the crime index. Additionally, I use separate dummy variables, *alcohol* and *drugs*, to indicate whether the individual drank alcohol or used drugs at least once as a minor in 1980. I interpret these variables as proxies for how much the respondent cares about his or her health.

Low self-esteem and *high self-esteem* are two additional dummy variables used as controls for individual characteristics. *Low self-esteem* indicates an individual with a Rosenberg self-esteem score less than 15 and *high self-esteem* indicates respondent's with a Rosenberg self-esteem score over 25. I use self-esteem with scores between 15 and 25 as the base category. A dummy variable captures whether a respondent has ever been suspended/expelled from school.

Home and school characteristics are represented through a list of several variables. *Total Net Family Income* in 1981 is a key variable on this list. I create income categories to allow for nonlinear effects of income, including threshold effects, where income becomes a significant determinant only above or below some threshold value. I account for the employment status of the parents (captured through the dummy variable *Both Parents Employed*) and the respondents themselves (captured through the dummy variables *Part-time Employed, Full-time employed* and *over-time employed*) as these variables may influence the respondents' decision to walk or bike to school. The educational background of a respondent's family enters with a number of variables, including dummy variables to indicate the highest grade of education completed by a respondent's father and dummy variables for family subscriptions to a *Magazine*, or

Newspaper or the possession of a *Library Card.* To capture school quality, I use *Drop-outs*, a variable representing the percentage of students in the respondent's school in 1979 that enter tenth grade but drop out before graduation. To control for the distance to school, I use dummy variables for those respondents residing within a two mile distance from school and those residing between three to five miles from school (with those over five miles as the base).

All the variables are summarized in Table I. Table II presents the summary statistics of the respondents by three sub-groups, overall, obese and overweight. All females with a pregnancy prior to 1982, the year in which such information is available, are excluded from the analysis. The table suggests that an average obese individual is more likely to be involved in leisure activity and less likely to be involved in criminal behavior (most of which requires some effort on the part of the individual). An average obese individual is also less likely to have access to magazines, newspapers or a library and is more likely to have a less educated father than the overall and the overweight sample. This indicates that obese individuals may have less information on healthy living available to them. An average obese respondent is more likely to have a higher self-esteem than his counterparts, suggesting that obesity does not affect the self-esteem of the respondent. Obese individuals are also less likely to live within five miles to school than the overall sample.

3.5. ESTIMATION RESULTS

The objective of the study is to analyze the effect of walking or biking to school

on weight. In the first three models of Table III, I present OLS estimates of (i) the effect of walking or biking to high school on BMI, (ii) the probability of being obese, and (iii) the probability of being overweight in 1981. Models 4 to 6 present estimates of the treatment effect when the treatment group is expanded to include individuals attending college. The results from all six models indicate that walking or biking to school is associated with a lower BMI (models 1 and 4), a reduced probability of being obese (models 2 and 5) and a lower probability of being overweight (models 3 and 6). However, the negative effect is not statistically significant at the five percent level in any of the six models.

I use PSM to arrive at results more precise than the OLS results being presented above. In order to implement PSM I first estimate the propensity scores for both the treated and the untreated respondents using the standard logit model with the outcome variable being a dummy variable that takes on a value of one if the student walks or bikes to high school. The logit estimates of this model are presented in column one of Table AI (see the appendix). As a robustness check, I include in model 2 of Table A1 those students who walk or bike to college in the treatment group along with high school students. In models 3 and 4, I re-estimate the propensity scores of models 1 and 2, but include variables for the employment status and drug usage habits since these variables may be important determinants of an individual's decision to walk or bike. However, including these variables comes at a cost. I need to drop the variables for *alcohol* usage, the percentage of *drop-outs* in school, *family income 4* as well as the indicator variable

black in order to satisfy the balancing tests.[29] While all models pass the balancing tests, the inclusion of models 3 and 4 only affirm that the results are quite robust.

Using the propensity scores from each model, I proceed to the second stage of the matching approach, estimating the Average effect of the Treatment on the Treated (ATT) by comparing the weighted outcomes for the treated and the untreated students. The key outcome variable is the Body Mass Index (BMI). Being obese and being overweight are used as additional measures of obesity. The outcomes are measured in 1981, the year in which the treatment is measured. Table IV presents the ATT's for models 1 and 2 discussed above, while Table V presents the ATT's for models 3 and 4.

Row 1 of Table IV (model1) provides the ATT's on different outcomes using radius matching as proposed by Dahejia and Wahba (2002). The ATT for the outcome variable *BMI* suggests that the mean difference in the *BMI* between those who walk or bike to school and those who could do so but preferred using a different mode of transportation is 1.08 units of BMI. This difference is statistically significant at the one percent level. Additionally, those who walk or bike to school are less likely to be obese by 2.35 percentage points (at a five percent significant level) and less likely to be overweight by 9.05 percentage points (at a one percent significant level) than the individuals in the control group.

In the same row of Table IV the last three columns present model 2, where college students are included in the treated units of those who choose to walk or bike to school. The inclusion of college students lowers the ATT in BMI to 0.75 units and the probability

29 I have explained the significance and the use of the balancing test in the methodology section.

of being overweight to 5.68 percentage points, while the probability of being obese remains almost constant at 2.21 percentage points. All these estimates are significant at the one percent level.

Row 2 of Table IV provides the ATT's on different outcomes for caliper matching with a radius of 0.25. This method finds a match only within a radius of 0.25 of the propensity score of the treated units.[30] Within this radius, the mean difference in BMI for those who walk or bike to school reduces to 0.71 units and these individuals are also less likely to be overweight by 6.3 percentage points (as compared to 9.05 percentage points under the default method). These results are statistically significant at the one percent level.

Since a radius of 0.25 is too sharp for a small sample of treated units, I increase the radius to 0.5 in row 3 and to 1 in row 4 of Table IV. Column 1 of row 3 presents the ATT with BMI being the dependent variable. The difference between the treated and untreated is 1.01 units of BMI, which is significant at the 1% level. The ATT's for the probabilities of being obese or overweight at this radius are presented in column 2 and in column 3 of row 3. While the probability of being obese at this radius reduces to 2.14 percentage points (significant at the 5 percent level) for those get treated, the probability of being overweight at this radius reduces further to 8.64 percentage points (significant at the 1 percent level). Columns 4 to 6 of row 3 present the estimates at the same radius of 0.5 but for those who walked or biked either to school or to college. In this case the ATT for BMI reduces to 0.37 units and is significant at the 5 percent level.

30 Using radii smaller than 0.25 drastically reduces the treated units which find a match, which is likely to lead to inconsistent results.

In row 4 I increase the radius to 1 which yields results consistent with row 1. However, since the matches found are with replacement[31] as compared to without replacement under the default, the results have slightly different standard errors. In order to verify if there is not too much variation in the tails of the distribution of the propensity score, I present in row 5 the results of changing the estimation specification to radius matching, with the latent variable index used instead of probabilities. Again the results are consistent with the default and it affirms that there is not much variation in the propensity scores in the tails of the distribution.

Table V presents the ATTs of the outcome variables for model 3 (for those in school) and for model 4 (for those in school or college). Models 3 and 4 differ from models 1 and 2 in terms of the covariates used in the estimation of the propensity score. The key covariates being added are dummy variables to represent the employment status of the student as well as the usage of drugs. Inclusion of these variables comes at the cost of dropping variables such as alcohol usage, one of the dummy variables for family income (between $30,001 and $40,000) and a variable for race during balancing. This model specification, while being consistent with the findings of Table IV, generates a slight reduction in the ATT for both models 3 and 4, under all outcomes and all matching methodologies. However, the ATT for the probability of being obese under both models 3 and 4 no longer remains statistically significant. For those who are in school, column 1 of model 3 reports that the ATT for BMI ranges from 0.63 units under the strictest radius matching, a caliper of 0.25, to 0.95 units under the default matching. Column 3 of model

31 Treated units are matched with the closest comparison unit on the basis of the propensity score even if more that one match takes place (Dahejia and Wahba, 2002).

3 reports the ATT for the probability of being overweight for school going children. I find that it ranges from 4.77 percentage points under radius matching with a caliper of 0.25 to 6.61 percentage points under the default matching methodology. These results are significant at the one percent level.

Model 4 of Table V presents the ATTs on the effects of walking or biking to school and college with covariates different from model 2. Notable results are that, for BMI (column 4) under radius matching under a caliper of 0.5, the ATT is 0.36 units and is significant at the one percent level while the ATT under default radius matching is 0.60 units. Additionally, for the probability of being overweight (column 6), under radius matching and under a caliper of 0.5, the ATT is 3.42 percentage points and is significant at the one percent level while the ATT under default radius matching is 4.76 percentage points. Overall, these results suggest that walking or biking to school is an effective way to keep obesity under control.

3.6. CONCLUSIONS

With the help of a rich set of covariates from the NLSY, I use Propensity Score Matching to estimate the difference in means in the levels of BMI, obesity and being overweight of those students who walk or bike to school and those students of a matched control group, who do not do so.

The results suggest that those students who walk or bike to high school have a statistically significant lower level of BMI, obesity and of being overweight. When I estimate the effects after including college students in the treatment group, the results

remain statistically significant.

The findings suggest that policy makers at the federal, state and local levels may want to seriously consider spending more on developing walking and biking paths, providing safety measures on these paths and improving the overall infrastructure required to allow students to walk or bike to school. Simultaneously, policy interventions may be necessary to discourage students from using other modes of transportation. Measures, such as higher parking fees for school parking lots, a more expensive school bus service for short distance users and the re-development of cities such that schools become approachable by walking or biking may be worth pursuing.

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Table 1: List of Variables used.

Variable Name	Details
Outcome Variables:	
BMI	Calculated by dividing weight in 1981 in pounds (lbs) by height in 1981 in inches (in) squared and multiplying by a conversion factor of 703.
Overweight	Dummy variable indicating BMI between 25 and 30
Obese	Dummy variable indicating BMI over 30
Treatment:	
Model 1 and 3	Dummy variable indicating that the individual is a high school student who either walks or bikes to school.
Model 2 and 4	Dummy variable indicating that the individual is a high school or a college student who either walks or bikes to school.
Controls:	
Basic Characteristics:	
Male	Dummy variable indicating gender of respondent is male.
Black	Dummy variable indicating race of respondent is African American.
Hispanic	Dummy variable indicating race of respondent is Hispanic.
Leisure Index	0 to 100 index indicating time spent by respondent in sleeping, watching T.V. and reading in 1981.
Crime Index	0 to 100 index indicating deviant behavior of the respondent in 1980 if they were less than 18 years old. This index is derived from sixteen deviant activities that the respondent admits he has been involved in including running away from home; skipping a full day of school without a real excuse; intentionally damaging property not belonging to them; getting into a physical fight at school or work; shoplifting from a store; stealing belongings of others worth less than $50; stealing belongings of others worth more than $50; using force or strong arm methods to get money or things from a person; seriously threatening to hit a person; attacking somebody with the intention of seriously hurting or killing them; selling marijuana or hashish; selling hard drugs such as heroin, cocaine or LSD; trying to con somebody; taking another person's vehicle without permission; breaking into a vehicle or building; knowingly selling stolen goods; and, aiding in a gambling operation.
Alcohol	Dummy variable indicating respondents drinking alcohol as a minor at least once in 1980.
Drugs	Dummy variable indicating respondents using drugs as a minor at least once in 1980.
Low Self-Esteem	Dummy variable indicating that the respondent's Rosenberg self-esteem score in 1980 is less than 15 indicating that the respondent is of low self-esteem.
High Self-Esteem	Dummy variable indicating that the respondent's Rosenberg self-esteem score in 1980 is greater than 25 indicating that the respondent is of high self-esteem.
Suspended/Expelled	Dummy variable indicating if, by 1980, the respondent has ever been suspended or expelled from school.
Part-time work	Dummy variable indicating respondent has worked part time (less than or equal to 20 hours) for pay in the last 7 days in 1981.
Full-time work	Dummy variable indicating respondent has worked full time (greater than 20 and up to 40 hours) for pay in the last 7 days in 1981.

Table 1: List of Variables used.(contd.)

Variable Name	Details
Regional Characteristics:	
Urban	Dummy variable indicating that the respondent resides in an urban area in 1981, the year of the treatment.
Some S.M.S.A.	Dummy variable indicating that the respondent resides in an S.M.S.A. in 1981.
South	Dummy variable indicating that the respondent resides in the Southern region of the U.S. in 1981.
West	Dummy variable indicating that the respondent resides in the Western region of the U.S. in 1981.
N. East	Dummy variable indicating that the respondent resides in the North-Eastern region of the U.S. in 1981.
Home and school Characteristics:	
Both Parents Employed	Dummy variable indicating both parents of the respondent are employed.
Family Income 1	Dummy variable indicating Total Net Family Income less than and equal to $10,000.
Family Income 2	Dummy variable indicating Total Net Family Income between $10,001 and $20,000.
Family Income 3	Dummy variable indicating Total Net Family Income between $20,001 and $30,000.
Family Income 4	Dummy variable indicating Total Net Family Income between $30,001 and $40,000.
Foreign Language	Dummy variable indicating any Language, other than English, spoken at respondents home during childhood.
Magazine	Dummy variable indicating that any household member received a magazine regularly when the respondent was of age fourteen.
Newspaper	Dummy variable indicating that any household member received a newspaper regularly when the respondent was of age fourteen.
Library Card	Dummy variable indicating that any household member had a library card when the respondent was of age fourteen.
Father's grade 0-8	Dummy variable indicating that the highest grade of regular school the respondent's father had ever completed by 1979 lied between no schooling and grade eight.
Father's grade 9-11	Dummy variable indicating that the highest grade of regular school the respondent's father had ever completed by 1979 lied between grade nine and eleven.
Father's grade 12	Dummy variable indicating that the highest grade of regular school the respondent's father had ever completed by 1979 was twelfth grade.
Father's grade 13-16	Dummy variable indicating that the highest grade of regular school the respondent's father had ever completed by 1979 was some college between first and fourth year.
Drop-outs	0 to 100 index indicating percentage of students in respondents school in 1979 who enter tenth grade but drop out before graduation.
Miles 1-2	Dummy variable indicating that the respondent lives within two miles from school.
Miles 3-5	Dummy variable indicating that the respondent lives between three to five miles from school.

Table 2: Descriptive Statistics

Variable Name	Overall		Obese		Overweight	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Treatment- Only School	0.0394	(0.1946)	0.0138	(0.1169)	0.0239	(0.1529)
Treatment- School and College	0.0726	(0.2595)	0.0311	(0.1738)	0.0550	(0.2280)
Male	0.6422	(0.4794)	0.6413	(0.4799)	0.7846	(0.4112)
Black	0.2364	(0.4249)	0.2180	(0.4131)	0.2290	(0.4203)
Hispanic	0.1564	(0.3632)	0.1961	(0.3973)	0.1785	(0.3831)
Male x Black	0.1618	(0.3683)	0.1211	(0.3264)	0.1636	(0.3701)
Male x Hispanic	0.1003	(0.3004)	0.1349	(0.3419)	0.1410	(0.3481)
Urban	0.6962	(0.4599)	0.3506	(0.4774)	0.7005	(0.4582)
Some S.M.S.A.	0.6452	(0.4785)	0.3137	(0.4643)	0.6255	(0.4842)
South	0.3490	(0.4767)	0.1845	(0.3882)	0.3790	(0.4853)
West	0.1804	(0.3846)	0.0923	(0.2896)	0.1850	(0.3884)
N. East	0.1934	(0.3950)	0.0969	(0.2960)	0.1895	(0.3920)
Family Income 1	0.1223	(0.3276)	0.0830	(0.2761)	0.1151	(0.3193)
Family Income 2	0.1302	(0.3365)	0.0750	(0.2635)	0.1223	(0.3277)
Family Income 3	0.1078	(0.3102)	0.0600	(0.2376)	0.0983	(0.2978)
Family Income 4	0.0700	(0.2552)	0.0323	(0.1769)	0.0712	(0.2572)
Leisure Index	41.3259	(10.6234)	43.7706	(11.6401)	41.8699	(11.0903)
Crime Index	5.1826	(8.1106)	3.6464	(7.6760)	5.5702	(8.2260)
Foreign Language	0.2186	(0.4133)	0.2930	(0.4554)	0.2337	(0.4233)
Magazine	0.5920	(0.4915)	0.5064	(0.5003)	0.5905	(0.4919)
Newspaper	0.7764	(0.4167)	0.7283	(0.4451)	0.7827	(0.4125)
Library Card	0.7182	(0.4499)	0.6701	(0.4704)	0.6966	(0.4599)
Father's grade 0-8	0.2029	(0.4022)	0.2734	(0.4459)	0.2180	(0.4130)
Father's grade 9-11	0.1473	(0.3545)	0.1476	(0.3549)	0.1740	(0.3792)
Father's grade 12	0.2978	(0.4573)	0.2630	(0.4405)	0.2943	(0.4559)
Father's grade 13-16	0.1641	(0.3704)	0.1200	(0.3251)	0.1429	(0.3501)
Both Parents Employed	0.2152	(0.4110)	0.0992	(0.2991)	0.2180	(0.4130)
Drop-outs	11.4128	(10.0605)	11.8929	(10.2252)	11.3726	(10.0699)
Suspended/Expelled	0.2587	(0.4379)	0.2257	(0.4183)	0.2847	(0.4514)
Alcohol	0.2065	(0.4048)	0.0923	(0.2896)	0.1539	(0.3610)
Low Self-Esteem	0.0150	(0.1217)	0.0185	(0.1347)	0.0142	(0.1185)
High Self-Esteem	0.3081	(0.4617)	0.4487	(0.4976)	0.2827	(0.4504)
Miles 1-2	0.1595	(0.3661)	0.0519	(0.2220)	0.1177	(0.3224)
Miles 3-5	0.0877	(0.2828)	0.0392	(0.1942)	0.0737	(0.2614)
Drugs	0.5259	(0.4994)	0.5729	(0.4949)	0.5122	(0.5000)
Part-time work	0.1714	(0.3768)	0.0718	(0.2582)	0.1496	(0.3567)
Full-time work	0.2785	(0.4483)	0.1526	(0.3598)	0.3010	(0.4589)

Pregnant females have been excluded from the analysis.

Table 3 : OLS effects of Walking or Biking to School (Model 1) and to School or College (Model 2) on BMI, Probability of being Obese and the Probability of being Overweight in 1981.

	Model 1 (only school)			Model 2 (school or college)		
	BMI	Obese	Overweight	BMI	Obese	Overweight
Treatment	-0.4273	-0.0006	-0.0567 **	0.1284	0.0114	-0.0048
	(0.2711)	(0.0164)	(0.0289)	(0.2092)	(0.0126)	(0.0223)
R-Squares	0.0899	0.0189	0.0413	0.0895	0.0190	0.0407
N	5432	5463	5463	5432	5463	5463

Note: Asterisks indicate level of statistical significance: *** Statistically significant at 1% level, ** Statistically significant at 5% level, * Statistically significant at 10% level. Standard errors in parenthesis. For all models pregnant females have been excluded from the analysis. Controls include variables on individual and regional characteristics as well as the variables on home and school characteristics.

Table 4 : ATT of walking or biking to school using Radius and Caliper Matching

	Model1 (only school)			Model2 (school or college)		
Matching Method	BMI	Obese	Overweight	BMI	Obese	Overweight
Default D-W Radius	-1.0803***	-0.0235**	-0.0905***	-0.7487***	-0.0221***	-0.0568***
(without replacement)	(0.2316)	(0.0098)	(0.0205)	(0.1517)	(0.0069)	(0.0159)
Radius =0.25	-0.7091***	-0.0140	-0.0657***	0.0476	0.0046	-0.0098
	(0.2496)	(0.0111)	(0.0227)	(0.2103)	(0.0107)	(0.0221)
Radius = 0.5	-1.0136***	-0.0214**	-0.0864***	-0.3704**	-0.0113	-0.0343*
	(0.2365)	(0.0102)	(0.0211)	(0.1691)	(0.0081)	(0.0177)
Radius = 1	-1.0803***	-0.0235**	-0.0905***	-0.7487***	-0.0221***	-0.0568***
	(0.2362)	(0.0102)	(0.0211)	(0.1594)	(0.0074)	(0.0167)
D-W Radius with index	-1.0803***	-0.0235**	-0.0905***	-0.7487***	-0.0221***	-0.0568***
	(0.2316)	(0.0098)	(0.0205)	(0.1517)	(0.0069)	(0.0159)

Notes: Coefficients refer to the effect of walking or biking to school for equations explaining BMI, Obese and Overweight as the outcome variables. In models 1 and 2 usage of drugs and variables for the employment status of the student have not been included in the analysis. Both models satisfy the balancing property. Asterisks indicate level of statistical significance: *** Statistically significant at 1% level, ** Statistically significant at 5% level, * Statistically significant at 10% level. Standard errors in parenthesis. For all models pregnant females have been excluded from the analysis. The number of treated and control units used for the analysis and satisfying common support in model 1 are 177 and 4593 and in model 2 are 412 and 4772.

Table 5 : ATT of walking or biking to school using Radius and Caliper Matching

	Model 3 (only school)			Model 4 (school or college)		
Matching Method	BMI	Obese	Overweight	BMI	Obese	Overweight
Default D-W Radius	-0.9465***	-0.0119	-0.0661***	-0.5973***	-0.0042	-0.0476***
(without replacement)	(0.1813)	(0.0086)	(0.0158)	(0.1316)	(0.0072)	(0.0127)
Radius =0.25	-0.6257***	-0.0061	-0.0477***	0.1841	0.0161	-0.0032
	(0.1896)	(0.0092)	(0.0169)	(0.1638)	(0.0090)	(0.0163)
Radius = 0.5	-0.9017***	-0.0111	-0.0635***	-0.3635***	0.0010	-0.0342***
	(0.1825)	(0.0087)	(0.0160)	(0.1358)	(0.0074)	(0.0132)
Radius = 1	-0.9465***	-0.0119	-0.0661***	-0.5973***	-0.0042	-0.0476***
	(0.1824)	(0.0087)	(0.0160)	(0.1335)	(0.0073)	(0.0129)
D-W Radius with index	-0.9465***	-0.0119	-0.0661***	-0.5973***	-0.0042	-0.0476***
	(0.1813)	(0.0086)	(0.0158)	(0.1316)	(0.0072)	(0.0127)

Notes: Notes: Coefficients refer to the effect of walking or biking to school for equations explaining BMI, Obese and Overweight as the outcome variables. In models 3 and 4 usage of drugs and variables for the employment status of the student have been included in the analysis. Alcohol usage, family income 4 and blacks have been excluded in order to meet balancing requirements. Both models satisfy the balancing property. Asterisks indicate level of statistical significance: *** Statistically significant at 1% level, ** Statistically significant at 5% level, * Statistically significant at 10% level. Standard errors in parenthesis. For all models pregnant females have been excluded from the analysis. The number of treated and control units used for the analysis and satisfying common support in model 1 are 369 and 8607 and in model 2 are 692 and 8235.

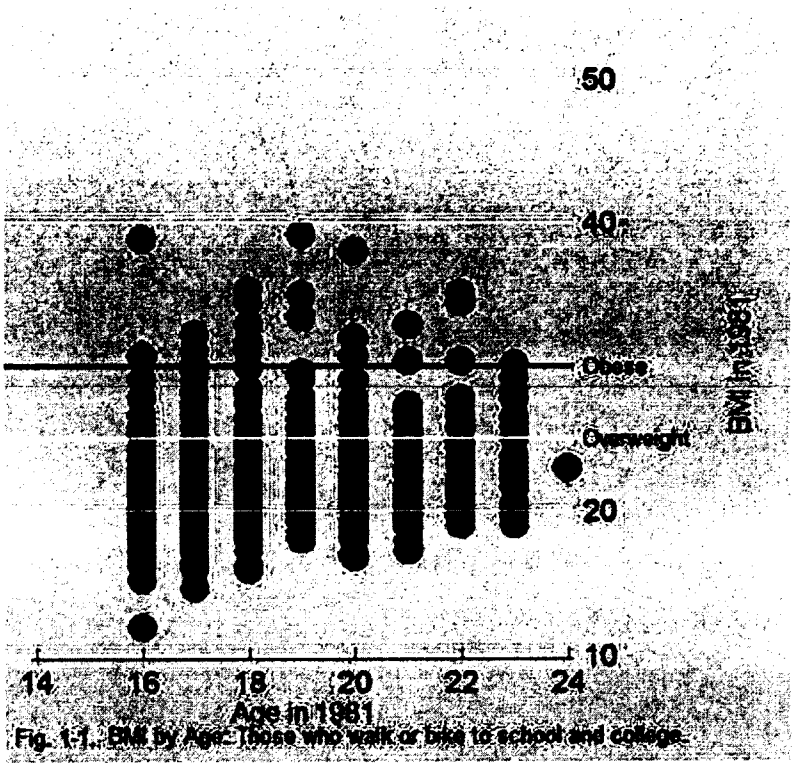

Fig. 1-1. BMI by Age: Those who walk or bike to school and college.

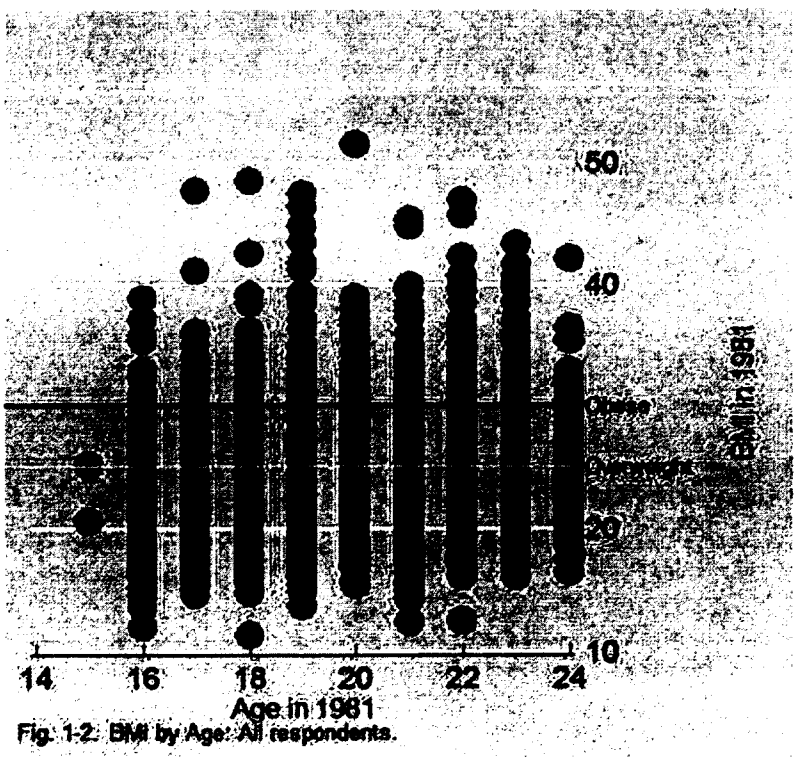

Fig. 1-2. BMI by Age: All respondents.

APPENDIX

Table A1 : Logistic Regression for the Estimation of Propensity Scores (Outcome Variable: Walking or Biking to School or College.)

Variable Name	Model1 Only School	Model2 School or College	Model3 Only School	Model4 School or College
Male	0.1673	0.0956	0.1685	0.0180
	(0.2382)	(0.1627)	(0.1306)	(0.0699)
Black	0.7307 **	0.0394		
	(0.3672)	(0.2611)		
Hispanic	1.0405 **	0.2937	0.7347 ***	0.1696
	(0.4523)	(0.3633)	(0.2432)	(0.1466)
Male X Black	0.1810	0.2808		0.1717 *
	(0.4210)	(0.3211)		(0.0914)
Male X Hispanic	-0.1027	-0.1639		0.0064
	(0.4729)	(0.3998)		(0.1560)
Urban	0.1657	0.1814	0.3691 *	0.1525 *
	(0.2707)	(0.2059)	(0.2014)	(0.0909)
Some S.M.S.A.	-0.5960 **	-0.4370 **	-0.3782 **	-0.2051 **
	(0.2339)	(0.1807)	(0.1749)	(0.0818)
South	-1.2401 ***	-0.5374 ***	-0.7316 ***	-0.2043 ***
	(0.2595)	(0.1757)	(0.1706)	(0.0755)
West	-0.2214	-0.1712	0.0402	-0.1110
	(0.2723)	(0.2159)	(0.1867)	(0.0887)
N. East	-0.0969	0.0508	0.1852	0.1434 *
	(0.2391)	(0.1832)	(0.1724)	(0.0805)
Family Income 1	0.5989 **	-0.2079	0.8087 ***	0.0337
	(0.2636)	(0.2205)	(0.1794)	(0.0880)
Family Income 2	0.1578	-0.1943	0.3917 **	-0.0709
	(0.2492)	(0.1914)	(0.1700)	(0.0817)
Family Income 3	0.1603	-0.2668	0.1776	-0.1378
	(0.2607)	(0.1975)	(0.1834)	(0.0861)
Family Income 4	-0.0184	-0.3789		
	(0.3088)	(0.2328)		
Leisure Index	0.0150 *	-0.0200 ***	0.0097	-0.0105 ***
	(0.0082)	(0.0068)	(0.0060)	(0.0029)
Crime Index	0.0215 *	0.0066	0.0233 ***	-0.0022
	(0.0113)	(0.0099)	(0.0085)	(0.0042)
Foreign Language	-0.5539 *	-0.4204 *	-0.5575 **	-0.1171
	(0.3206)	(0.2316)	(0.2301)	(0.1007)
Magazine	-0.2488	0.1113	-0.2956 **	0.0035
	(0.2038)	(0.1631)	(0.1435)	(0.0677)
Newspaper	-0.0610	0.2654	0.0226	0.1477 *
	(0.2412)	(0.2060)	(0.1655)	(0.0814)
Library Card	0.1175	0.2267	0.1851	0.1313 *
	(0.2171)	(0.1742)	(0.1518)	(0.0720)
Father's grade 0-8	-0.0304	0.1581	-0.1251	-0.0548
	(0.2985)	(0.2350)	(0.2009)	(0.0952)
Father's grade 9-11	0.1367	-0.3306	0.0702	-0.1244
	(0.2913)	(0.2409)	(0.2053)	(0.0995)
Father's grade 12	-0.3395	-0.5071 ***	-0.3307 *	-0.2788 ***
	(0.2553)	(0.1904)	(0.1769)	(0.0818)
Father's grade 13-16	-0.3990	0.0084	-0.4989 **	0.0183
	(0.2840)	(0.1940)	(0.2067)	(0.0865)

Both Parents Employed		0.1022	0.1849	-0.0240
		(0.1518)	(0.1430)	(0.0659)
Drop-outs	-0.0001	-0.0114		
	(0.0098)	(0.0077)		
Suspended/Expelled	0.3066	0.3573 *	0.3897 **	0.0455
	(0.2270)	(0.1948)	(0.1583)	(0.0778)
Alcohol	0.6887 ***	-0.6512 ***		
	(0.1880)	(0.1507)		
Low Self-Esteem	-0.2983	-0.5340	0.1469	-0.0694
	(0.6752)	(0.5531)	(0.3913)	(0.2078)
High Self-Esteem	-0.6265 ***	-0.0914	-0.5830 ***	0.0109
	(0.2224)	(0.1464)	(0.1604)	(0.0641)
Miles 1-2	5.2472 ***	5.8334 ***	5.0661 ***	2.5091 ***
	(0.4668)	(0.3071)	(0.3028)	(0.0826)
Miles 3-5	2.4999 ***	2.9005 ***	2.8364 ***	1.0417 ***
	(0.5697)	(0.3710)	(0.3547)	(0.1068)
Drugs			-0.3173 **	0.0903
			(0.1379)	(0.0612)
Part-time work			-0.2410 *	-0.0616
			(0.1436)	(0.0655)
Full-time work			-0.4626 **	-0.3686 ***
			(0.2043)	(0.0853)
N	5356	5356	9023	8980
Pseudo R-Square	0.4276	0.4961	0.4058	0.4682

Notes: Models 1 and 2 exclude Drugs, Part-time work and full-time work. Additionally, in order to satisfy the balancing tests, Both Parents Employed has been dropped from model 1 while Blacks, Family Income 4, Drop-outs and Alcohol have been been dropped from the estimation in Models 3 and 4 and the interactions between race and gender has been dropped from model 3. All models satisfy the balancing property. Asterisks indicate level of statistical significance: *** Statistically significant at 1% level, ** Statistically significant at 5% level, * Statistically significant at 10% level. Standard errors are in parenthesis. For all models pregnant females have been excluded from the analysis.

CHAPTER 4

THE EFFECTS OF MATERNAL FINANCIAL STRESS ON CHILD BEHAVIOR.

4.1. INTRODUCTION

Net worth is the difference between the assets and liabilities of a household. While liabilities are debt in the form of secured and unsecured loans, assets consist of property in the form of a house, cars and investments in stocks, bonds, mutual funds, savings accounts, and retirement funds. The value of assets is determined on the basis of the market price and, therefore, fluctuates over time. Changes in asset prices can be a significant source of financial stress for a household (Choi, 2009). For example, as experienced in the recent recession, a fall in the value of house prices makes it difficult for families to relocate to seek work elsewhere. Declines in the value of stocks and investments make families rethink their retirement plans. A drop in income generated from assets leaves households with less money to spend. Declining asset values or incomes from assets during an economic downturn may be particularly problematic if household members are laid off at the same time. This may compel households to survive on unsecured debt from sources such as credit cards, which may further aggravate their financial stress. These arguments suggest that asset price fluctuations can have serious implications on the stress levels experienced by households.

Another source of family stress appears to have developed over the last few decades as a result of significant changes in the division of labor in households. Traditionally, males specialized in earning a livelihood in the labor market, while females specialized in domestic duties and child rearing (Becker, 1981). This traditional model of the division of labor inside a household is no longer the norm as female labor force participation has increased significantly over the last decades (Mosisa and Hipple, 2006).

Analysis of the 2008 recession shows that in many households females provide the primary source of income (Ludden, 2009). In fact, many females are the primary earners while upholding at the same time their traditional household duties (Ludden, 2009). This suggests that females carry an extraordinary responsibility for an increasing number of households.

The combination of financial stress caused by asset price declines and the need to work to support the family can be expected to affect the behavior of mothers toward their children. In particular, they may spend less time in activities involving the family, spending more time at the workplace rather than being available to the children at home. Since mothers play a key role in the upbringing of children, it would appear to be of interest to empirically test and quantify whether maternal financial stress has any negative implications for children.[32]

The remaining paper is organized as follows. In section 2 I present a review of the literature. This is followed by a discussion of the data in section 3 and a review of the methodology in section 4. In section 5 I discuss my results and in section 6 suggest some policy conclusions.

4.1. LITERATURE REVIEW

Child behavioral issues have been analyzed extensively in the literature. I present a brief literature review emphasizing the economic and financial causes of such behavior.

32 Net worth is measured at the household level and information on this variable is available for both males and females in the NLSY79 data. However, the NLSY collects information on children for only the females of NLSY79, not the males. For this reason, I drop all men from my analysis and concentrate on the effects of maternal financial stress on child behavior.

Several studies have analyzed the effects of home ownership, an important aspect of net worth, on children. For instance, Haurin et al. (2002) use four waves (1988, 1990, 1992 and 1994) of the NLSY data to show that home ownership leads to lower behavioral problems by 1 to 3%. In another study, Cairney (2005) uses the Canadian National Population Health Survey from 1994 to 1995 to show that home ownership leads to greater psychological well being among adolescents. Green and White (1997) also contribute to this literature to show the benefits of home ownership on children. They employ a variety of data sets using probit and bivariate probit models to show that children of homeowners stay longer in school and that girls are less likely to give birth by age 18. Boehm and Schlottmann (1999) use the PSID data from 1968 to 1992 to show that children of homeowners attain higher education and earning levels. They also demonstrate that parent housing tenure is an important aspect of a child's decision to own a house.

Since home ownership is an important aspect of a family's net worth, one can conclude from these studies that a drop in home values, or even foreclosures may lead to severe distress among parents with unfavorable consequences for the children. However, home ownership is not the only aspect of net worth and, therefore, not the only cause of financial stress.

Several studies analyze the effects of net worth on child behavior, but these tend to focus on racial differences. Chiteji and Stafford (1999) use PSID data from 1994 to show how parental asset holdings affect the way children own assets when they turn adults. They suggest that, overall, if parents own stocks, their children are also likely to

own stocks. Their research contradicts earlier research that the results do not hold for African American families. In a separate study, conducted at the same time but using the same data as this paper, Conley (1999) rules out the hypotheses that particular races react differently when considering the effects of parental wealth on child outcomes.

Notable studies not concentrating on racial disparities are those by Shanks (2007) and Campbell (2007). Shanks (2007) uses OLS techniques on PSID data with information on net worth from 1994 and child behavioral data from 1997 to show that wealth does significantly affect child behavior. Campbell (2007) uses the same NLSY data as this study from waves beginning in 1986 and ending in 2000 to show the effects of net worth on child behavior among many other variables. She uses OLS techniques and conducts estimates for two age categories, 6 to 7 year olds and 10 to 11 year olds. Her findings suggest that an increase in net worth has a negative effect on child behavior.

My study improves on the work done by Shanks (2007) and Campbell (2007) in several ways. First, I exploit the panel nature of the data to account for unobserved heterogeneity. Second, I do not restrict myself to the behavioral problems index, but also provide estimates on sub-indices of the aggregate problems index in order to pin-point the actual behavioral issues. Third, I consider a wider age distribution and a longer time horizon than Campbell (2007). This longer time horizon accounts for the 2008 financial crisis, which adds a significant amount of variation to the data set. Fourth, my estimates by gender are also unique because they show that boys and girls react somewhat differently in terms of behavioral issues. Finally, I decompose net worth into dichotomous categories to allow for non-linearities and threshold effects of this variable

on child behavior. My analysis also improves on the other works mentioned above because I use net worth, a more inclusive measure of financial status, rather than a more restricted one, such as housing, savings or stocks. In fact, I control for a variety of other financial variables that other studies are unable to incorporate.

4.3. DATA

The National Longitudinal Survey of Youth 1979 (NLSY79) cohort and the subsequent NLSY79 Children and Young Adult (NLSY Child) are the two sources of data used in this study.[33] Both data sets are nationally representative and longitudinal in nature. I employ the waves from the years 1986, 1988, 1990, 1992, 1994, 1996, 1998, 2000, 2004 and 2008 for my analysis.[34]

The NLSY79 began in 1979 with 12,686 respondents in the age range of 14 to 22 years. These individuals were surveyed annually until 1994 and biennially thereafter (Center for Human Resource Research, 2002). This data set provides critical information on the mother's financial status. Mother's net worth, family income, her savings, whether she owns a house and her poverty status are some important financial variables found in the data set. Besides, the mother's age, race, marital status, education, her region of residence, whether her residence is in a metropolitan area and whether her residence is in an urban area are some other demographic variables that I use from this survey.

The NLSY Child survey started in 1986 as an extension of the NLSY79 cohort. It

33 These data sets are merged using the mother's unique identification number.

34 NLSY Child data are available biennially from 1986 to 2008. However, I exclude the years 2002 and 2006 because information on net worth is not available for those years.

consists of information on the children of mother's in the NLSY79. Key demographic variables, such as the child's gender, race, age, whether the child attends school, whether the mother attends school, whether the child's biological father is residing in the same house, the age of the mother's spouse or partner and the highest grade completed by the mother's spouse or partner, are used from this survey.

The key dependent variable is the Behavioral Problems Index. This is an index measured in percentiles and is designed to identify abnormal behavior of the child. This index is based on 28 questions administered to mothers of children 4 years or older. The development of these questions is accredited to Nicholas Zill and James Peterson, who followed primarily the Achenbach Behavioral Problems Checklist (Achenbach and Edelbrock, 1981), which is widely used to assess child behavioral issues (Center for Human Resource Research, 2002).

Other than the aggregate index, I use the six sub-indices that are developed from the same 28 questions (Center for Human Resource Research, 2002). These indices identify issues such as antisocial behavior, anxiousness/depression, headstrongness, hyperactivity, dependency and peer conflict (Center for Human Resource Research, 2002). For instance, if a child has difficulty concentrating, is easily confused, is impulsive, is obsessed over certain thoughts or restless, he or she is considered hyperactive. If a child cheats, bullies, does not feel sorry, purposely breaks things, is disobedient and has trouble with getting along with teachers, then he or she is considered antisocial. An unhappy or sad child, who is too fearful or feels worthless, who complains that he or she is not loved by anybody or has sudden mood swings is categorized as being

depressed. If a child clings, cries or demands too much attention, he or she is classified as dependent. Finally, a headstrong child is one who is tense, nervous, stubborn, who argues a lot or loses his temper easily (Center for Human Resource Research, 2002). For all these indices, a higher the percentile score indicates that the child has more of a behavioral issue (Center for Human Resource Research, 2002).

The key independent variable is net worth, which is the difference between the assets and liabilities of the mother's household. More specifically, it is defined using the method suggested by Zagorsky (1999) and includes the sum of the value of the home (+), the outstanding mortgage (-), property debt (-), cash savings (+), stock holdings (+), trusts (+), business, farm, or real estate equity (+), business, farm, or real estate debt (-), the value of any car (+), any car debt (-), the value of personal possessions (+), other debt (-), the value of IRAs (+), 401K savings (+), and certificates of deposit (+), where a negative sign in parenthesis indicates that a value is subtracted and vice versa for a positive sign. The net worth amounts are converted to 1986 dollar amounts so as to account for increases in the general price level.[35]

In Table 1, I present the descriptive statistics for the overall sample and also for single mothers, the group most likely to suffer from financial stress. When compared to the overall sample, single mothers are more likely to be from the African-American community (53% vs 27%), from the south (42% vs 39%), from an urban (80% vs 76%) or metropolitan area (64% vs 57%) and less likely to have a college degree (4% vs 10%).

In addition to the above mentioned disparities, one observes that in terms of the

35 Along with net worth, family income is also converted to 1986 dollar amounts.

financial variables, single mothers report a much lower net worth ($14,900 vs $49,800) compared to the overall sample and a much lower annual family income ($12,776 vs $30,262). They are more likely to be indebted (20% vs 13%) or more likely to be breaking even (23% vs 8%), more likely to be in poverty (54% vs 25%) and less likely to have savings (38% vs 62%) or own a house (22% vs 49%).

Since the children of single mothers report greater behavioral problems in terms of all the indices that are available, one may wonder whether the cause of such behavior is financial distress at home. This is the key question of this paper.

4.4. METHODOLOGY

This study intends to analyze the effects of maternal financial stress on child behavior. I take advantage of the longitudinal nature of the data to estimate between-effects and fixed-effects models for my analysis.

A simple linear panel data model is of the following form

$$Y_{it} = X_{it}\beta + \epsilon_i + \mu_{it} \tag{1}$$

where Y indicates the value of a specific behavioral index for child i at time t; X is a vector of independent variables, including the key net worth variable and a series of control variables; ϵ_i is a unit specific effect that measures unobserved and time-fixed individual characteristics uncorrelated with the coefficients of the vector X. Equation (1) averaged over time yields

$$\bar{Y}_i = \bar{X}_i\beta + \epsilon_i + \bar{\mu}_i \tag{2}$$

When equation (2) is subtracted from equation (1), it results in the unobserved

individual specific characteristics canceling out.[36] The fixed-effects estimator then produces consistent estimates of the impact of changes in each individual's or each family's characteristics over time on the dependent variable, which is an index of child behavioral problems. However, it does not provide us any information to what extent differences in household characteristics are associated with the behavioral problems of children. As children get older, the fixed-effects estimator provides information on whether changes in net worth have any effect on a child's behavioral problems. Information on how differences in behavioral problems are associated with different child and family characteristics is found from equation (2), the between-effects estimator, which is simply a least squares regression using variables that are averaged for all individuals and families over time.

In my analysis, I estimate both, between-effects and fixed-effects models. These estimates are conducted for the overall sample as well as by gender and by two different age groups - young children of 4 to 8 years in age and older children who are over 8 years of age but less than 18 years old. While these estimates help me identify whether children have behavioral issues, and which age group or gender is most affected by them, these estimates do not provide information on what kind of behavioral issue these children suffer from. Hence, other than the behavioral problems index, I employ 6 other indices as dependent variables to pinpoint the exact nature of the behavioral issue. These indices identify whether the child is being antisocial, hyperactive or headstrong. They also identify whether the child has been anxious or depressed, whether the child is too

36 This process of removing the individual unobserved heterogeneity is also known as demeaning. It is an alternative to adding a dummy variable for each cross-section unit.

dependent on others or whether the child has been having peer conflict issues.

Net worth has a large range of values from negative (being indebted) to large positive values (being of high net worth). Using net worth as a continuous variable may miss non-linearities that can arise from threshold effects. For example, a given increase in net worth, when it is relatively large to begin with, may have a rather different effect than when this same increase moves the household from being indebted to having some positive net worth. To capture this type of non-linearity, the key independent variable, net worth, is also transformed into a number of dichotomous categories and regressions are run with these categorical variables. In particular, mothers are classified as indebted, breaking even, modestly well-off and of high net worth. I expect that the move from being indebted to having a net worth of zero is an important one for reducing financial stress. Similarly, it is likely that there is a difference in financial stress levels between those who have a moderate level of net worth and those who are wealthy (Smith et al. 2005).

4.5. RESULTS

In Table 2, I present the between-effects and fixed-effects estimates of net worth on the behavioral problems index for the overall sample as well as by gender. The between-effects results suggest that on, an average, high net worth is associated with lower behavioral issues for children. This applies to the overall model (1) as well as to those that are gender specific (models 2 and 3). By contrast, the fixed-effects models (4) and (5) indicate that a $10,000 increase in net worth results in a 0.39 percentile and statistically significant increase in behavioral issues overall (model 4) and a 0.43

percentile increase in behavioral issues for females. These results indicate that children of mothers with low levels of wealth have greater behavioral issues but, at the same time, they show that increases in wealth lead to an escalation of behavioral issues among children. One possible explanation for such outcomes is that mothers with less wealth may be under severe financial stress which gets carried over to the children. When a mother experiences a positive wealth shock and move to a new social stratum. Consequently, she may happen to be more relaxed at home, spending more time outside home and less time with her children. This could result in children developing behavioral issues.

These results, however, do not inform us on the age groups that are most affected nor of the kinds of behavioral issues that are involved. Hence, in Table 3 I present the results by age group, in particular for younger children in the age range of 4 to 8 years and for older children, those who are over 8 and less than 18 years old. I also present the effects for 6 other sub-indices created out of the 28 questions that make up the aggregate behavioral problems index. The between-effects results (model 1) suggest that children of mothers with low net worth happen to have deep behavioral issues. These children are significantly more anti-social, anxious and depressed, dependent on others, headstrong and hyperactive. The estimations by age category indicate that both younger (model 2) and older children (model 3) of mothers with low net worth have greater behavioral issues. However, there is a distinct difference in the type of behavioral issues they display. Younger children are significantly more anti-social and hyperactive, while older children tend to be significantly more depressed and dependent on others and, at the same

time, happen to have significantly greater potential for peer conflict. Financially stressed mothers may themselves be withdrawn (making younger children anti-social) or they may not be as concerned about their children, thereby making younger children hyperactive. When these children grow older, they continue to feel their mother's financial stress and either seek comfort in others and, thus becoming more dependent, or the older children get so withdrawn that they become depressed.

The fixed-effects results of model (6) suggest that, with increases in net worth over time, behavioral issues become significantly more prevalent only among older children. These children happen to get more headstrong when their mothers see increases in net worth. At the same time, an increase in net worth over time results in younger children becoming less dependent on others. The results of the fixed-effects models suggest that a rise in net worth may push the household into a new social stratum, which may be associated with a change in behavior on the part of both the mothers and the children. With increases in net worth, mothers may perhaps spend more time in entertainment and socializing with friends and less time supervising their children. Younger children may now be getting less attention from their mothers and may be sent to day care or other after school activities thus becoming less dependent. Receiving less supervision and by becoming less sympathetic to their mothers financial conditions, older children may become stubborn and may get into arguments with their mothers, thus making them more headstrong.

In Table 4 I categorize mothers into 4 groups of net worth, those who are indebted (negative net worth), those breaking even (zero net worth and base category),

those having modest net worth (net worth being positive, but less than $200,000)[37] and those with high net worth. I present the between-effects results for the overall index in model (1), the antisocial index in model (2) and the headstrong index in model (3) as these indices are statistically significant. The results indicate that indebted mothers have children with far greater behavioral issues. These children happen to be significantly more antisocial, depressed and headstrong. Studies suggest that indebted individuals may be insecure (Dubois and Anderson, 2010), have strained social relations (Carpentier and Van den Bosch, 2008) and are even depressed (Bridges and Disney, 2010). Gartstein et al. (2009) show that maternal depression may cause child behavioral issues. Hence, it is no surprise that maternal financial stress directly affects a child's behavior.

4.6. CONCLUSIONS

In this study I use a nationally representative longitudinal data set from 1986 to 2008 to analyze the effect of maternal financial stress on child behavior. I exploit the variation in a mother's net worth to determine her financial stress and a series of behavioral indices to determine child behavior. In my estimates, I control for important maternal and child demographic characteristics as well as other important financial variables, such as the family income, savings, house ownership and the poverty status. I estimate both between-effects and fixed-effects models. The between-effects models suggest that households with smaller mean net worth have more children with behavioral problems on average. Children of both genders and of all age groups report such

37 While this number is arbitrary, I do try other numbers but the effects are consistently statistically significant for indebted mothers for the results presented in Table 4.

problems. In particular, younger children are more anti-social and hyperactive, while older children are more depressed, dependent and have more peer-conflicts. The fixed-effects models suggest that a rise in net worth may push mothers into a new social stratum with different behavior patterns for mothers and children, where younger children become less dependent and older children get more headstrong. The increases in wealth have a significantly greater behavioral effect on female than male children. When I split net worth into dichotomous categories, the results suggest that young children of indebted mothers are highly influenced by the mother's financial stress and are significantly more likely to be anti-social, anxious, depressed and headstrong.

These results have important policy consequences, particularly after the recent financial crisis, where most households experienced declines in their net worth. More effort may be required in curtailing variations in asset prices of the type experienced around 2008 because such variations are likely to lead to a direct and measurably negative impact on children. Besides, increases rather than decreases in after school programs and activities to keep children involved during vacations and more personal attention at school is what appears to be needed for children to offset the strains caused by financial issues at home.

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Table 1: Demographics

Variable	Overall Mean	Overall Std. Dev.	Single Mother's Mean	Single Mother's Std. Dev.
Child's Behavioral Indices				
Behavioral Problem Index	597.08	(276.18)	644.84	(272.19)
Antisocial Behavior Index	606.06	(274.79)	662.77	(270.26)
Anxiousness/Depression Index	554.73	(269.89)	588.56	(265.49)
Dependent Index	592.39	(274.91)	641.77	(270.43)
Headstrong Index	553.55	(276.50)	574.57	(277.89)
Hyperactive Index	570.45	(282.61)	610.14	(284.19)
Peer Conflict Index	567.03	(233.82)	596.35	(245.58)
Mother's Financial Variables				
Net Worth ($ 0,000)	4.9826	(14.7104)	1.4949	(7.7021)
Family Income ($ 0,000)	3.0262	(4.9351)	1.2776	(1.7928)
Indebted	0.1298	(0.3361)	0.1982	(0.3987)
Breaking Even	0.0800	(0.2713)	0.2260	(0.4183)
Modest Net Worth	0.5489	(0.4976)	0.5602	(0.4964)
High Net Worth	0.2412	(0.4278)	0.0156	(0.1237)
Has Savings	0.6175	(0.4860)	0.3810	(0.4856)
Owns a House	0.4875	(0.4998)	0.2228	(0.4161)
In Poverty	0.2580	(0.4375)	0.5452	(0.4980)
Mother's Demographics				
Hispanic	0.1925	(0.3943)	0.2027	(0.4020)
Black	0.2777	(0.4479)	0.5311	(0.4990)
North East	0.1556	(0.3624)	0.1560	(0.3629)
North Central	0.2483	(0.4320)	0.2436	(0.4293)
South	0.3931	(0.4884)	0.4201	(0.4936)
Urban Area	0.7632	(0.4251)	0.7963	(0.4027)
Metropolitan Area	0.5743	(0.4945)	0.6413	(0.4796)
Never Married	0.1767	(0.3814)	0.4005	(0.4900)
Married	0.5983	(0.4902)	0.0000	(0.0000)
Separated	0.0633	(0.2436)	0.2175	(0.4125)
Divorced	0.1351	(0.3418)	0.3514	(0.4774)
Only Child	0.2029	(0.4022)	0.2774	(0.4477)
Two Children	0.3256	(0.4686)	0.3457	(0.4756)
Three Children	0.2049	(0.4037)	0.2252	(0.4177)
Four or More Children	0.0999	(0.2998)	0.1517	(0.3587)
Mom's HGC: 0 to 8th	0.0481	(0.2139)	0.0598	(0.2372)
Mom's HGC: 9th to 11th	0.1220	(0.3273)	0.1895	(0.3919)
Mom's HGC: High School	0.4531	(0.4978)	0.4932	(0.5000)
Mom's HGC: Some College	0.2307	(0.4213)	0.2067	(0.4049)
Mom's HGC: College	0.0973	(0.2964)	0.0369	(0.1885)
Mother Overweight	0.4951	(0.5000)	0.5522	(0.4973)
Mother Obese	0.2233	(0.4165)	0.2674	(0.4426)

Note: Child's Behavioral Indices are in percentiles. Net Worth and Family Income are in 1986 Dollars. HGC represents Highest Grade Completed.

Table 1: Demographics (continued)

	Overall		Single Mother's	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Child's Demographics				
Child's Body Weight (Lbs.)	63.9459	(38.8306)	69.7252	(41.1355)
Father at Home	0.5873	(0.4923)	0.0000	(0.0000)
Mother enrolled at school	0.0491	(0.2162)	0.0476	(0.2129)
Age of Spouse/Partner of Mother	36.5012	(7.9547)	35.7575	(8.7507)
Dad's HGC: 0 to 8th	0.0462	(0.2099)	0.0575	(0.2329)
Dad's HGC: 9th to 11th	0.1177	(0.3222)	0.2351	(0.4241)
Dad's HGC: High School	0.4339	(0.4956)	0.5320	(0.4990)
Dad's HGC: Some College	0.1935	(0.3951)	0.1275	(0.3336)
Dad's HGC: College	0.1238	(0.3294)	0.0307	(0.1725)
Child in School	0.8290	(0.3766)	0.8445	(0.3624)
Age of Child in years	11.2939	(7.2642)	11.7590	(6.8632)
Child – Male	0.5088	(0.4999)	0.5090	(0.4999)

Note: HGC represents Highest Grade Completed.

Table 2: Behavioral Problem Index, Between-Effects and Fixed-Effects, Overall and by Gender.

	Between-Effects			Fixed-Effects		
	Overall	Males	Females	Overall	Males	Females
	(1)	(2)	(3)	(4)	(5)	(6)
Net Worth ($ 0,000)	-0.8757***	-0.7486**	-1.0244***	0.3890**	0.3298	0.4307**
	(0.2139)	(0.3047)	(0.3020)	(0.1658)	(0.2419)	(0.2188)
N	15719	7872	7847	15719	7872	7847
R-square	0.1015	0.1074	0.1002	0.0108	0.0171	0.0194

Note: Standard Errors in Parenthesis. *** indicates p-value<0.01, ** indicates p-value<0.05 and * indicates p-value<0.10. Controls include mother's demographics, child demographics, family income, savings, own house and in poverty status. Appropriate survey weights and clustering for multiple children at each home have been used in the estimation.

Table 3: All Behavioral Indices, Between-Effects and Fixed-Effects by Age Groups.

	Between-Effects			Fixed-Effects		
	4 to 17 years	4 to 8 years	9 to 17 years	4 to 17 years	4 to 8 years	9 to 17 years
	(1)	(2)	(3)	(4)	(5)	(6)
Behavioral Problem Index						
Net Worth ($ 0,000)	-0.8757***	-0.7017***	-0.5766***	0.3890**	0.02957	0.7694***
	(0.2139)	(0.2485)	(0.2140)	(0.1658)	(0.3396)	(0.2795)
N	15719	8337	7382	15719	8337	7382
R-square	0.1015	0.0978	0.082	0.0108	0.016	0.0138
Antisocial Behavior Index						
Net Worth ($ 0,000)	-0.5068**	-0.4847**	-0.3431*	0.2609	0.08427	0.5004
	(0.2008)	(0.2397)	(0.2024)	(0.2197)	(0.4134)	(0.3388)
N	15716	8369	7347	15716	8369	7347
R-square	0.1164	0.0893	0.1241	0.0087	0.0143	0.0164
Anxiousness/Depression Index						
Net Worth ($ 0,000)	-0.5027**	-0.3985*	-0.4672**	0.1102	-0.4067	0.546
	(0.2031)	(0.2412)	(0.2052)	(0.2111)	(0.4256)	(0.3429)
N	16105	8519	7586	16105	8519	7586
R-square	0.0777	0.0683	0.0638	0.0115	0.0175	0.0167
Dependent Index						
Net Worth ($ 0,000)	-0.4829**	-0.2219	-0.5861**	-0.4581**	-0.7592**	-0.4355
	(0.2171)	(0.2429)	(0.2478)	(0.2190)	(0.3527)	(0.5337)
N	13076	8599	4477	13076	8599	4477
R-square	0.0594	0.0563	0.0576	0.0096	0.0206	0.0615
Headstrong Index						
Net Worth ($ 0,000)	-0.6260***	-0.4639*	-0.3341	0.5409***	0.3632	0.7882**
	(0.2106)	(0.2440)	(0.2129)	(0.1789)	(0.4109)	(0.3732)
N	16126	8531	7595	16126	8531	7595
R-square	0.0707	0.0632	0.0529	0.0144	0.0244	0.0154
Hyperactive Index						
Net Worth ($ 0,000)	-0.7548***	-0.8212***	-0.3965*	0.3734*	0.1968	0.6514*
	(0.2089)	(0.2425)	(0.2119)	(0.2072)	(0.3875)	(0.3576)
N	16138	8545	7593	16138	8545	7593
R-square	0.1186	0.1242	0.0867	0.0088	0.0284	0.0097
Peer Conflict Index						
Net Worth ($ 0,000)	-0.2553	-0.1648	-0.3413**	0.1596	0.2443	0.2323
	(0.1627)	(0.1942)	(0.1681)	(0.1687)	(0.4629)	(0.3353)
N	16150	8552	7598	16150	8552	7598
R-square	0.0575	0.0458	0.0521	0.0057	0.0183	0.0134

Note: Standard Errors in Parenthesis. *** indicates p-value<0.01, ** indicates p-value<0.05 and * indicates p-value<0.10. Controls include mother's demographics, child demographics, family income, savings, own house and in poverty status. Appropriate survey weights and clustering for multiple children at each home have been used in the estimation.

Table 4: Between-Effects of Dichotomous Categories on Behavioral Indices.

	Behavioral Problem Index	Antisocial Behavior Index	Anxiousness/ Depression Index	Headstrong Index
	(1)	(2)	(3)	(4)
Indebted	60.0529**	90.4981***	72.1381***	67.3103**
	(27.3633)	(26.3570)	(26.4674)	(26.6509)
Modest Net Worth	26.5001	59.4281**	23.2613	39.1878
	(26.1308)	(25.1401)	(25.2896)	(25.4281)
High Net Worth	-13.0177	29.7658	0.074103	12.8125
	(30.2042)	(29.1302)	(29.2383)	(29.4978)
N	6938	6970	7090	7105
R-square	0.0938	0.0817	0.0703	0.0586

Note: Standard Errors in Parenthesis. *** indicates p-value<0.01, ** indicates p-value<0.05 and * indicates p-value<0.10. Controls include mother's demographics, child demographics, family income, savings, own house and in poverty status. Appropriate survey weights and clustering for multiple children at each home have been used in the estimation.

CHAPTER 5

CONCLUSION

This dissertation consists of three essays. The first examines the effects of financial stress caused due to variations in net worth on the body weight of the respondents. The results suggest that an increase in net worth leads to lower body weight among the respondents. Besides, the results also show that indebted and modestly well-off individuals are most likely to be gaining weight. The second essay examines the effects of walking or biking to school on obesity levels. The estimation compares two sets of individuals who are similar in all aspects but one of them chooses to walk of bike to school. The results suggest that those who choose to walk or bike to school have significantly lower BMI and probabilities of being obese and overweight. Finally, the third essay examines the effects of financial stress caused to mothers due to variations in their net worth and the consequent behavioral issues that the children suffer from. The findings suggest, among other things that children of low net worth mothers are most likely to have behavioral issues and that increases the mothers in net worth aggravate behavioral issues among children.