Is Obesity As Dangerous to Your Wealth As to Your Health?

JAY L. ZAGORSKY
Ohio State University

Obesity is a growing public health issue, with a rising number of adults classified as overweight. Although medical research shows being overweight is dangerous to one's health, this research, which investigates young, U.S. baby boomers from 1985 to 2000, finds it is also dangerous to one's wealth. The net worth of the obese is roughly half that of those with normal body mass. As young baby boomers age, peak net worth slowly shifts toward those with lower mass. Boomers with a body mass index (BMI) of 22 in 1985 held the most net worth, but by 2000 the peak shifted to those with a BMI of 17. From 1985 to 2000, for every one-point BMI increase, net worth on average fell $1,000, holding other factors like income constant. Surprisingly, part of the reason BMI is inversely related to net worth is because lighter people receive more inheritances than heavier individuals.

Keywords: *obesity; weight; wealth; net worth*

Obesity is a rapidly growing public health issue in the United States. Mokdad et al. (1999, 2001) provided figures showing obesity among adults has risen rapidly in the United States, with almost one out of every five adults self-reporting height and weight values that classify them as obese in 2000. The exact numbers and trend are important because being obese is dangerous to one's health. Obesity is associated with higher chances of having heart disease, a stroke, diabetes, and cancer (National Institute Of Health 1998), to name only a few medical conditions. Just as important as the morbidity effects, Allison et al. (1999) estimated that in 1991 there were between 262,000 and

AUTHOR'S NOTE: Please address all correspondence to Jay Zagorsky, Ohio State University, 921 Chatham Lane, Suite 100, Columbus, OH 43221; e-mail: zagorsky.1@osu.edu. The author would like to thank Dr. Robert Sege for his helpful discussion of obesity and the anonymous reviewers for their suggestions. All errors are the author's.

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383,000 U.S. mortalities attributable to people being overweight or obese.

Although much is known about obesity's medical effects, much less is known about the interrelationship between weight and socioeconomic indicators. Research clearly shows obesity is dangerous to health, but there is no research on whether obesity is dangerous to an individual's wealth. This research investigates the linkages between wealth and body mass. Numerous public policies attempt to improve wealth and reduce obesity separately. If there are linkages, then public poverty and public health policies could have important unmeasured benefits that spill over from one type of program to another.

For example, if obesity affects wealth, then public health initiatives, which improve the health of individuals by lowering their weight, would indirectly reduce the number of poor individuals. Conversely, if the amount of wealth owned affects obesity, then poverty reduction programs would indirectly improve the health and well-being of poor individuals.[1]

Previous research examining socioeconomic indicators and weight have not focused on wealth but instead focused on understanding whether there are education-obesity and earnings-obesity linkages. Wealth is very different from earnings, because many individuals live on more than just their income. During low-income periods, many families spend down their savings or borrow. During periods of prosperity, many families build up savings or pay off past debts. Hence, focusing on just current earnings ignores important ways that families cope with life's financial changes.

Nayga (2000), looking at the United States, and Kaluski et al. (2001), looking at Israeli women, both found that obesity is directly related to the level of education. Increased schooling lowers the chances that a person is obese.

Pagan and Davila (1997) and Mirta (2001) found that women who are obese have lower earnings but that obese men do not experience significant wage penalties. Averett and Korenman (1996) found, however, that not all obese women are hurt economically as their research showed no earnings penalty for overweight African American women.

Taking a broader view, Ruhm (2000) found that obesity is related to economic conditions and showed that obesity increases during upturns in the economy. Finally, Philipson and Posner (1999) showed

that the reason obesity is increasing over time is that the inflation-adjusted cost of food has been falling at the same time that the typical job has become more sedentary. As it becomes cheaper to eat and fewer calories are burned during the workday, average weight increases.

The next sections explain the data set used in this research and how body mass and net worth are measured. Then, the sample's demographics are explained and the linkage between body mass and net worth is shown. Given that body mass and net worth are related, the direction of causation is explored, followed by regressions, which determine the magnitude of body mass's effect on net worth. Finally, the article concludes with a discussion of why body mass is related to net worth.

Data

To accurately compare body mass and wealth, this research uses the National Longitudinal Survey of Youth (NLSY79), a nationally representative panel survey of young baby boomers started in 1979.[2] The NLSY79 survey from its inception to present has questioned the same group of people 19 times. This repetitive surveying provides an in-depth picture of how baby boomers are aging over time. Although the NLSY79 began in 1979, this research starts its focus in 1985, which was the first survey that included wealth questions, and ends in 2000, the latest publicly available year of wealth data. Additional details about the survey are found in Zagorsky (1997).

The primary goal of the NLSY79 is not to track either health or wealth. Instead, the survey was created to understand how the education and training backgrounds of individuals affected their labor market outcomes. Fortunately, health and wealth questions were added to expand the list of outcomes that researchers could monitor. Beyond the survey's longitudinal aspects, the NLSY79 also oversampled poor individuals, Blacks, and Hispanics to ensure more accurate research results for these groups.[3]

Not all NLSY79 respondents are used in this research. To ensure health and wealth are precisely tracked, a simple sample selection criterion was used. All individuals used in this research needed to participate in more than half (> six) of the NLSY79 surveys since a wealth

module was first fielded in 1985. This criterion ensures a detailed history is available for every respondent and the noise caused by respondents with irregular participation is attenuated.[4] The two key data series used in this research are the respondent's body mass and net worth. Creation of both series is described in the next sections.

Body Mass

How fat or thin is a person? There are a number of methods of measuring body type. For example, in one method, males whose waists are greater than 40 inches and females with waists greater than 35 inches are classified as having excess body fat (National Institute Of Health 1998:61). This research uses a more common measure than waist size, the body mass index (BMI), which calculates a person's weight-to-height ratio.[5] By including both height and weight, tall individuals are not penalized for weighing more than short. Individuals with a BMI of less than 18.5 are classified as underweight, those with a BMI of 18.5 to 24.9 are normal weight, those with a BMI of 25.0 to 29.9 are overweight, and those with a BMI of 30.0 or more are obese.[6]

Young baby boomers in the NLSY79 survey were asked to self-report their weight 13 times from 1981 until 2000. The average response to the weight questions shows young baby boomers steadily gaining weight over time. Weight gain from 1981 to 1985 is expected because in 1981 the youngest respondent was just 16 years old. Beyond 1985, when all respondents were older than 21, weight gain is not biologically expected because almost all respondents had reached their maximum height. Nevertheless, young baby boomers continued to increase their weight, with males climbing 15% from 172 pounds to 197 pounds from 1985 to 2000 and females increasing by 17%, rising from 132 pounds to more than 158.

In 1981, 1982, and 1985, survey respondents were asked to self-report their height. These data and the corresponding weight information were used in the body mass formula to compute a BMI series for each respondent.[7] Using the BMI cutoffs, Figure 1 tracks the percentage of young baby boomers classified as underweight, normal, overweight, and obese over time. Figure 1 reveals that NLSY79 respondents are participating in the same growing obesity trend identified by Mokdad et al. (1999, 2001). The number of young baby boomers with

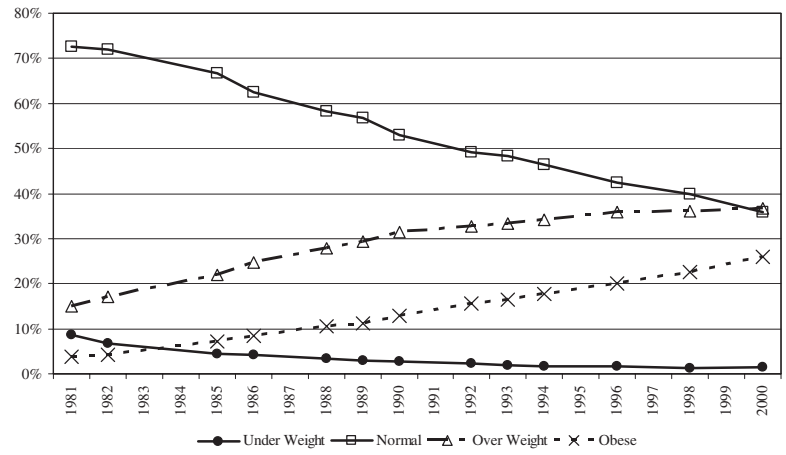

Figure 1: Percentage of Young Baby Boomers Underweight, Normal, Overweight, and Obese

normal weight fell dramatically from almost three quarters in 1981 down to only one third by 2000. Conversely, the number of either overweight or obese individuals grew dramatically from one fifth in 1981 to almost two thirds by 2000.

Demographics

What is the demographic profile of the young baby boomers tracked by this research? Table 1 provides a demographic overview from the year 2000 survey of boomers meeting the sample criteria, both overall and broken down into four weight categories. The top section, labeled "Race," shows that although the majority of the obese are White (70.4%), the obese represent a larger fraction of Black and Hispanic boomers. The second section shows that marriage rates do not differ radically by body mass, but the obese are more likely to be single (20.3%) and less likely to be divorced (11.7%) than the other categories. The gender section shows that females (87.9%) make up the vast proportion of the underweight and males (62.7%) the vast proportion of the overweight, but obesity is gender neutral. The highest-grade completed section shows a slightly inverse relationship between body mass and amount of schooling, corroborating the results of Nayga (2000) and Kaluski et al. (2001).

TABLE 1
Demographics of NLSY79 Young Baby Boomer Sample as of 2000

	Overall	*Underweight*	*Normal*	*Overweight*	*Obese*
Race (%)					
White	78.9	89.7	85.5	78.7	70.4
Black	14.7	7.0	9.9	14.5	21.3
Hispanic	6.4	3.2	4.6	6.9	8.4
Marital status (%)					
Single	16.1	13.2	13.6	15.8	20.3
Married	70.7	65.7	72.8	70.9	68.1
Divorced	13.2	21.0	13.7	13.3	11.7
Gender (%)					
Male	48.6	12.1	36.9	62.7	51.5
Female	51.4	87.9	63.2	37.3	48.6
Highest grade completed (%)					
Less than 12th grade	15.4	19.0	14.0	15.4	17.4
12th Grade	35.0	27.0	30.5	36.7	38.9
More than 12th grade	49.6	54.0	55.5	48.0	43.7
Mean net worth ($)	180,973	159,518	235,299	180,279	118,635
Mean family income ($)	64,332	48,166	72,957	63,994	54,974
Expenditures on food ($)	5,184	5,315	5,358	5,193	4,893
Percentage self-employed	8.3	7.9	8.3	8.9	7.4
Number of children	1.77	1.93	1.74	1.75	1.81
Average age (years)	38.7	38.9	38.6	38.6	38.7
Percentage reporting (%)					
Heavy drug user	6.1	10.1	6.6	6.3	5.1
Heavy alcohol user	7.1	7.2	6.5	8.6	6.4
Heavy smoker	28.1	46.6	29.6	28.0	26.5
Number of respondents	7,699	85	2,439	2,868	2,307

NOTE: Asians, Indians, and other non-Black non-Hispanics are grouped in the White category. NLSY79 = National Longitudinal Survey of Youth, started in 1979.

Examining family net worth, which is described in more detail in the next section, shows that in the 2000 survey, the typical obese respondent has only half the net worth ($118,635) of someone with a normal body mass ($235,000). Although wealth varies dramatically, income differences are less pronounced with the typical normal respondent's family earning almost $73,000, which is a factor of only 1.3 times more than the average obese person's total family income. The line labeled "Expenditures on Food" shows that spending is relatively constant at about $5,200 per year.[8] Those with normal weight spend the most per year on food ($5,358), whereas the obese spend slightly less ($4,893). The final line in this section shows that the overweight had the largest self-employment rate (8.9%) of all the groups.

Because food expenditures are dependent on family size, the next line looks at the number of children and shows that the underweight, with 1.93 children, are the most fertile group, whereas those with normal weight (1.74) are the least. Respondents were about 39 years old in 2000. The three lines examining drug,[9] alcohol,[10] and smoking usage[11] are included to check whether substance abuse varies by weight class. These lines show that the underweight use drugs, alcohol, and cigarettes the most, and the obese use them the least. Finally, the last row shows that the table is based on responses from nearly 7,700 individuals.

Net Worth

How wealthy or poor are young baby boomers? To answer this question, each respondent's net worth was calculated for every survey in which they participated and a wealth module was fielded. Each wealth module follows the same simple pattern. Respondents are first asked whether they or their spouse currently owe a debt or have an asset. If they answer yes, the interviewer asks them to state the current market value as of the interview date. Summing for each respondent all the asset answers in each wealth module and subtracting from that total all debt answers creates total net worth from each survey. Although the complete details of constructing the computed net-worth series are described in Zagorsky (1999), the key equation for computing the total is shown in equation 1. After the sum is computed, all values are adjusted to account for inflation so amounts are in 2000 dollars.[12]

$$\begin{aligned}\text{Net Worth} = {} & \text{Home Value} - \text{Mortgage} - \text{Property Debt} + \text{Cash Saving} \\ & + \text{Stock} + \text{Trusts} + \text{Business/Farm/Re-equity} - \text{Business/Farm/Redebt} \\ & + \text{Car Value} - \text{Car Debt} + \text{Possessions} - \text{Other Debt} + \text{IRA} \\ & + 401\text{K} + \text{CD}\end{aligned} \tag{1}$$

Table 2 shows the median net worth held overall by young baby boomers and then broken down by the four weight classifications.[13] In general, the median boomer has relatively little net worth no matter which year is examined, with the typical boomer holding less than $85,000 in every year and category analyzed. Table 2 is missing data

TABLE 2
Median Net Worth of Young Baby Boomers by Weight Classification: 1985 to 2000 (in dollars)

Year	*Overall*	*Underweight*	*Normal*	*Overweight*	*Obese*
1985	5,055	3,317	5,213	5,687	3,475
1986	6,378	6,067	6,689	7,000	4,413
1988	11,552	12,274	12,707	12,274	8,375
1989	13,776	15,567	15,154	14,465	6,888
1990	16,229	23,297	18,323	15,444	10,274
1992	21,029	21,640	25,675	20,784	9,842
1993	24,678	23,187	29,935	24,257	13,080
1994	30,733	17,396	36,532	32,473	16,237
1996	40,546	38,080	48,217	42,738	25,095
1998	51,833	45,486	65,479	56,594	34,379
2000	65,500	50,050	85,500	69,200	43,400

NOTE: All dollar figures are inflation adjusted to 2000 dollars. The overall number of respondents ranges from 8,965 in 1985 to 7,958 in 2000.

for 1987 and 1991 because the survey did not ask weight questions in 1987 or wealth questions in 1991. There are no data for 1995, 1997, and 1999 because the NLSY79 switched from interviewing respondents every year to every other year in 1994 to lower the survey's cost and reduce respondent burden.

Among the four weight groups, when boomers are young (1985 and 1986), individuals who are overweight have the highest net worth. As boomers age (1988 and beyond), peak net worth shifts toward lighter individuals, and those with a normal body mass have the highest net worth, whereas those who are under- and overweight have similar net worth and rank second. Over the entire life span obese individuals have the lowest net worth, with the median obese individual having roughly half the net worth of those with normal body mass.

One drawback to using these net worth figures is that for married respondents, they are family-level measures, yet the reported body mass figures are only for individuals. Unfortunately, the NLSY79 does not capture height or weight for the vast majority of spouses. If most people marry individuals of similar body mass, this issue is not a problem. Katzmarzyk et al.'s (1999) research indicates this is true by finding "significant spousal resemblance" in Canada's population during 1981. In a follow-up survey among these same couples seven

years later, the correlation between spouses' body mass grew even stronger (Katzmarzyk et al. 2002). The NLSY79 data set contains a small number of body mass observations for both respondents and their spouses (Zagorsky 2003). Although these couples are not a nationally representative sample, their average body mass correlation of 0.392 also indicates that respondents' BMIs are similar to their spouses'.

Body Mass and Net Worth

Is body mass linked to wealth? Table 2, which tracks median net worth broken down by the four weight classifications, provides an initial answer by showing that in 1985 and 1986, the overweight have the highest net worth, and then starting in 1988, individuals with a normal body mass have the highest net worth. This section improves on Table 2 by using regression techniques to more precisely measure the relationship between body mass and net worth. Charting the results from this regression shows that as baby boomers age, those with lower body mass increasingly hold the highest net worth.

Examining the data in Table 2 reveals that median net worth steadily increases for young baby boomers, and the relationship between body type and net worth is not linear but is curved. Based on these observations, weighted ordinary least squares regressions were run with net worth as the dependent variable and three types of independent variables on almost all the NLSY79 observations.[14] First, to track net worth's increases over time, the survey year was included. Second, because body type and net worth are not linearly related, BMI, squared BMI, and BMI raised to higher powers were included. Finally, an interaction term between the survey year and BMI was included to capture any association between the two. The best fitting result was the following spline, with *t*-statistics subscripted in parenthesis.[15] To eliminate the influence of outliers, net worth observations that were higher than the top 1% of each year's values were excluded.[16]

$$\begin{aligned}\text{Net Worth} = &-\$367{,}330_{(5.4)} - \$253_{(13.5)}\,[\text{BMI} \times \text{Year}] + \$14{,}740_{(30.4)}\,\text{Year} \\ &+ \$51{,}134_{(5.4)}\,\text{BMI} - \$2{,}532_{(5.0)}\,\text{BMI}^2 + \$56_{(4.4)}\,\text{BMI}^3 \\ &- \$0.6_{(3.8)}\,\text{BMI}^4 + \$0.002_{(3.3)}\,\text{BMI}^5 \quad (R^2 = 0.08,\ N = 93{,}329)\end{aligned} \tag{2}$$

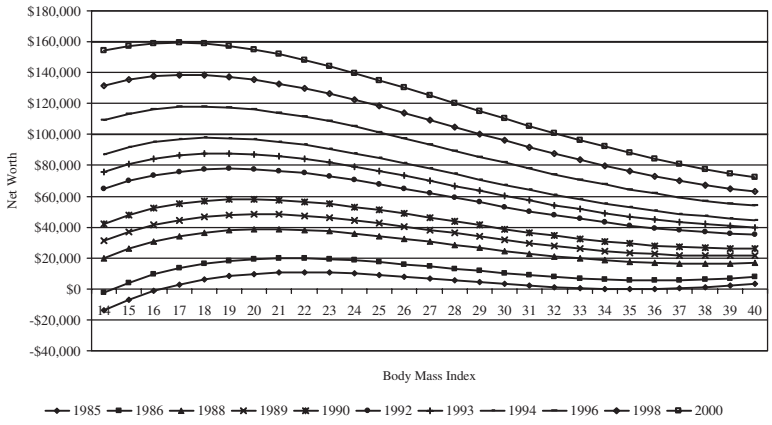

Figure 2: Young Baby Boomers' Net Worth and Body Mass Index

Figure 2, which uses equation 2 to graph net worth against BMI, shows three key ideas. First, peak net worth is slowly shifting toward those with lower body mass over time. In 1985, when most young baby boomers were in their early 20s, individuals with a body mass of 22 held the peak net worth. However, by 2000, those with a body mass of 17 hold the peak net worth. Second, net worth for all young baby boomers, regardless of their body mass, is increasing over time. On average, the regression shows net worth increases by almost $15,000 per year. Third, as body mass moves from overweight to obese, net worth falls. However, this fall is not as steep as the net worth decline that occurs when body mass goes from normal to overweight. This suggests that the penalty for becoming overweight is more severe than the penalty incurred by obese people who continue to gain weight.

Why does peak net worth slowly shift toward those with lower body mass over time? One reason is that heavier individuals are more likely to leave school earlier than lighter individuals.[17] By leaving school early, they begin earning money with which they build wealth. Breaking down school leavers by 1981 body type, the earliest available BMI shows that in 1981, only 47.2% of the underweight had left continuous schooling, compared to 56.4% of the normal weight, 69.4% of the overweight, and 81.1% of the obese. Using 1985 body type data shows the schooling effect diminishing but still significant because almost 97.4% of the obese had left continuous schooling, compared to 93.5% of the overweight and just 90% of normal and

underweight individuals. By 1990, when the youngest boomer was older than 25, the schooling effect disappeared because almost all respondents, no matter what their body type, had left continuous schooling.

Causation

Does body mass affect net worth or does net worth affect body mass? Equation 2 and Figure 2 clearly show a relationship between net worth and body mass, but neither determines the direction of change. Simple stories abound for either direction of causation. For example, rich individuals can afford good food and exercise, which lowers their body mass. Conversely, overweight individuals might face discrimination in the labor market because companies believe they will increase health insurance costs[18] or because companies want to present a pleasing face to the public (Hamermesh and Biddle 1994). If companies discriminate for any reason, then body mass lowers earnings, which indirectly reduces wealth.

One common statistical method of determining causation is to use Granger's (1969) test. Granger hypothesized that if a variable *X* causes changes in *Y*, then regressions with lagged values of *X* on the right-hand side will be statistically significant in explaining *Y*, but lagged values of *Y* will not be statistically significant in explaining *X*.[19] Granger tests were run with both one and two periods' lagged values from 1988[20] to 2000. Although no causality is discernible in many years at the 95% level, the tests show that in both 1994 and 1996, body mass causes changes in net worth in the NLSY79 data.

Although the Granger results are suggestive that causation runs from body mass to wealth, they are clearly not definitive. Another method of testing is to directly investigate the simple causation stories. Given that the NLSY79 tracked food expenditures in four surveys from 1990 to 1994, the story that rich individuals can afford good food, which lowers their body mass, is directly testable. If the story is true, then regressions should show wealthier people spend more on food, and regressions should also show that increased food spending results in decreased body mass.

Because similar results are seen for all survey years, the regressions reported are just for 1994. Regression 3a, with *t*-statistics in paren-

thesis, shows a $10,000 change in net worth caused a $5.50 increase in food spending and a $10,000 change in income caused a $210 increase in spending. Regression 3b, which uses the log transformation to provide results in percentage terms, shows that a 1% change in net worth caused a 0.01% increase in food spending and a 1% change in total family income, resulting in a 0.15% increase in food spending. Given that all variables are statistically significant at the 99% level, the R^2 is relatively high, and increases in wealth or income cause a quantitatively measurable rise in food spending, the regression indicates that the first part of the story, that rich people spend more on food, is true.

$$\$\ \text{Spent on Food}_{1994} = \$3{,}923_{(90)} + \$0.00055_{(5.6)}\ \text{Net Assets}_{1994} + \$0.021_{(30.4)}\ \text{Income}_{1994}\ (R^2 = .13,\ N = 7{,}730) \tag{3a}$$

$$\text{Log}\ (\$\ \text{Spent on Food}_{1994}) = 6.7_{(118)} + 0.012_{(5.6)}\ \text{Log}\ (\text{Net Assets}_{1994}) + 0.15_{(30.4)}\ \text{Log}\ (\text{Income}_{1994})\ (R^2 = .12,\ N = 7{,}730) \tag{3b}$$

Regressions 4a and 4b check whether increased food spending results in decreased body mass, which investigates the second part of the puzzle. Regression 4a shows that a $10,000 increase in food spending drops BMI by 0.07 points. Regression 4b, using the log transformation, shows that in 1994, a 1% increase in food spending caused a 0.09 decrease in the BMI, holding total family income constant. This means that if a person increased his or her food spending by a factor of 11, his or her BMI should drop by 1 point.

$$\text{BMI}_{1994} = 27.1_{(210)} - 0.00001_{(9.4)}\ \text{Income}_{1994} + 0.000007_{(0.3)}\ \$\ \text{Spent on Food}_{1994}\ (R^2 = .004,\ N = 7{,}563) \tag{4a}$$

$$\text{BMI}_{1994} = 29.8_{(35)} - 0.245_{(4.7)}\ \text{Log}\ (\text{Income}_{1994}) - 0.09_{(0.9)}\ \text{Log}\ (\$\ \text{Spent on Food}_{1994})\ (R^2 = .004,\ N = 7{,}563) \tag{4b}$$

These extremely small coefficients, their very low *t*-statistics, and overall R^2 values close to zero in both regressions 4a and 4b combine to suggest that increased food spending does not lead to decreased

body mass. Hence, regressions 4a and 4b suggest that wealth does not cause changes in body mass.

The opposing story is that overweight individuals face discrimination in the labor market, which lowers their earnings and indirectly reduces their wealth. Previous research by Pagan and Davila (1997), Mirta (2001), and Averett and Korenman (1996) backs up this story by showing that some groups of obese people have lower earnings. Again, if the story is true, then the first set of regressions should show that people with increased body mass have lower earnings. Just as importantly, the second set of regressions should also show that people with higher earnings have higher wealth. To conserve space, just two pairs of male and female regressions from the 1994 survey are shown, but the results are similar using data from the other surveys.

Equations 5a and 5b confirm that people with increased body mass have lower earnings. The typical female young baby boomer earns $313.70 less per year for each one-point BMI increase, whereas male young baby boomers lose $161.30 in earnings for each one-point increase.[21]

$$\text{Female Wages}_{1994} = \$30{,}958_{(21.9)} - 313.7_{(5.9)} \quad (5a)$$
$$\text{BMI}_{1994}\ (R^2 = .011,\ N = 3{,}066)$$

$$\text{Male Wages}_{1994} = \$38{,}388_{(14.2)} - 161.3_{(1.6)} \quad (5b)$$
$$\text{BMI}_{1994}\ (R^2 = .001,\ N = 3{,}587)$$

Equations 6a and 6b confirm that people with higher earnings in the 1994 survey have acquired more wealth. Female young baby boomers have $1.49 in net worth for every $1.00 in annual earnings, whereas male young baby boomers have $2.29 in net worth.[22]

$$\text{Net Worth Females}_{1994} = \$28{,}280_{(4.4)} + 1.49_{(7.8)} \quad (6a)$$
$$\text{WAGES}_{1994}\ (R^2 = .021,\ N = 2{,}736)$$

$$\text{Net Worth Males}_{1994} = -\$14{,}485_{(1.8)} + 2.29_{(14.2)} \quad (6b)$$
$$\text{Wages}_{1994}\ (R^2 = .059,\ N = 3{,}208)$$

Overall, the regression results, using a variety of functional forms, suggest that both parts of the story are true. This indicates for this particular story that body mass changes cause wealth changes.

Although the above analysis is clearly not definitive, the Granger tests combined with direct investigations into the simple stories suggest that causation runs from body mass to wealth, not the other way. The next section uses regression analysis to investigate exactly how body mass and other factors affect wealth.

Regression Analysis

Exactly how much does body mass affect wealth? What additional factors are important for understanding these changes? This section uses regression techniques to investigate these questions. Regressions estimate the changes by using equation 7.

$$\text{Net Worth} = f(\text{Body Mass, Income, Race, Age, Gender, Survey Year}) \quad (7)$$

The equation states that net worth is a baseline function (f) of body mass, income, race, age, gender, and the year the survey was fielded. After running the baseline equation, the function is expanded to include other important characteristics such as education, self-employment, and marital and health status. The model is estimated using multiple observations for each respondent, one for each year of wealth data in an ordinary least squares framework following Allison (1995).

The key problem with all wealth regressions is to ensure that the small number of individuals with outlying values does not exert an undue influence on the results. The regressions handle this by dropping the very richest net worth observations, those above the top 1% of net worth in each year, to reduce the impact of these extreme values.

How does wealth vary based on body mass? The baseline regression in Table 3 contains the simple answer where the line labeled "BMI" and column 1 intersect. It shows that an increase in the BMI by one point decreases net worth by almost $1,000 a year. This means that two six-foot-tall males with similar income, age, and racial characteristics but different weights on average have different net worth.

TABLE 3
Regressions Explaining Net Worth of Young Baby Boomers Over Time

	(1)		(2)		(3)		(4)	
	Coefficient	T-*Statistic*	*Coefficient*	T-*Statistic*	*Coefficient*	T-*Statistic*	*Coefficient*	T-*Statistic*
Intercept	–99,097	17.6	–248,492	4.5	–140,968	24.1	–170,968	14.7
BMI	–982	15.3	17,587	2.3	–899	14.1	–1012	11.9
BMI^2			–827	2.0				
BMI^3			16	1.5				
BMI^4			–0.12	1.1				
BMI^5			0.0003	0.7				
Income	0.95	125.8	0.95	125.7	0.83	102.6	0.94	85.4
Black	–30,658	40.8	–30,640	40.7	–24,679	31.9	–30,391	28.7
Hispanic	–20,372	23.7	–20,307	23.6	–15,364	17.7	–19,679	16.2
Age	3,036	21.4	3,032	21.3	2,682	18.7	2,964	11.2
Female	277	0.4	467	0.72	–258	0.4	–540	0.6
Survey year	4,361	59.6	4,372	59.6	4,118	54.0	4,576	45.3
Highest grade					3,777	28.2	3,629	19.9
Self-employed					32,556	23.9	28,322	15.8
Married					15,260	21.4	12,240	12.5
Number of children					–259	0.9	–35	0.1
SF-12 physical score							104	1.9
SF-12 mental score							331	6.3
Ever a heavy drug user							–3,963	2.0
Ever a heavy drinker							–5,671	3.3
Ever a heavy smoker							–8,329	8.0
R^2	.24		.24		.26		.28	
Number of observations	93,329		93,329		93,329		58,865	

NOTE: BMI = body mass index.

For example, if one man weighs 175 pounds (BMI of 23.7) and the other 200 (BMI of 27.1), the lighter male's net worth should be $3,300 higher on average. Given the relatively low net worth of young baby boomers (mean $77,642, median $18,400) over the entire 1985 to 2000 time period, this increase of a few thousand dollars represents a significant change.

The rest of column 1 shows that earning $10,000 more income per year boosts net worth by $950, although Blacks (–$30,658) and Hispanics (–$20,372) have lower net worth than Whites (the omitted group). Within the young baby boomer cohort, individuals who were born earlier have higher net worth. Specifically, each additional year of age increases net worth by $3,036. This coefficient is similar to the $4,361 found on the line labeled "Survey Year," which shows that as the entire cohort ages, the typical respondent's net worth increases by slightly more than $4,000 per year. In the first regression, females have slightly higher net worth than males. Examining all four female regression coefficients shows that two are positive and two are negative. Because none of the female coefficients are statistically distinguishable from zero, these regressions suggest that gender has no effect on young baby boomer's net worth.

Column 2 expands on the baseline regression by adding body mass squared, cubed, and to the fourth and fifth powers. These terms replicate the spline used previously to estimate equation 2. Although these higher power terms were very successful in the earlier regression, the extremely low *t*-statistics show that including all these terms is not as useful as other explanatory variables. Nevertheless, although these coefficients are not precisely measured, they still give a similar drop in net worth for most BMI levels. For example, using all five terms' coefficients shows that a BMI increase from 25 to 26 drops net worth by $1,216, increasing BMI from 30 to 31 drops net worth by $1,380, and increasing BMI from 35 to 36 drops it by $1,030.

Column 3 expands the baseline regression by adding terms that track education, self-employment status, marital status, and the number of children born to the respondent. These additional terms reduce the BMI coefficient slightly to –$899. Beyond BMI, the third regression shows that each additional year of education boosts net worth by $3,777. Bates (1997) showed that entrepreneurs and business owners have much higher wealth holdings than wage and salary workers. Column 3 agrees with Bates by showing that even after holding income

and other factors constant, self-employed boomers have a much higher net worth (+$32,556). Marriage also boosts net worth, with married respondents having a net worth $15,260 more than those not married. Last, each additional child decreases net worth slightly (–$259), but the coefficient is not distinguishable from zero at all conventional statistical levels.

The final column (4) adds five special variables that measure health and drug usage. Columns 1, 2, and 3 are based on variables that are either permanently fixed, like race, or are remeasured in every survey, like income. Because of survey budget and time constraints, the question underlying these special variables were not asked frequently enough and are included as constants for each respondent even though the answers potentially could vary from year to year. Nevertheless, even with these additional variables included, the BMI coefficient (–$1,012) does not change appreciably.

The first two variables are the SF-12 physical score and mental score. The SF-12 (short form–12 question) is a widely used health questionnaire that is given to each NLSY79 respondent once when he or she reaches 40 years of age. Instead of using the 12 questions separately, two summary scores merge all the information in these questions into two simple-to-interpret numbers.[23] A one-point increase in the SF-12 physical scores increases net worth by $104, whereas a one-point increase in the mental score results on average in net worth increasing by $331. Interestingly, those who ever reported being a heavy smoker (–$8,329), drinker (–$5,671), or heavy drug user (–$3,963) have much lower net worth than those reported not engaging in these activities.

Overall, the columns in Table 3 show a consistent finding: The BMI coefficient is approximately –$1,000. This means that two individuals with similar characteristics, except for their weight, have a net worth difference that is on average $1,000 times the difference in their body mass.

Discussion

Although the above research shows that increases in BMI are associated with decreased net worth, the regressions do not explain why this occurs. There are three possibilities based on how wealth is

created. Creating wealth is primarily done by receiving transfers, saving, or having capital assets appreciate. Transfers, which are gifts from outside the household, increase wealth if the transfer is not completely spent. Savings increases wealth when people spend less than their current income because, by definition, the residual not spent increases wealth holdings. Capital appreciation increases net worth because when the value of assets increases, the resulting asset base grows but debts do not. Examining all three areas suggests, surprisingly, that higher inheritances are the reason individuals with higher BMIs have lower net worth.

Differences in capital appreciation are one potential explanation for net worth differences. The largest asset in most young baby boomer's portfolio is their home. To see if body type is linked to capital appreciation, the gain or loss in the respondent's perceived home value was calculated survey by survey.[24] The median yearly gain was 2.86% for underweight individuals, 2.86% for normal-weight individuals, 3.13% for overweight individuals, and 2.78% for the obese. The gain's close similarity, plus the overweight having the highest home appreciation, suggests that at least for this key asset, differing rates of capital appreciation are not why individuals with higher BMI have lower net worth.

Savings, which equals income minus expenditures, is another possible reason. Income differences cannot explain why net worth varies by body mass because income is explicitly held constant in Table 3's regressions. Because income is not the reason, the other explanation is expenditures. The two most obvious expenditures that could be related to weight are food and health care, as it is hard to believe that other expenditure categories such as travel, clothing, recreation, or education vary based on an individual's body type. Previously, in the section on causality, no relationship was found between NLSY79 food expenditures and body mass data. Although the NLSY79 does not track out-of-pocket health care spending, it does track whether the respondent is covered by a health care plan. The health care data show no relationship between body mass and insurance coverage. For example, in 2000, the percentage insured by body type were 84% of the underweight, 86.1% of the normal weight, 86.7% of the overweight, and 86.2% of the obese. These numbers suggest that at least among young baby boomers, insurance coverage does not vary based on body

TABLE 4
Prevalence and Amount of Inheritances Among Young Baby Boomers

	Overall	*Underweight*	*Normal*	*Overweight*	*Obese*
Percentage who got inheritance	45.0	50.6	49.9	43.6	40.6
Mean amount ($)	24,614	55,978	26,718	23,960	22,767
Median amount ($)	5,000	10,000	6,200	5,000	3,500

NOTE: Body type is based on weight reported in the National Longitudinal Survey of Youth (NLSY79) 2000 survey.

type. Given that neither food expenditures nor health insurance is related to body mass, it does not appear that savings is an explanation.

The last potential reason for the difference is gifts and transfers. In every survey since 1987, respondents were asked whether they had received an inheritance since the last interview and if so, what was the inheritance's value. Unfortunately, the source of the inheritance is not known. Table 4 combines all the survey's inheritance answers and shows a clear inverse relationship between body mass and inheriting. Underweight individuals had the highest chance (50.6%) of getting an inheritance and also received the largest amounts (mean $55,978; median $10,000). The obese had the lowest chance (40.6%) and received the lowest amounts (mean $22,767; median $3,500). Because the NLSY79 did not ask how much of these gifts were spent versus invested, it is impossible to declare that inheritance differences are the reason for the inverse relationship between body mass and net worth. However, the numbers indicate that it might be the primary reason.

One drawback to this research is that the NLSY79 survey does not capture the height or weight of spouses. This is a problem because although body mass is an individual measurement, net worth is a family-level measure. This issue is partially attenuated because during the research time period, many young baby boomers were either single or divorced.[25] Second, because many people marry individuals of similar body mass, the respondent's BMI is a good proxy for their spouses. Nevertheless, not having this information is a drawback to precisely measuring the effects of body mass on wealth.

Obesity is a rapidly growing public health issue, with a rising number of adults classified as obese. Medical research clearly shows that being overweight is dangerous to one's health. This research finds that being overweight is also dangerous to an individual's wealth. For

every one-point increase in a person's BMI, their net worth on average falls $1,000, holding factors such as income and education constant. Part of the explanation for why net worth falls when body mass rises is because lighter people receive more inheritances than do heavier. Young baby boomers appear to be not only receiving their parent's genes but also their wealth.

NOTES

1. For example, the Department of Housing and Urban Development's American Dream Down Payment Fund is providing $1 billion over five years in matching funds to poor individuals who need additional cash to make a home down payment (Housing and Urban Development 2001).

2. Young baby boomers are individuals who were between the ages of 14 and 22 in 1979.

3. Given this oversampling, all results are reported after being adjusted by the survey weights, which removes the oversampling effects and allows the answers to be considered national totals. The 1979 survey weights found on the data CD-ROM as variable R02161.00 adjust all data.

4. Individuals with higher average body mass are more likely to continue participating in the National Longitudinal Survey of Youth (NLSY79). Among those completing more than six surveys since 1985, 84% of the underweight completed either every survey or missed just once. The percentage rises to 84.6% for those with normal body mass, 86.6% for the overweight, and 90.1% for the obese. The same participation pattern is seen in the whole NLSY79 when the sample selection criterion is dropped.

5. The body mass index (BMI) formula is equal to Weight in Pounds ÷ (Height in Inches × Height in Inches) × 703. The 703 scale factor converts pounds and inches into metric measurements. The Center for Disease Control provides an online BMI calculator at http://www.cdc.gov/nccdphp/dnpa/bmi/calc-bmi.htm.

6. Extreme obesity is a BMI of 40 or higher.

7. For years beyond 1985, the respondent's terminal height was used in the BMI formula. For the small number of cases in which the person reported shrinking over time, the middle height was used.

8. From 1990 to 1994, the NLSY79 survey asked respondents how much money they spent on food purchased at home using money other than food stamps, food delivered to the home, food purchased eating outside the home, and the value of all food stamps they were given. Total food spending per year is the summation of these four categories from each survey.

9. Drug abusers are determined from NLSY79 supplements fielded in 1984, 1988, 1992, and 1994, which ask about the quantity and frequency of drugs used. Because the supplements focus primarily on marijuana, cocaine, and crack, abusers of other drugs like heroin are not counted as drug users. In addition, because only the 1984 survey included questions on how drugs affected respondents' lives, abusers are primarily determined by frequency of use. In this research, drug abusers are individuals using crack, cocaine, or marijuana more than three times per week over the past 30 days in the 1994, 1990, and 1988 surveys. Respondents who used drugs at work in 1984 were also classified as abusers. To avoid including reformed drug abusers, the most recent data (1994 if possible) determined drug status.

10. Heavy drinkers are defined in a two-step process. First, all people who told the interviewer that they had six or more drinks on at least two occasions in the last month were identified. Then such individuals were questioned to see whether drinking caused serious problems. If these drinkers had at least 12 times in the past year faced a serious drink-induced problem such as arrest, staying away from work, hurting their chances for a raise, or losing ties with family, they were considered heavy drinkers. To avoid penalizing reformed drinkers, the most recent data (1994) were used unless they were missing.

11. Heavy smokers are defined as people who, in any one of the 1998, 1994, 1992, or 1984 cigarette supplements, ever stated that they smoked more than a pack a day.

12. All missing wealth values were imputed. Although many imputation algorithms are available, the longitudinal aspect of the NLSY79 data provides a simple but effective solution. Data were linearly interpolated if bracketing values were available. This algorithm is a slight refinement to the procedure used in the Netherlands Socio-Economic Panel (Camphuis 1993) and is based on the assumption that wealth changes are primarily low-frequency trend movements. This imputation choice causes some data smoothing because of the interpolation. However, no matter what algorithm is chosen, the high response rates of the survey mean that little imputation was needed.

13. The median is primarily used in this research instead of the mean to avoid the dramatic fluctuations caused by the presence or absence of very rich individuals.

14. Because racial dummies were not included to adjust for the NLSY79's oversampling, all regressions were weighted by the 1979 sample weights, which is variable R02161.00.

15. The best fit was determined by adding higher order terms to the regression until the R^2 stopped increasing and all coefficients were no longer statistically significant at the 95% level.

16. This filter eliminated 617 observations.

17. School attendance is based on a question in each survey that asks whether the respondent currently attends or is enrolled in a regular school program. The first year a respondent reports that they are no longer attending or enrolled is marked as the school leaving year, even if they resume full-time schooling later.

18. Burton et al. (1998) studied the personnel records of a large financial services company and found that when employees' BMI exceeds 27, health care costs start rising rapidly.

19. Specifically, the Granger test involves running four regressions, two of which use just lagged values of the dependent variable as explanatory factors and two of which use lagged values of the dependent variable plus lagged values of the opposite or potential causation variable. Comparing the sum of the squared residuals via F tests shows whether there is a statistical causation.

20. Granger tests are impossible to run for 1985 and 1986 because there are no data to lag for these variables.

21. Like the findings of previous research, regressions for females show a consistent negative relationship between BMI and total money from wages and salaries. Although previous research did not find a penalty for males, this research finds a positive effect between BMI and wages during the 1980s when using actual wages but a negative effect in the 1990s. During the 1990s, the male penalty is from one half to two thirds the size of the female penalty. Regressions using log (wages) show a positive male effect until the mid-1990s but a negative effect starting in the 1998 survey.

22. For all years from 1985 to 2000 and for both sexes, regressions in both dollar and log form show that increases in wages increase net worth. Regression coefficients are both statistically and quantitatively significant.

23. The SF-12 scores are designed so that in the entire U.S. population, the physical and mental scores have a mean of 50 and a standard deviation of 10. NLSY79 respondents with a score higher than 50 have better health, and respondents with scores below 50 have worse health than

the typical U.S. person. Each one-point difference higher or lower than 50 corresponds to one tenth of a standard deviation.

24. There were 29,566 observations in which an individual owned a home and provided its value in two consecutive surveys. The calculations have an unknown bias because the NLSY79 public data set does not record whether the consecutive surveys are referring to the same home.

25. Respondents were not married in half of the 93,665 regression observations.

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Jay L. Zagorsky is a research scientist at Ohio State University. He received his Ph.D. in economics from Boston University in 1992. His primary research focuses on personal finance issues. In addition to his research work, he also teaches in the MBA program at Boston University's School of Management.