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Abstract

Between the early 1980s and 2002, both the prevalence of obesity and the number of beneficiaries of the Social Security Disability Insurance program doubled. We test whether these trends are related; specifically, we test whether obesity *causes* disability and movement onto the disability rolls. We estimate several models, including fixed effects and instrumental variables models, using two nationally representative data sets: the Panel Survey of Income Dynamics and the National Longitudinal Survey of Youth, 1979 Cohort. We find considerable evidence that weight increases the probability of health-related work limitations and the probability of receiving disability-related income.

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Introduction

This paper is motivated by two recent trends in the U.S.: a rise in obesity and a rise in disability. The age-adjusted prevalence of obesity -- which is defined as a body mass index (BMI) greater than or equal to thirty – more than doubled from 15 percent during 1976-1980 to 30.4 percent during 1999-2002 (Hedley et al., 2004; Flegal et al., 2002). Over roughly the same period, the number of beneficiaries receiving income from the Social Security Disability Insurance program (DI) doubled from 3.8 million in 1983 to 7.6 million in 2002 (Social Security Administration, 2004). This paper tests whether these trends are related; specifically, we test whether obesity raises the probabilities of employment disability and of movement onto the rolls of DI.

There exists suggestive, but not definitive, evidence on the relationship between obesity and disability. For example, Lakdawalla, Bhattacharya, and Goldman (2004) document that, in the National Health Interview Surveys from 1984 to 1996, rates of disability rose faster among the obese than among the non-obese. Ferraro et al. (2002) found that obesity or becoming obese was subsequently associated with higher levels of upper-body and lower-body disability in the National Health and Nutrition Examination Survey I and its follow-ups.

There are three possible explanations for the correlation between obesity and disability. First, obesity may in fact cause disability. This is plausible given the evidence that obesity is a risk factor for many chronic diseases (Pi-Sunyer, 2002). Second, the reverse may be true -- disability may cause obesity. Disability is likely to result in a decline in physical activity, which, if not matched with a decline in calorie intake, will result in weight gain. Third, unobserved factors may cause both obesity and disability.

One possible such unobserved factor is rate of time discount. People who do not value future outcomes are likely invest less in their health, which may lead to both obesity and employment disability.

Cawley (2000) tested the first hypothesis, that obesity causes employment disability. Using the method of instrumental variables to exploit the genetic (i.e. exogenous) variation in weight between mothers and children, it found little evidence that obesity causes employment disability in young women (aged 16-41). This paper builds on the previous analysis by expanding the scope of inquiry beyond young mothers to working-age adults of both genders. This paper studies men and women aged 25-61 in the Panel Survey of Income Dynamics, and men and women aged 25-43 in the National Longitudinal Survey of Youth, 1979 Cohort.

Methods

We estimate three models, with the goal of generating a causal estimate of the effect of weight on disability. First, we estimate logit models of disability as a function of current obesity status. However, people who are obese may have always been different in important ways than those of healthy weight. To address this possibility, we estimate our second model, in which we estimate a logit model controlling for individual fixed effects. This model essentially tests whether gain in weight is associated with a higher probability of becoming disabled.

The fixed effects model eliminates time-invariant heterogeneity, but time-varying heterogeneity may still a problem. To eliminate the influence of time-varying heterogeneity, we estimate our third model: instrumental variables (IV). For the sake of convenience, our IV model has a linear probability, rather than a logit, second stage regression.

Our instrument for the weight of adult workers is the weight of a relative (in the PSID, a child or parent; in the NLSY, a sibling). Our identifying assumption has two parts. First, the weights of children and parents, and siblings, are highly correlated. This is confirmed by the behavioral genetics literature (e.g. Maes et al., 1997), which is predictable since a child and a parent, and siblings, share on average half of their genes. Results from the first-stage regression confirm that sibling weight is a powerful instrument for respondent weight. The F statistic associated with the hypothesis that the first-stage coefficients on the instruments are jointly equal to zero is, in each case, far above the minimum F statistic of 10 suggested by Staiger and Stock (1997).

The second part of the identifying assumption is that the only way that the weight of a child or sibling is correlated with the respondent's disability status is through its correlation with the respondent's weight. In other words, the weight of a relative is uncorrelated with the residual in the disability equation. One might be concerned that the non-genetic variation in a relative's weight is correlated with the respondent's disability status because of habits learned in the household. However, to date studies have failed to detect any effect of common household environment on body weight (Grilo and Pogue-Geile, 1991).

Data

We use data from two longitudinal, nationally representative datasets: The Panel Survey of Income Dynamics (PSID) and the National Longitudinal Survey of Youth, 1979 Cohort (NLSY). In each sample we study respondents of prime working age; we drop those under age 25 because many are enrolled in school and drop those over age 61 because that is when a large fraction of workers retire. In this section, we describe the relevant features of, and variables in, each dataset.

1. Panel Study of Income Dynamics (PSID)

The Panel Study of Income Dynamics (PSID) is a nationally representative, longitudinal survey of individuals and the families in which they reside. The sample size has grown from 4,800 families in the 1968, the first year of the study, to more than 7,000 families in 2001.

The PSID has collected information on respondents' height and weight in 1986, 1999, and 2001. Data from these three years were pooled to create the sample for this paper.

For our instrumental variables analysis, we will use as an instrument the weight of the PSID respondent's first child, which was collected in 1997 as part of the Child Development Supplement, controlling for the child's age and gender. If parents' weight is available, we also control for mother's weight and age, and father's weight and age. Parental weight was not collected as part of any special supplement; it is sometimes available as a natural byproduct of the PSID design, which follows households that spin off from the original 1968 households.

2. National Longitudinal Survey of Youth, 1979 Cohort

The National Longitudinal Survey of Youth (NLSY), designed to represent the entire population of American youth, consists of a randomly chosen sample of 6,111 U.S. civilian youths, a supplemental sample of 5,295 randomly chosen minority and economically disadvantaged civilian youths, and a sample of 1,280 youths on active duty in the military. All sample members were between fourteen and twenty-two years of age when the first annual interview was conducted in 1979. Since 1994, interviews have been conducted every two years.

The NLSY recorded the self-reported weight of respondents in 1981, 1982, 1985, 1986, 1988, 1989, 1990, 1992, 1993, 1994, 1996, 1998, and 2000. Data from these thirteen years were pooled to create the sample used in this paper. Reported height was recorded in 1981, 1982, and 1985; given that respondents were between the ages of 20 and 27 in 1985, height in 1985 was assumed to be the respondents' adult height. Weight may be affected by pregnancy, so all females who are pregnant at the time that they report their body weight are dropped from the sample.

For our instrumental variables analysis, we will use as an instrument the weight of the NLSY respondent's sibling, if available, controlling for the sibling's age and gender. Sibling weight was not collected as part of any special supplement; instead, the NLSY survey design involved interviewing every age-eligible child in each randomly selected household. 2,862 households included more than one NLSY respondent, and 5,914 NLSY respondents have at least one sibling in the sample (Bureau of Labor Statistics, 2003). A different observation of BMI from the same sibling is used as an instrument for each observation of respondent weight.

Cawley (2000) used as an instrument the weight of a child. We prefer to use sibling weight rather than child weight as an instrument for two reasons. First, child weight was recorded only for female respondents whereas sibling data is available for both genders. Second, the NLSY did not begin to record child weight until 1986, while sibling data is available for the entire survey history.

Measures of Weight

Weight is self-reported in both the PSID and the NLSY. There are well-documented biases in how individuals report their weight (e.g. Rowland, 1989). In order to correct for this reporting error, which has the potential to bias regression coefficients, we use the method of Lee and Sepanski (1995) and Bound et al. (2002); specifically, we use the NHANES III data as validation data. NHANES III is ideal for this purpose because it contains both self-reports and measures of actual height and weight. By regressing reported on actual weight in NHANES III, "transporting" the coefficients to the PSID and NLSY, and multiplying them by the self-reported values, we generate measures of weight corrected for reporting error. We will use two measures of weight in this paper: BMI and weight in pounds (controlling for height in inches). Both are corrected for reporting error.

Measures of Disability

Disability is an elusive concept to measure since it reflects both health-based impairments and the social environment. We utilize two measures of disability. First, we follow the strategy suggested by Burkhauser, Houtenville and Wittenberg (2003) and use a self-reported work limitation measure of disability. Specifically, respondents in both the PSID and the NLSY are asked whether their health limits the type/kind or amount of work that they can do for pay. Respondents who answer yes to either are coded as disabled under this first measure. Second, we measure disability by receipt of income from either the Veterans Administration, Workers Compensation, or Social Security

Disability Insurance; all three sources reflect work limitations in working-age samples. An important difference between the PSID and the NLSY is that PSID respondents are asked if they received income from such sources, while NLSY respondents are asked if they *or their spouse* received such income. This increases the likelihood of false positives when assigning disability status to NLSY respondents; for example: an NLSY respondent who has no work limitations but whose spouse is disabled and receives DI will be coded by us as disabled.

Other Regressors

Disability will be modeled as a function of body weight, controlling for the following variables: highest grade completed, age, number of children in household, and indicator variables for marital status, region of residence, black and Hispanic.

Empirical Results

Results relating to work limitations are presented in Table 1 for the PSID and Table 2 for the NLSY. Results relating to receipt of disability income are presented in Table 3 for the PSID and Table 4 for the NLSY. Results are presented separately for men and women in parts A and B of each table. In each table, results from eight regressions are presented. From left to right, in separate columns, are presented results from logit, logit fixed effects, linear probability, and IV. IV uses a linear probability second stage, so for the sake of comparison linear probability is listed in the third column to permit comparisons of how IV changes coefficients. In the top panel of each table are listed the coefficients on weight in pounds and height in inches. In the lower panel of each table appear the coefficients on BMI.

Work Limitations

Setting aside for the moment the issue of causality, it is clear from Tables 1A, 1B, 2A, and 2B that obesity is positively correlated with health limiting the type or amount of work that one can do for pay. For both men and women in the PSID, and for women in the NLSY, the logit coefficients on weight in pounds and body mass index are positive and statistically significant. Controlling for individual fixed effects has a strong effect for both men and women in the PSID; logit coefficients on both pounds and BMI are no longer statistically significant, and switch sign. However, for NLSY women, the point estimates of the logit coefficients rise and remain statistically significant after controlling for fixed effects.

Overall, the IV results suggest that weight has a causal effect on work limitations. For males and females in the PSID, instrumented weight in pounds is statistically significant and positive; for each, a 10-pound increase in weight is associated with a roughly 2 percent increase in the probability of work limitations. For PSID males, but not PSID females, the IV coefficient on BMI is also statistically significant and positive .

The IV coefficients on the weight variables are statistically significant for NLSY males but not NLSY females, which is interesting given that in the logit and logit fixed effects regressions the weight variables were statistically significant for NLSY females but not NLSY males.[1] Among NLSY males, a 10-pound increase in weight is associated with a 0.7 percent increase in the probability of work limitations.

Disability Income Receipt

[1] The finding that work limitations among NLSY females are not caused by obesity is consistent with Cawley (2001), which used the weight of a child (rather than a sibling) as an instrument.

Setting aside for the moment the issue of causality, it is clear from Tables 3A, 3B, 4A, and 4B that obesity is positively correlated with the probability that one's household received disability income in the current year. For both men and women in the PSID, and for both men and women in the NLSY, the logit coefficients on weight in pounds and body mass index are positive and statistically significant. Controlling for individual fixed effects has a strong impact; in both the PSID and the NLSY the logit coefficients on weight are no longer statistically significant.

Overall, the IV results provide mixed support for the hypothesis that weight has a causal effect on receipt of disability income. In Tables 3A and 3B, the IV coefficients on pounds and BMI are not statistically significant for either men or women in the PSID. In contrast, in Tables 4A and 4B, both measures of weight are statistically significant for both men and women. A ten-pound increase in weight is associated with an increase in the probability of receiving disability income of 0.7 percent for men and 0.5 percent for women.

Summary

This paper uses the method of instrumental variables to test the hypothesis that weight causes employment disability. While there is some variation in the results, overall we find considerable evidence that weight increases the probability of health-related work limitations and the probability of receiving disability-related income.

This analysis also underscores the importance of conducting parallel analyses in complementary data sets. Even though our two datasets are both nationally representative and were both collected during the 1980s and 1990s, even though we estimated models with identical sets of regressors, we occasionally find different results for the two samples. Some of this variation may be attributable to the following differences between the data sets: 1) The PSID sample is older, up to 61 years old, whereas the oldest NSLY respondents are 43 years old. 2) In the NLSY we use the weight of a sibling as an instrument whereas in the PSID we use the weight of a child and/or parent as an instrument. The fact that even nationally representative datasets collected over similar time periods can generate results that differ in important ways underscores the need for studies to test their hypotheses using multiple datasets in order to determine which results are truly robust.

A better understanding of the effect of obesity on work limitations may be useful for determining whether obesity should be grounds for DI eligibility. In several instances recently, the Social Security Administration has revised its medical listing of obesity. In 1999, obesity was deleted from the medical listings. In 2000, a Social Security Ruling ensured that obesity would once again be included in the medical listings. In 2002, SSA policy was revised yet again with obesity considered a severe impairment that merits its own medical listing (*Federal Register*, 2002).

The finding that obesity may cause disability may also permit more accurate projections of future DI applications and caseloads. The prevalence of obesity is expected to continue to rise (Flegal et al., 1998), suggesting that, all else equal, DI applications and caseloads may continue to rise.

Table 1A:
Work Limitations, Males in the PSID

	Logit	Logit FE	LS	IV
Wt (lbs)	0.0087**	-0.0054	0.0004#	0.0020#
	(0.00288)	(0.00609)	(0.00019)	(0.00108)
Ht (inches)	-0.0385	-0.2022#	-0.0003	-0.0101
	(0.04321)	(0.11895)	(0.0026)	(0.00686)
Change in adjusted R2 of instruments				*0.0272*
F-statistic of instruments				*51.80*
BMI	0.0598**	-0.0069	0.0024#	0.0145#
	(0.02017)	(0.04068)	(0.00133)	(0.00767)
Change in adjusted R2 of instruments				*0.0346*
F-statistic of instruments				*51.11*

Table 1B:
Work Limitations, Females in the PSID

	Logit	Logit FE	LS	IV
Wt (lbs)	0.0091**	-0.0011	0.0007**	0.0018#
	(0.002)	(0.00359)	(0.00016)	(0.00107)
Ht (inches)	-0.0242	0.033	0.0013	-0.0027
	(0.03292)	(0.08878)	(0.00252)	(0.00486)
Change in adjusted R2 of instruments				*0.0253*
F-statistic of instruments				*48.61*
BMI	0.0501**	-0.0095	0.0039**	0.0099
	(0.01168)	(0.02089)	(0.00093)	(0.00618)
Change in adjusted R2 of instruments				*0.0270*
F-statistic of instruments				*50.42*

Note: Numbers are rounded. # stands for significance at 10% level, * stands for significance at 5% level, ** stands for significance at 1% level. Numbers in parentheses are standard errors. Other variables that are included in the regressions are: Black dummy, Hispanic dummy, schooling, age, number of children, marriage dummies, and region dummies. Dependent variable is a dummy that equals 1 if the person has physical conditions that limit type or amount of work, equals 0 otherwise. In the IV estimation, instruments used are: first child's age, sex and BMI, whether first child's information is missing, father's age and BMI, whether father's information is missing, mother's age and BMI, whether mother's information is missing. For males, the number of observations used in Logit and Logit FE are 4330, in LS and IV are 2550. For females, the number of observations used in Logit and Logit FE are 4918, in LS and IV are 2833.

Table 2A:
Work Limitations, Males in the NLSY

	Logit	Logit FE	LS	IV
Wt (lbs)	0.0017	0.0020	0.0001	0.0007*
	(0.00173)	(0.00313)	(0.00007)	(0.0003)
Ht (inches)	-0.0281	-1.0459	-0.0015	-0.0051*
	(0.034)	(1.57359)	(0.00131)	(0.00208)
Change in adjusted R2 of instruments				*0.0448*
F-statistic of instruments				*232.43*
BMI	0.0099	0.0104	0.0003	0.0045*
	(0.01229)	(0.02169)	(0.0005)	(0.00203)
Change in adjusted R2 of instruments				*0.0610*
F-statistic of instruments				*236.82*

Table 2B:
Work Limitations, Females in the NLSY

	Logit	Logit FE	LS	IV
Wt (lbs)	0.0097**	0.0115**	0.0004**	0.0003
	(0.00169)	(0.00301)	(0.00007)	(0.00031)
Ht (inches)	-0.0601	-35.984	-0.0023	-0.0019
	(0.04494)	(3227832)	(0.00149)	(0.00196)
Change in adjusted R2 of instruments				*0.0466*
F-statistic of instruments				*295.04*
BMI	0.0563**	0.0682**	0.0025**	0.0020
	(0.00984)	(0.01777)	(0.00043)	(0.00183)
Change in adjusted R2 of instruments				*0.0512*
F-statistic of instruments				*297.86*

Note: Numbers are rounded. # stands for significance at 10% level, * stands for significance at 5% level, ** stands for significance at 1% level. Numbers in parentheses are standard errors. Other variables that are included in the regressions are: Black dummy, Hispanic dummy, schooling, age, number of children, marriage dummies, region dummies. Dependent variable is a dummy that equals 1 if the person has physical conditions that limit type or amount of work, equals 0 otherwise. In the IV estimation, instruments used are: sibling's BMI, age, and sex. For males, the number of observations used in Logit and Logit FE are 22304, in LS and IV are 19037. For females, the number of observations used in Logit and Logit FE are 19289, in LS and IV are 16440.

Table 3A:
Disability Income Receipt, Males in the PSID

	Logit	Logit FE	LS	IV
Wt (lbs)	0.0074*	0.0106	0.0002	0.0008
	(0.00332)	(0.00927)	(0.00012)	(0.00062)
Ht (inches)	0.0364	-0.0056	0.0015	-0.0023
	(0.04538)	(0.16914)	(0.00163)	(0.004)
Change in adjusted R2 of instruments				*0.0272*
F-statistic of instruments				*51.80*
BMI	0.0506*	0.0604	0.0013	0.0060
	(0.0232)	(0.05801)	(0.00083)	(0.0044)
Change in adjusted R2 of instruments				*0.0346*
F-statistic of instruments				*51.11*

Table 3B:
Disability Income Receipt, Females in the PSID

	Logit	Logit FE	LS	IV
Wt (lbs)	0.0109**	0.0084	0.0002**	0.0003
	(0.00228)	(0.0074)	(0.00007)	(0.00044)
Ht (inches)	-0.0310	0.152	-0.0004	-0.0008
	(0.04282)	(0.31769)	(0.00111)	(0.002)
Change in adjusted R2 of instruments				*0.0253*
F-statistic of instruments				*48.61*
BMI	0.0617**	0.0442	0.0011**	0.0017
	(0.01333)	(0.04352)	(0.00041)	(0.00253)
Change in adjusted R2 of instruments				*0.0270*
F-statistic of instruments				*50.42*

Note: Numbers are rounded. # stands for significance at 10% level, * stands for significance at 5% level, ** stands for significance at 1% level. Numbers in parentheses are standard errors. Other variables that are included in the regressions are: Black dummy, Hispanic dummy, schooling, age, number of children, marriage dummies, region dummies. Dependent variable is a dummy that equals 1 if the person received disability income, veteran's benefits, or workers' compensation, equals 0 otherwise. In the IV estimation, instruments used are: first child's age, sex and BMI, whether first child's information is missing, father's age and BMI, whether father's information is missing, mother's age and BMI, whether mother's information is missing. For males, the number of observations used in Logit and Logit FE are 4330, in LS and IV are 2550. For females, the number of observations used in Logit and Logit FE are 4919, in LS and IV are 2883.