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The incidence of the healthcare costs of obesity

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ABSTRACT

Who pays the healthcare costs associated with obesity? Among workers, this is largely a question of the incidence of the costs of employer-sponsored coverage. Using data from the National Longitudinal Survey of Youth and the Medical Expenditure Panel Survey, we find that the incremental healthcare costs associated with obesity are passed on to obese workers with employer-sponsored health insurance in the form of lower cash wages. Obese workers without employer-sponsored insurance do not have a wage offset relative to their non-obese counterparts. A substantial part of the lower wages among obese women attributed to labor market discrimination can be explained by their higher health insurance premiums.

1. Introduction

Average annual medical expenditures are $732 higher for obese than normal weight individuals (Finkelstein et al., 2003).[1] But who bears the costs of medical care associated with obesity? In competitive health insurance markets, equilibrium prices never ignore relevant and easily observable data about the insured (Arrow, 1963). Because obesity is easily observable by insurers,[2] obese individuals who obtain health insurance in private markets are likely to pay for their higher utilization of medical care in the form of higher health insurance premiums. While the vast majority of the under 65 population in the U.S. obtains health insurance from private insurers, most coverage is employment-based. As a result, the incidence of the health care costs of obesity for the under 65 population is largely a question of the incidence of the costs of employer-sponsored coverage.

Premiums for employer-sponsored coverage could potentially reflect differences across individuals in observable risk factors through two mechanisms. First, workers often make an out-of-pocket contribution to the premium for coverage from an employer. Although these employee premium contributions could, in theory, vary by employee characteristics, they are rarely risk adjusted for obesity or any other observable risk factor (Keenan et al., 2001).[3] Alternatively, variation in individual expected expenditures could be passed on to individual workers in the form of differential wage offsets for employer-sponsored coverage. In the absence of risk-adjusted premium payments by workers, if wages did not adjust, firms in a competitive industry could make positive profits by hiring only thin workers. Equilibrium wage offsets based on weight eliminate such arbitrage opportunities. The existing literature, however, does not provide evidence on whether the incidence of the costs of employer-sponsored coverage varies by individual risk factors.

The absence of risk rating for observable risk factors like obesity potentially creates two sources of inefficiency. First, it may lead

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[1] Differences in payments by insurers for obese and non-obese individuals are limited to some extent by coverage exclusions; for example, many insurers do not cover bariatric surgery or drugs to aid dieting.

[2] Even if weight and height are not currently reported in claims records, it would be a small change to require medical providers to report such information. Most providers already collect weight information during routine office visits, so the costs to providers would be low. Adult height does not change, so collecting such information would impose a one-time cost.

[3] In practice, the Health Insurance Portability and Accountability Act of 1996 prohibits employers from varying employee contributions on the based of health related factors (GAO, 2003).

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to inefficient quantities of insurance coverage. In a population of heterogeneous risks, a movement of premiums away from the actuarially fair rate toward the average of the group distorts the quantity of health insurance purchased by consumers, potentially leading to adverse selection (Pauly, 1970; Rothschild and Stiglitz, 1976). In the context of employer-sponsored health insurance, the inability of employers to make wage offsets that reflect individual variation in the cost of providing coverage could create incentives for them to hire relatively low cost workers, creating inefficiencies in labor markets (Summers, 1989). Second, a lack of risk rating of premiums may even lead to higher rates of obesity by creating moral hazard in risky behaviors that affect health expenditures (Ehrlich and Becker, 1972). In other words, the failure of the obese to pay for their higher medical care expenditures through higher health insurance premiums may reduce incentives for individuals to maintain a normal weight (Bhattacharya and Sood, 2006).

In this paper, we examine whether obese individuals receiving employer-provided health insurance pay for their higher medical costs through reduced wages. Our empirical work is based upon a simple idea: all else equal, obese individuals with health insurance from an employer should receive lower wages relative to their similarly insured non-obese colleagues, while there should be no difference between the wages of obese and non-obese individuals in jobs without health insurance. We find that, while obese workers who receive health insurance through their employer earn lower wages than their non-obese colleagues, obese workers who are uninsured earn about the same as their thinner colleagues. Furthermore, we show that a substantial part of these wage penalties at firms offering insurance can be explained by the difference between obese and non-obese individuals in expected medical care costs. Finally, we show that obese individuals pay no wage costs for other employer-provided fringe benefits, where obesity is not a relevant risk factor in price setting.

By providing evidence consistent with the risk rating of premiums for obesity through differential wage offsets, our findings reduce concerns over the possibility that inefficiencies in insurance markets are (in part) responsible for rising rates of obesity. Our results suggest that the obese, at least those with employer-sponsored coverage, bear the full cost of the incremental medical care associated with obesity.

Our results also provide evidence on the validity of two controversial and important findings in economics, each of which has generated a large literature. The first is that even if employers nominally pay for health insurance premiums, it is really employees who bear the cost of employer-sponsored insurance. While there is only limited empirical evidence demonstrating the existence of *any* wage offset for health insurance, even less evidence is available on whether the wage offset varies across workers. Many studies, in fact, have produced estimates of either no relationship or a positive relationship between wages and the provision of health insurance (Gruber, 2000). The few studies that produce evidence consistent with the theory of compensating differentials leave open the question of whether incidence is at level of the individual or the group (Gruber, 1994; Pauly and Herring, 1999; Sheiner, 1999). Our results indicate that, in the case of obesity, these wage offsets not only exist, but also vary by individual characteristics.

The second finding is that the wages of obese workers are lower than those of their normal weight peers, and in the case of white women, the relationship appears to be causal (Cawley, 2004). While obesity could cause lower wages through either invidious workplace discrimination or a negative effect of obesity on worker productivity, the absence of an effect of obesity on wages for either men or black women casts doubt on lower productivity as the explanation. In other words, the literature leaves open the possibility that white women experience significant labor market discrimination in the form of lower wages due to obesity. Our results suggest a reinterpretation of this literature. That obese white women earn lower wages appears to be due, at least in part, to the higher cost of insuring these workers.

2. Empirical framework

Standard economic theory predicts that jobs that provide fringe benefits provide correspondingly lower cash wages, reflecting the costs to employers and the value to workers of the fringe benefit (Rosen, 1986). Although theory predicts that workers, not employers or firms, bear the incidence of the costs of fringe benefits, less is known about how these costs are allocated across workers when the cost of providing the fringe benefit varies across individuals. Individual-specific incidence requires that the wage differential for health insurance equal the cost of providing health insurance to a particular worker. In this case, the premium for an individual worker would effectively be risk-rated and the components of the compensation package adjusted correspondingly. In practice, it is difficult to see how firms could appropriately set worker specific compensating differentials (Gruber, 2000). Yet, the alternative – that employers pass on the average cost of providing health insurance to workers within a firm – is also problematic. Under this assumption, a worker's total compensation, the total cash wages and the value of the fringe benefits, would be dependent upon the health status of coworkers. In competitive labor markets, such differences across firms would not be sustainable.

In a job with no fringe benefits, in a competitive spot labor market the wages of worker i, w_i, will equal marginal revenue product, MRP_i.[4] In firms that provide health insurance to their employees, this equality between wages and marginal product will be modified by the fact that health insurance provision is costly. Suppose that health insurance premiums are actuarially fair and that workers within a firm vary in their expected health expenditures.[5] The premium charged to the firm for the coverage of worker i, say p_i, will exactly equal the expected medical costs of coverage, Em_i.[6] If incidence is specific to the individual worker, the equilibrium condition is

$$w_i = MRP_i - p_i = MRP_i - Em_i \tag{1}$$

In (1), the worker pays the full cost of health insurance coverage through decreased wages, even though the employer nominally provides the coverage. Also, the wage offset varies by individual risk. Suppose instead that firms pool risk among workers, and that the wage offset for each employee is the mean cost of insuring each member of the firm: $1/K\sum_k Em_{kt} = \bar{p}$. In this second case, the equilibrium condition is

$$w_{it} = MRP_{it} - \frac{1}{K}\sum_k Em_{kt} = MRP_{it} - \bar{p} \tag{2}$$

We observe whether an individual is enrolled in health insurance through her employer and whether the individual is obese, which is associated with higher expected health expenditures. Let ε_i represent a zero mean and orthogonal regression error and let α, β, δ, γ, and λ represent the parameters of the regression. Our

[4] By focusing on spot labor markets, we are abstracting away issues of investment in job-specific human capital which can also lead to differences between wages and marginal revenue product.

[5] This assumption could be relaxed to permit fixed loading charges without altering our main points.

[6] We assume for the sake of staying focused on our point that there are no employee out-of-pocket contributions to enroll in the employer provided health plan.

empirical model is

$$w_i = \alpha + X_i\beta + \delta HI_i + \gamma O_i + \lambda HI_i \cdot O_i + \varepsilon_i \quad (3)$$

where HI_i indicates whether worker i enrolls in health insurance through her employer, O_i represents whether worker i is obese, and X_i represents a set of observable covariates that determine either labor market productivity, expected medical costs of insurance coverage, or both. λ represents the difference-in-difference estimate of the individual wage offset attributable to insuring obesity.

A key assumption underlying our identification strategy is that the factors that contribute to the observed negative relationship between obesity and wages (other than the higher cost of health insurance) are similar between workers in insured and uninsured jobs. One source of these types of differences is unobserved productivity differences between obese and non-obese workers. But such productivity differences by themselves are not enough to bias our estimates. Rather, our estimates will be biased only if such productivity differences differ between firms that do and do not provide health insurance. For example, one possibility is that health insurance increases the marginal productivity of obese workers by improving health.[7] We test whether differential productivity differences can explain our results by conducting a falsification exercise. In particular, we estimate a version of Eq. (3) in which we replace employer health insurance (*HI*) by indicators for other fringe benefits whose value depends weakly or not at all on body weight. If differential productivity differences are driving our main results, then we should find wage differentials ($\lambda < 0$) in our falsification exercise as well.

If workers with higher expected medical expenditures pay for employer-provided health insurance through lower wages, then we should find that wage offsets vary by the level of expected medical expenditure. Because expected health care expenditures increase with BMI, we expect that the wage offsets should also increase with BMI (Finkelstein et al., 2003). Thus, as an additional robustness check, we estimate a version of Eq. (3) that includes separate dummy variables and interaction terms for overweight ($25 \leq BMI < 30$), mildly obese ($30 \leq BMI < 35$), and morbidly obese ($BMI \geq 35$) individuals.

Finally, we test for differences between small and large firms in the magnitude of the wage offset for obesity. Eq. (2) implies that all the workers within the firm pay, in part, for the high medical costs of one of the employees. A one dollar increase in medical expenditures for worker i will decrease her wages by only $\$1/K$. Obviously, under pooling, as the firm size grows large, the marginal costs to any particular worker of higher expected medical costs tend toward zero. An implication of this is that, even if pooling exists at the level of the firm, we may observe wage offsets associated with obesity driven by limitations in pooling among small firms. In this case, it would not be possible to differentiate between firm level pooling, with differences by firm size in the extent of pooling, and individual incidence. We examine this by testing for differences in the magnitude of the wage offset by firm size. If the wage offsets we observe operate at the level of the firm, but emerge through this mechanism, we should find that they exist in small but not large firms. Alternatively, if the wage offsets operate at the level of the individual, they should exist in both small and large firms.

[7] The empirical literature suggests that health insurance coverage does not have a large marginal effect on worker health. For example, in the RAND Health Insurance Experiment, the marginal health effects of generous first-dollar health insurance coverage over more stingy insurance are small (Newhouse, 1993). Levy and Meltzer (2004) survey the literature on the health effects of health insurance coverage and also conclude that the effects are small on the margin.

We estimate all of our models using ordinary least squares, applying the NLSY sample weights and allowing for within-person clustering when calculating the standard errors.

3. Data

The empirical work in this paper is based on two data sources, including the NLSY, collected by Bureau of Labor Statistics, for our analysis of obesity and worker wages, and the Medical Expenditure Panel Survey (MEPS) primarily for our analysis of obesity and medical expenditures. We also analyze the relationship between wages and obesity using data from the MEPS both to replicate our findings from the NLSY using an alternative data source and to conduct additional tests that are not possible using the NLSY.

3.1. National longitudinal survey of youth

The NLSY is a nationally representative sample of 12,686 people aged 14–22 years in 1979. The survey was conducted annually until 1994, and biennially through 2004. The NLSY retention rates are high and attrition has not been found to be systematic.[8] Our study uses NLSY data from 1989 to 2002. We use only post-1988 data because earlier years of the survey did not include questions on health insurance status or other types of fringe benefits offered by employers. We omit 1991 from our analyses due to the lack of information on health insurance status for that year. After these restrictions on the survey years, 88,412 person-year observations are eligible to be included in the study sample.

We further restrict the sample to individuals employed full-time in either a private or non-profit firm in a given year, defining full-time workers as those who indicate they usually worked 7 or more hours a day at their primary job ($N = 52{,}594$ person-years).[9] We exclude 770 observations of pregnant women from our study sample. We further limit our main analysis sample to workers who indicate that they either had employer-sponsored health insurance in their own name from their current employer or were uninsured. After exclusions for missing data for control variables and key study variables (hourly wage, BMI, and insurance coverage), this sample includes 31,176 observations. We also construct an alternative analysis sample for our robustness check involving workers who receive health insurance from sources other than their employer. This alternative sample includes all the workers in our main sample in addition to those with health insurance from other sources, so the sample size rises to 38,645 observations. Descriptive statistics for the main sample are presented in Table 1.

The dependent variable in our analysis is the worker's hourly wage, which is the hourly rate of pay for the respondent's current or most recent job. We top and bottom code the wage at \$1 and \$290 per hour, respectively to correct errors in coding.[10] The NLSY includes measures of individual self-reported weight in each year and height in 1985 for each respondent.[11] We use these

[8] Looking for evidence of differential attrition on the basis of wages, earnings, and education, MaCurdy et al. (1998) conduct an exhaustive examination of the NLSY 1979. They conclude that their "analysis offers little basis for suspecting that the NLSY79 presents an inaccurate picture of youths' labor market experiences."

[9] We exclude workers employed by the government as well as those who were either self-employed or employed in a family business due to differences in these types of employment situations in the wage setting process.

[10] Cawley (2004) follows this same procedure.

[11] In both the NLSY and MEPS data we use for the project, weight is self-reported. Although both men and women systematically misreport their weight, Lakdawalla and Phillipson (2002). Find that this misreporting is small enough that it does not affect the qualitative conclusions of their empirical work.

Table 1
Descriptive statistics for study sample. Sample: full-time workers either with employer-sponsored health coverage in their own name or uninsured (N = 31,176).

Variable	Mean	Std. Dev.
Hourly wage	14.98	15.58
Employer coverage in own name	0.80	
Uninsured	0.20	
Unknown source of coverage	–	
Non-employer coverage	–	
Obese ($BMI > 30$)	0.19	
Mildly obese ($BMI > 30$ and <35)	0.13	
Morbidly obese ($BMI \geq 35$)	0.06	
Overweight	0.37	
Obese * employer coverage (own)	0.15	
Female	0.37	
Any children in household	0.54	
Race—Black	0.13	
Race—Other	0.02	
Never married	0.25	
Formerly married	0.21	
Age	34.23	4.81
Education: <9	0.02	
Education: 9–12	0.53	
Education: 13 and over	0.45	
AFQT: 0–25	0.15	
AFQT: 25–50	0.22	
AFQT: 50–75	0.29	
AFQT: 75–100	0.34	
Urban residence	0.75	
Job tenure: 0–1 years	0.20	
Job tenure: 1–3 years	0.23	
Job tenure: 3–6 years	0.21	
Job tenure: 6+ years	0.36	
Employer size: 0–9	0.18	
Employer size: 10–24	0.14	
Employer size: 25–24	0.12	
Employer size: 50–999	0.42	
Employer size: 1000+	0.14	

Note: Data source is the 1989–2002 NLSY. Estimates are weighted.

measures to calculate body mass index[12] (BMI) and indicators for overweight ($25 \leq BMI < 30$) and obesity ($BMI \geq 30$). In some specifications, we distinguish mild obesity ($30 \leq BMI < 35$) from morbid obesity ($BMI \geq 35$).

Health insurance status is defined in the NLSY questionnaire as coverage "by any kind of private or government health or hospitalization plans or health maintenance organization (HMO) plans."[13] Health insurance sources are identified for those with health insurance as either current employer, other employer (former employer coverage or spouse's current or former employer coverage), individually purchased, public (Medicaid, Medi-Cal, Medical Assistance, Welfare, Medical Services), or other source. Survey respondents are able to indicate more than one source of coverage, and we classify those indicating more than one source into a single source based on the following hierarchy: employer-sponsored coverage in own name, other source of employer-sponsored coverage, individual coverage, public coverage, and, finally, other coverage. We define insured as employer-sponsored coverage in own name.

The control variables that we include in X_{it} are the survey year, gender, race (white, black, and other), an indicator of whether there are any children in the household and its interaction with gender, marital status (never married, married with spouse present, and other), age, age squared, education level measured by highest

Table 2
Unadjusted difference-in-difference estimates of the wage offset for obesity. Sample: full-time workers either with employer-sponsored coverage in their own name or uninsured.

	Hourly wage		
	Obese	Not obese	Difference
Insured	15.22	16.64	−1.42 [0.40]***
Uninsured	9.47	9.21	0.25[0.50]
Unadjusted difference-in-difference estimate			−1.68 [0.63]***

*Significant at 10%; **signficant at 5%, ***significant at 1%. *Note:* Standard errors in parentheses are adjusted for repeated observations of individuals.

grade completed (0–8 years, 9–12 years, and 13 or more years), AFQT score (0–24th percentile, 25th–50th percentile, 51st–75th percentile, 76th–100th percentile), job tenure (less than 48 weeks, 48–143 weeks, 144–287 weeks, and 288 or more weeks), location of residence (urban or rural), number of employees at workplace (less than 10 people, 10–24 people, 25–49 people, 50–999 people, and 1000 or more people), industry category (agriculture; forestry and fisheries; mining; construction; manufacturing; transportation, communications, and other public utilities; wholesale trade; retail trade; finance, insurance and real estate; business and repair services; personal services; entertainment and recreation services; professional and related services; and public administration), and occupation category (managerial and professional specialty; technical and sales; administrative support; service; farming, forestry, and fishing; precision, production, craft, and repair; operators, fabricators, and laborers; and armed forces). Summary statistics are presented in Table 1.

3.2. Medical expenditure panel survey

Because the NLSY does not report information on medical expenditures, we use an alternative data source to examine the relationship between obesity and medical expenditures. The 2003 Medical Expenditure Panel Survey (MEPS) collects nationally representative data on how much non-institutionalized Americans spend on medical care.[14] The MEPS tabulates expenditures on a comprehensive set of categories including inpatient care, outpatient care, and prescription drugs. The MEPS is the best available source of data on medical expenditures for a broad population because it combines a detailed survey of respondents along with an audit of those responses conducted by consulting the administrative records of health insurance companies, pharmacies, and hospitals. We exclude people who received health insurance through the Veterans' Administration or through Workers' Compensation programs from our analysis as well as children (under age 18) and pregnant women.

We also use the MEPS to replicate findings regarding the relationship between wages, health insurance, and obesity from the NLSY and to test the validity of alternative explanations for our findings. The main advantage of the MEPS is that it provides detailed information on insurance status. This allows us to identify workers who were continuously covered by employer-sponsored coverage

[12] BMI is weight, measured in kilograms, divided by height, measured in meters squared.

[13] The NLSY question on health insurance does not specify any particular time period of coverage, but in the context of the rest of questionnaire, it seems likely that respondents are giving information about their current health insurance coverage.

[14] In an earlier draft of this paper, we also examined data from the 1998 MEPS. The results using 1998 data are substantively similar to the ones we report here. The main advantage of using the 2003 data is that unlike 1998, MEPS respondents were directly asked about their height and weight. To get such information for the 1998 sample, we had to link together the MEPS and 1996 and 1997 National Health Interview Survey data (where some MEPS respondents were asked about height and weight). Thus, the height and weight data for the 1998 MEPS come from 1997, while medical expenditure information comes from 1998. In 2003 height, weight, and expenditures are contemporaneously measured.

Table 3
Estimates of the obesity wage offset for health insurance.

	(1)	(2)	(3)
	Main study sample	Overweight, obese, and morbidly obese	Log transformed wage
Obese	−0.2 [0.49]		−0.03 [0.02]
Employer coverage (own)	2.37 [0.26]***	2.47 [0.34]***	0.23 [0.01]***
Obese * employer coverage (own)	−1.45 [0.57]**		−0.05 [0.02]**
Overweight (25 ≤ *BMI* < 30)		−0.35 [0.38]	
Mildly obese (30 ≤ *BMI* < 35)		−0.53 [0.39]	
Morbidly obese (*BMI* ≥ 35)		0.02 [1.31]	
Overweight * employer coverage (own)		−0.18 [0.50]	
Mildly obese * employer coverage (own)		−1.27 [0.53]**	
Morbidly obese * employer coverage (own)		−2.22 [1.38]	
Constant	23.27 [7.27]***	14.17 [7.31]*	2.13 [0.22]***
Observations	31,176	31,176	31,176
R-squared	0.18	0.18	0.50

*Significant at 10%; **significant at 5%; ***significant at 1%. *Note:* Estimates are weighted and standard errors in parentheses are adjusted for repeated observations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, marital status, age, education, urban residence, AFQT score, job tenure, employer size, year, industry, and occupation. Data source is the 1989–2002 NLSY.

through out the year and workers offered health insurance from an employer as well as those enrolled in employer-sponsored coverage.

Using the MEPS, we measure health insurance status two ways. First, we limit the analysis to individuals who were continuously insured through their own employer or continuously uninsured throughout the year. Second, we expand the sample to include individuals who either held or were offered a plan from their employer at any point during the year. While the first definition provides a cleaner test of the relationship between employer-sponsored health insurance and wages by eliminating workers with part-year coverage, the second allows us to differentiate between offer and take-up of coverage.

Using MEPS data from 2000 to 2005, we construct the sample to resemble as closely as possible that from the NLSY. We include full-time workers age 18–50, who were employed throughout the year working on average 35 or more hours per week. We exclude self-employed workers as well as those working more than one job. We also exclude women who were pregnant at any point during the year, as identified by a medical expenditure related to pregnancy. The sample size in models in which we analyze workers who were offered employer-sponsored coverage at any point during the year is 31,192. In models in which we limit to workers who held coverage from their employer at any point during the year, the sample size is 29,430. Finally in models in which we limit the analysis to workers who were continuously covered by employer-sponsored health insurance, the sample size is 26,478.

4. Results

4.1. Difference in difference estimates

In Tables 2–5, we present results from our primary data source, the NLSY. Table 2 presents the difference-in-difference estimates of the effect of obesity on hourly wages using our main sample. Among workers with health insurance, obese workers earn $1.42 per hour less on average than non-obese workers. Among uninsured workers, the difference in hourly wages between those who are obese and those who are not is small ($0.25) and not statistically significant. The unadjusted difference-in-difference estimate of the incidence of obesity on wages for workers insured through their employer is −$1.68, and the estimate is statistically significant at the 1% level.

In Table 3, Model 1, we present the adjusted estimate of the wage offset for obesity. The key coefficient is the interaction term between obesity and employer coverage, which represents our adjusted difference-in-difference estimate. The adjusted estimate, −$1.45, is similar to the unadjusted estimate. Unsurprisingly, in Model 1, we find a large, positive relationship between employer-sponsored coverage and wages. Because we believe this is driven primarily by unobserved characteristics of worker productivity that are correlated with compensation in the form of both wages and health insurance, we do not interpret this as an estimate of employee incidence. We also find no evidence of an obesity wage penalty among workers without employer-sponsored insurance in this model.

4.2. Wage offsets for overweight and obesity

In Model 3 (Table 2), we include an indicator of overweight (25 ≤ *BMI* < 30) and distinguish mild obesity (30 ≤ *BMI* < 35) from morbid obesity (*BMI* ≥ 35), interacting each of these variables with the indicator of employer-provided health insurance. In the literature on medical costs of obesity, overweight individuals typically have much lower expenditures than the obese, and often have expenditures that do not differ substantially from normal weight individuals (Finkelstein et al., 2003). If the wage offsets we have observed for the obese do reflect increased medical expenditures, the relatively low medical expenditures of the overweight suggests there should be little or no wage offset for overweight in jobs that provide health insurance. In addition, because the health care expenditures of the morbidly obese are larger than those of the mildly obese, we expect their wage offset to be larger. The results from Model 2 are consistent with these relationships. We find

Table 4
Estimates of the obesity wage offset for other fringe benefits.

Fringe benefit	*n*	Unadjusted	Adjusted
Life insurance	30,469	−0.1 [0.52]	0.12 [0.43]
Dental insurance	30,700	−0.47 [0.58]	−0.47 [0.49]
Maternity benefits	28,682	−0.24 [0.63]	−0.31 [0.55]
Retirement	30,362	−0.51 [0.57]	−0.59 [0.49]
Profit sharing	30,476	−0.42 [0.66]	−0.49 [0.53]
Training/education	30,354	0.13 [0.58]	0.17 [0.48]
Childcare	30,114	1.1 [1.54]	0.86 [1.38]
Flexible working hours	30,781	−0.33 [0.58]	0.15 [0.46]

*Significant at 10%; **significant at 5%; ***significant at 1%. *Note:* Estimates are weighted and standard errors in parentheses are adjusted for repeated observations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, marital status, age, education, urban residence, AFQT score, job tenure, employer size, year, industry, and occupation. Data source is the 1989–2002 NLSY.

Table 5
Analysis of the wage offset for obesity by sex.

	Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)
Obese	−1.21 [0.39]***	−1.27 [0.39]***	−0.79 [0.48]	−1.66 [0.39]***	−1.66 [0.39]***	0.43 [0.98]
Employer coverage (own)		2.3 [0.33]***	2.4 [0.35]***		1.81 [0.39]***	2.37 [0.33]***
Obese * employer coverage (own)			−0.58 [0.63]			−2.64 [1.00]***
Constant	22.36 [9.47]**	20.22 [9.51]**	20.12 [9.50]**	15.35 [10.89]	9.83 [10.81]	9.51 [10.81]
Observations	19,183	19,183	19,183	11,993	11,993	11,993
R-squared	0.19	0.19	0.19	0.14	0.14	0.14

*Significant at 10%; **significant at 5%; ***significant at 1%. *Note:* Estimates are weighted and standard errors in parentheses are adjusted for repeated observations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, marital status, age, education, urban residence, AFQT score, job tenure, employer size, year, industry, and occupation. Data source is the 1989–2002 NLSY.

Table 6
Analysis of the wage offset for obesity using data from the medical expenditure panel survey.

	Continuously covered by ESI or uninsured	Coverage at any point during the year	
		Offered	Held
All	−0.51 [0.31]*	−0.40 [0.36]	−0.49 [0.30]
Men	−0.01 [0.40]	0.25 [0.47]	0.09 [0.39]
Women	−1.27 [0.47]***	−1.56 [0.53]***	−1.40 [0.46]***
Observations (pooled sample)	26,478	31,192	29,430

*Significant at 10%; **significant at 5%; ***significant at 1%. *Note:* The estimates in the table are the coefficient and standard error on the obesity and insurance coverage interaction term from different models. All models include controls for the main effects of obese and health insurance status as well as sex (when data are pooled by sex), indicator of children in the household and its interaction with female, race, marital status, age, education, urban residence, employer size, year, industry, and occupation. Data source is the 2000–2005 MEPS.

no evidence of a wage offset for overweight workers. Overweight workers in jobs that provide health insurance earn a statistically insignificant $0.35 less than normal weight workers in similar jobs. We also find evidence suggesting that the wage offset for health insurance increases with obesity. The estimates of the wage offset is a statistically significant −$1.27 for mildly obese workers and −$2.22 ($p \leq 0.11$) for morbidly obese workers.[15]

4.3. Log transformed wage

In Model 3 (Table 3), we re-estimate Model 1 using a log transformation of the hourly wage. While most studies of the wage offset for obesity use a log transformation, we do not because it is not the correct specification to test the hypothesized relationship between obesity and wages in our study. In particular, the wage offset represents the incremental health care costs of obesity, and its magnitude should be independent of, not proportional to, the worker's wage. Using a log specification would be equivalent to parameterizing the health care costs of obesity as a percent of worker wages, and we see no *a priori* theoretical justification for this relationship. Nonetheless, we test this version of the model in order to provide estimates that are more comparable with the existing literature on the effects of obesity on wages. In this model, the point estimate indicates a statistically significant 5% average wage reduction.

4.4. Obesity and other fringe benefits

Health insurance is not the only fringe benefit that employers sometimes provide to their employees. The NLSY also asks survey respondents about the availability of other types of fringe benefits including life insurance, dental insurance, maternity leave, retirement benefits, profit-sharing, vocational training, child care, and flexible hours. Because the value of these benefits, for the most part, does not vary with worker weight, they provide an additional opportunity to test our empirical specification. While obese individuals do have shorter life spans than non-obese individuals (Flegal et al., 2006), life insurance premium differences are substantially smaller than differences in medical expenditures. Obese workers should suffer little or no extra wage penalty if employers provide these benefits. This test allows us to determine if the results we find for health insurance are driven by omitted factors relating to worker productivity that affect the availability of all types of benefits.

We use the same differences in differences approach to test the incidence of other types of employer-sponsored benefits on worker wages. In other words, we regress hourly wage on indicators of obesity, the availability of a particular type of fringe benefit, and interaction of the two as well as the control variables included in the main models. The results in Table 4 indicate no wage penalty for the obese when employers offer any of the other fringe benefits that we consider, whether we adjust for covariates or not. For all the benefits listed, with the exception of health insurance, the survey does not provide information about whether the worker was enrolled, so we unfortunately cannot check whether the same results hold for enrollment for the other fringe benefits. Overall, these results provide strong evidence that our main findings are not driven by omitted variables that affect the availability of many types of benefits, such as unobserved productivity differences.

4.5. Gender differences in obesity wage penalties

One important finding of the obesity-wage literature is that it is women, rather than men, who suffer the greatest wage penalty from being obese.[16] In Table 5, we analyze the effects of includ-

[15] Although we cannot reject the hypothesis that the estimates of the wage offset for mildly and morbidly obese workers are the same, the small number of morbidly obese, uninsured workers limits our ability to detect this effect.

[16] The most robust version of this finding is presented by Cawley (2004). Using the same dataset as our study, Cawley estimates wage regressions including individual fixed effects and finds evidence that the wage penalty for obesity is concentrated among white women. When we estimate our models like Cawley's – including fixed

ing the insurance coverage variables in the wage regressions on the estimate of the effect of obesity separately for men and women. We find that obese men earn $1.21 per hour less than non-obese men, while obese women earn $1.66 less than non-obese women (Model 1 for men and women, respectively). Model 2, which includes enrollment in employer-provided health insurance (HI_{it}) as an additional control produces essentially the same results as Model 1 for both men and women. However, the results change considerably in Model 3, which includes an interaction term between obesity and HI_{it}. For women, we find that the wage penalty for obesity is concentrated in firms where employers provide health insurance—a $2.64 penalty. In firms that do not provide health insurance, obese women earn 43 cents more than non-obese women, though the estimate is not statistically significant. For men, by contrast, while the wage penalty for obesity is no longer statistically significant in Model 3, the interaction between obesity and employer-provided insurance is also not statistically significant. In other words, the wage penalty associated with obesity is concentrated among workers with coverage from their employer for women, but not for men.[17] While this seems like prima facie evidence against our story of an individual wage offset due to obesity, we show below in Section 4.7 that this pattern of results – no wage offsets for obese men, substantial wage offsets for obese women – is consistent with data on differential health expenditures for obese individuals of different sexes.

4.6. Definitions of insurance coverage

A potential weakness of the NLSY for our analysis is that it does not provide detailed information on insurance coverage. For example, in the absence of detailed information on the period of time for which a respondent was enrolled in different types of coverage, we created a mutually exclusive categorical indicator of coverage type using a hierarchy to identify a single source of coverage for those reporting multiple types. This likely introduces measurement error into the classification of type of insurance. In addition, the survey asks only whether a respondent held employer-sponsored coverage, rather than whether he or she was offered coverage from an employer. As a result, some of the uninsured people in our sample may have been offered a policy but declined to enroll. This could bias our estimates in wage offsets are determined on the basis of an offer of coverage rather than enrollment. In addition, the estimates of the wage offset for obesity for other types of fringe benefits using the NLSY are based on whether the worker was offered these benefits rather than whether he or she enrolled in them.

To address this issue, we re-estimate the wage regressions using data from the MEPS, which provides more detailed information on insurance coverage. Using the MEPS, we identify people who were continuously enrolled in employer-sponsored coverage for the 12 months of the survey year as well as those who were continuously uninsured. For the indicator of continuous insurance coverage, we limit the sample to those who reported having coverage in their own name at any point during the year. We also estimate models in which we expand the definition of insurance coverage to include those with employer-sponsored coverage in their own name at any point during the year, estimating separate models for those with an offer of coverage and those enrolled in coverage through their employer.

Overall, the results are quite similar to those from the NLSY (Table 6). In particular, when the data are pooled by sex, we find a relatively small and marginally statistically significant estimate of the wage offset for obesity – approximately −$0.50. As in the estimates from the NLSY, the wage offset is concentrated entirely among women. The magnitude of the estimate of the wage offset for obesity for women, however, is much smaller, −$1.27 among women continuously enrolled in employer-sponsored coverage (Column 1—Table 6) than it was in the NLSY. We also find little evidence that differentiating between offer and take-up of coverage substantively affects our main findings. A potential concern with estimates based on take-up is differential selection into coverage among obese women with an offer of employer-sponsored health insurance based on their expected use of medical care. In practice, however, we estimate a similar wage offset for obesity among women with employer-sponsored health whether we define health insurance based on offer or enrollment.[18]

Table 7
Total medical expenditures by obesity and age.

	Non-obese	Obese	Difference
Women			
18–64	$2,718	$4,175	$1,457***
20–50	$2,406	$3,193	$787***
20–50 Privately insured	$2,586	$3,169	$583**
Men			
18–64	$2,498	$2,904	$405
20–50	$1,719	$1,881	$162
20–50 Privately insured	$1,896	$1,949	$52

*Significant at 10%; **significant at 5%; ***significant at 1%. *Note:* Data source is the 2003 MEPS.

4.7. Medical expenditures

The results in Tables 5 and 6 present important new evidence that suggests a rethinking of the conclusion that the obesity wage penalty for women is due mostly to discrimination. However, our finding of a substantial obesity wage-offset for women but not for men is potentially inconsistent with our interpretation that the differential wage-offset is due to the provision of health insurance. An important premise of this argument, however, is that obese individuals spend more on health care than do non-obese individuals. While results from the studies we discussed earlier indicate that this is indeed the case, we know of no estimate in the literature from nationally representative data that reports yearly medical expenditures for obese and non-obese separately for men and women.

Table 7 reports our calculations from 2003 MEPS which includes all adult Americans in its sample frame. The difference in the average health expenditures between the obese and the non-obese is larger for adult women than for adult men. Obese women spent $1457 more per year on healthcare than did non-obese women; the analogous difference for men is $405. When we examine adults

effects and a subset of time varying control variables – we do not find evidence of the wage offset for health insurance among the obese. However, we also do not find any evidence that obese individuals earn less than thinner individuals in the case of either male or female workers. These results, not included here, are available upon request from the study authors. Because the results presented by Cawley are based on a much longer panel (he includes NLSY data from before 1988 when respondents were not queried about health insurance) we believe that our inability to replicate Cawley's (2004) findings with our sample is driven by a lack of statistical power.

[17] One possible explanation for the relatively large wage offset for obese women is that their plan from their employer is more likely to cover family members than non-obese women with employer-sponsored coverage. We test this by re-estimating the model only on single women. We find that the estimate of the wage offset is similar (−3.28 with a standard error of 1.37), suggesting that these types of differences in coverage generosity are unlikely to be driving our results.

[18] We also analyzed directly whether take-up rates vary by body weight and found no evidence of this type of selection. Using data from the MEPS, we calculate that 89.0% of obese workers with an offer of health insurance take up coverage compared with 89.6% of non-obese workers.

Table 8
Expenditure and prevalence differences by condition.

	Disease prevalence			Expenditures conditional on disease		
	Non-obese	Obese	Difference	Non-obese	Obese	Difference
Women						
Diabetes	1.15%	4.64%	3.49%***	$4,246	$5,769	$1,522
Asthma	9.29%	14.58%	5.30%***	$3,805	$4,147	$342
Hypertension	6.18%	22.14%	15.96%***	$3,834	$4,278	$444
Coronary artery disease	0.13%	0.68%	0.56%***	$19,274	$6,641	−$12,633
Angina	0.18%	0.46%	0.29%*	$2,637	$8,574	$5,937
Myocardial infarction	0.22%	0.69%	0.48%**	$6,709	$8,240	$1,531
Other heart disease	3.26%	4.46%	1.21%*	$4,333	$3,900	−$433
Stroke	0.44%	0.62%	0.17%	$10,728	$7,969	−$2,760
Emphysema	0.10%	0.24%	0.14%	$13,712	$8,851	−$4,861
Joint pain	22.53%	35.57%	13.04%***	$3,740	$4,726	$987
Arthritis	8.07%	17.96%	9.89%***	$4,141	$6,097	$1,956**
Men						
Diabetes	1.23%	6.60%	5.38%***	$5,425	$4,623	−$802
Asthma	7.99%	6.66%	−1.33%	$2,043	$2,533	$490
Hypertension	9.76%	26.84%	17.08%***	$3,276	$2,996	−$280
Coronary artery disease	0.50%	1.15%	0.64%**	$12,618	$6,959	−$5,658
Angina	0.28%	0.74%	0.46%**	$7,766	$9,610	$1,844
Myocardial infarction	0.54%	1.06%	0.52%*	$11,812	$6,123	−$5,690
Other heart disease	2.03%	2.75%	0.72%	$2,440	$4,014	$1,574
Stroke	0.15%	0.56%	0.41%**	$5,635	$12,730	$7,095
Emphysema	0.11%	0.20%	0.09%	$1,781	$106	−$1,675
Joint pain	24.93%	31.53%	6.59%***	$4,514	$3,215	−$1,298
Arthritis	6.54%	12.60%	6.06%***	$2,926	$4,150	$1,224*

*Significant at 10%; **significant at 5%; ***significant at 1%.

20–50 and privately insured adults 20–50, the difference is even more striking. For these groups, obese men do not have greater medical expenditures than non-obese men. For privately insured women, however, the incremental medical expenditures associated with obesity are $583. These differences indicate that the absence of the wage offset for obesity among those with employer-provide insurance for men can be explained by the fact that the medical expenditures are not higher for obese men than for their normal weight counterparts.

Though a complete examination of the differences in medical expenditures between thin and obese men and women is beyond the scope of this paper, in Table 8 we provide some information on the sources of the medical expenditures differences that we report in Table 7. MEPS respondents are asked whether a doctor has diagnosed them to have (or have had) a number of common medical conditions, including diabetes, asthma, hypertension, coronary artery disease, angina, myocardial infarction, other disease, stroke, emphysema, non-specific joint pain, and arthritis.[19] In the left columns in Table 8, we report the prevalence of each condition among thin and obese workers aged 20–50.[20] Among both men and women, obese individuals are more likely to be afflicted with a wide variety of conditions. These differences are both statistically and medically significant. Of particular note is the fact that obese women are 9.89 percentage points more likely to have an arthritis diagnosis than thin women, while obese men are only 6.06 percentage points more likely than thin men. This is of particular note because, among the set of conditions we consider, arthritis is the only one in which obese individuals with the condition spend (statistically significantly) more than thin individuals. For female workers with arthritis, the medical expenditure difference between obese and thin individuals is $1956; for male workers with arthritis, the difference is $1224. Clearly, differences between men and women in the connection between obesity and arthritis are an important part of the reason why obese female workers spend so much more on medical care than thin female workers, while obese male workers spend about the same as thin male workers. The story is certainly more complicated than just arthritis, though, and deserves a more careful treatment than what we can afford here.

4.8. Firm size

We return to the NLSY to examine differences by firm size in estimates of the wage offset. Workers in both small and large firms with employer-sponsored health insurance experience a wage offset for obesity (Table 9), and the wage offset is concentrated among women with employer-sponsored coverage among workers in both small and large firms.[21] The existence of a wage offset in large firms suggests that our findings are driven by individual incidence rather than group incidence. If the incidence of premiums were at the level of the group, we would expect to see little evidence of an obesity wage offset among insured workers in large groups. This is because the health care costs of an individual would have little effect on the average premium of the group.

4.9. Reconciling the estimates

Our estimates of the incremental medical care costs associated with obesity allow us to make a "back of the envelope" calculation to determine whether the incremental medical expenditures of the obese can explain the wage offset we observe. In the NLSY, obese women who work full-time and enroll in employer provided

[19] Of course, respondents may have been diagnosed with more than one condition.
[20] All of the estimates and statistical tests in Tables 6 and 7 take account of the complex sampling stratified scheme used by the MEPS.

[21] These results are not sensitive to the definition of firm size. The NLSY divides firms with 50 or more employees into two categories: 50–999 and 1000+. When we define a large firm as one with 1000+ workers, the results are substantively the same, although the sample size in the largest category is relatively small.

Table 9
Estimates by firm size.

	Small firms (0–49)			Large firms (50+)		
	All	Women	Men	All	Women	Men
Obese * employer coverage (own)	−1.59 [0.80]**	−3.78 [1.49]**	−0.36 [0.85]	−1.54 [0.60]***	−1.6 [0.59]***	−1.35 [0.94]
Observations	13,625	4,498	9,127	17,551	7,495	10,056
R-squared	0.14	0.13	0.15	0.21	0.17	0.22

Robust standard errors in brackets. *Significant at 10%; **significant at 5%; ***significant at 1%. *Note:* Estimates are weighted and standard errors in parentheses are adjusted for repeated observations of individuals. Adjusted estimates include controls for sex, children in the household and its interaction with female, race, marital status, age, education, urban residence, AFQT score, job tenure, employer size, year, industry, and occupation. Data source is the 1989–2002 NLSY.

health insurance work an average of 2191 h per year. Thus, the yearly income penalty from being obese is 2191 * \$2.64 = \$5784 (s.d. \$2340). The results from the MEPS indicate that \$583 (s.d. \$272) of this penalty can actually be attributed to higher expected medical expenditures for obese individuals.

While the difference between these estimates appears large, in fact, the difference is not statistically significant at the $p = 0.01$ level; the difference may be due to statistical noise.[22] Also, the estimates come from different samples—the wage effect estimate comes from the NLSY data, while the health expenditure difference comes from the MEPS. The yearly income penalty based on our analysis from the MEPS is \$2667 (2100 average annual hours * −\$1.27), which is substantially closer to the MEPS health expenditure difference, and is not statistically significantly different even at $p = 0.10$. In addition, premiums are unlikely to be actuarially fair and accounting for the loading of insurance in our estimate of medical expenditures would bring the estimates closer. Finally, it is possible that only part of the wage differential we observe is due to the higher expected medical spending of the obese and the remainder is due to residual discrimination.

Though we cannot definitively rule out residual discrimination as an explanation for the negative obesity wage premium, some of our other findings suggest that it is not a likely explanation. First, because we find no evidence of similar wage discrimination for obese women without health insurance or obese men with coverage, attributing the residual difference to discrimination requires an explanation of why discrimination exists only for obese, insured women. Second, we find no evidence of similar wage offsets for different types of benefits or for the working obese with coverage from alternative sources. Maintaining an explanation based upon discrimination thus requires potentially ad hoc reasoning about obese women outside of work settings where employers provide health insurance.

5. Conclusions

Our results indicate that obese workers with employer-sponsored health insurance pay for their higher expected medical expenditures through lower cash wages. These wage differences are greatest among female workers, who have larger expected medical expenditure differences associated with obesity than male workers. This conclusion is strengthened by our findings that these types of wage offsets do not exist either for obese workers with coverage through alternative sources or for other types of fringe benefits for which the cost to the employer of providing is less likely to be affected by BMI.

Although the existence of a wage offset for health insurance is the standard theoretical prediction from economic models of worker compensation, this finding is noteworthy given the dearth of empirical evidence of the existence of these types of wage offsets. Not only do our findings provide evidence supporting the few existing studies that find that these types of wage offsets exist, but they also provide new evidence on the level at which they occur. We find that the magnitude of the wage offset for employer-sponsored coverage varies by individual characteristics that affect expected medical expenditures, in this case obesity. This evidence reduces concerns regarding the effects of pooled premiums on adverse selection in insurance coverage and moral hazard in body weight decisions.

Our results do not provide direct evidence that employees bear the full incidence of the cost of employer-sponsored coverage. Our empirical specification leaves open the possibility that employers either partially or fully subsidize the average premium. The evidence we generate provides support for a weaker version of the employee incidence hypothesis—that employees pay for individual characteristics that make them high cost to insure. Nonetheless, our results imply that having insurance provided through an employer does not guarantee the pooling of health risks across employees. Because obesity is arguably an unusual indicator of health status, future research should examine whether similar types of wage offsets exist for other conditions. In addition, we focused on younger worker in our analysis, primarily because the NLSY sample consists primarily of younger workers. The wage determination process may differ between younger and older workers in ways which affect the ability to observe these types of differentials among older workers.

The findings of our study raise the obvious question of the mechanism by which these wage offsets occur. While our analysis does not provide direct evidence on this point, the differential obesity wage offsets could arise through (at least) two distinct mechanisms: (1) individual-specific incidence within a firm or (2) average incidence within a firm and differential sorting of workers across firms. While this distinction would not alter the efficiency implications discussed above, it does have important implications for the efficiency of labor markets. In particular, the sorting of workers across firms based on their expected health care costs could potentially result in inefficient allocation of workers to firms. Although we cannot differentiate between these two explanations with our data, the fact that we find evidence for the existence of the wage offset in both small and large firms suggests that our results are due to individual-specific incidence, rather than worker sorting. If worker sorting were the explanation, we would expect the wage offset for obesity among insured workers to be concentrated in small firms with less opportunity for pooling across workers.

While studies on the relationship between obesity and wages have provided evidence consistent with the proposition that obese, particularly white women, experience significant labor market discrimination in the form of lower wages, our results support an alternative explanation. We find that the wage penalty for obesity among women is concentrated in firms providing health insurance. We also find that, among relatively young people, obese women, but not obese men, have higher health care expenditures than their non-obese counterparts. Taken together, these results suggest that

[22] The upper bound of the confidence interval of the difference between the income penalty and the health expenditure difference crosses zero at $p = 0.027$.

the wage penalty for obesity among women can be explained, at least in part, by their higher health care expenditures.

Alternative explanations do exist. For example, among obese workers, those with relatively low productivity due to the health consequences of obesity may consume more medical care and, as a result, self-select into firms offering health insurance. In this case, the observed relationship may represent both the lower productivity and greater demand for health insurance among these workers. The absence of a wage-offset for obese male workers, however, weakens this explanation. For this alternative explanation to be true we would have to assume that only obese women are subject to this type of selection. Presumably, similar differences among obese men in their productivity exist.

Other alternative explanations include invidious discrimination against the obese mainly in high end jobs that provide health insurance, job sorting of the obese into relatively low wage occupations among the high end jobs, and perhaps even productivity differences between the obese and non-obese in high end but not low end jobs. In each case, however, these explanations would have to characterize obese women, but not obese men. None of these alternative explanations are inconsistent with our favored explanation of obesity-induced wage-offsets at firms that provide health insurance.

The two explanations – labor market discrimination against the obese and the higher costs of providing health insurance to obese workers – are not mutually exclusive explanations for the obesity wage penalty. In theory, competitive labor markets make invidious discrimination costly to the discriminator (Becker, 1971). This is because firms have strong incentives to hire workers for whom the prevailing wage is less than their marginal productivity; this type of competition among firms for workers will eliminate wage disparities unrelated to worker productivity. In the case of the wage penalty associated with obesity, the differential costs of insuring the obese may be a mechanism that allows labor market discrimination to persist in competitive markets. Firms that do not make these types of wage offsets and instead enforce the pooling of premiums among obese and non-obese workers will be at a competitive disadvantage relative to those who are able to provide non-obese workers with a cash wage and benefits combination that better reflects the costs of insuring these workers.

Finally, our results have implications for the policy debate over what to do about the obesity crisis. Some have suggested that the right response is a tax on fast food and junk food (Brownell and Horgan, 2003). Whether such a tax is a good idea depends, mainly, upon the extent to which individuals pay fully for the consequences of their decisions about diet and exercise.[23] If there are no externalities in these decisions, then "twinkie" taxes will only distort already optimal decisions. But if employer-provided insurance pools the health risk of the obese and non-obese, it will create an externality that reduces incentives to maintain a normal weight. Our evidence on the incidence of the obesity wage premium suggests that pooling of the obese and non-obese does not occur in the employer-sponsored insurance market; hence the externalities caused by health insurance on decisions about body weight are small.

[23] Other authors, like Cutler et al. (2003) have suggested that self-control problems on the part of individuals represent an "internality" that make body weight decisions inefficient. Time-inconsistent individuals do not take into account the future health implications of the food choices they make in the current period. Bhattacharya and Lakdawalla (2004) argue that even in the presence of such "internalities," sin taxes such as a "twinkie" tax will not, in general, improve the welfare of obese individuals.

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References

Arrow, K.J., 1963. Uncertainty of the welfare economics of medical care. American Economic Review 53 (5), 941–973.
Becker, G.S., 1971. The Economics of Discrimination. The University of Chicago Press, Chicago.
Bhattacharya, J., Lakdawalla, D., 2004. Time-Inconsistency and Welfare. National Bureau of Economic Research.
Bhattacharya, J., Sood, N., 2006. Health Insurance and the Obesity Externality. Advances in Health Economics and Health Services Research. K. Bolin and J. Cawley, p. 17.
Brownell, K., Horgan, K., 2003. Food Fight: The Inside Story of the Food Industry, America's Obesity Crisis and What We Can Do About It. McGraw-Hill/Contemporary Books, New York, NY.
Cawley, J., 2004. The impact of obesity on wages. Journal of Human Resources XXXIX (2), 451–474.
Cutler, D.M., Glaeser, E.L., et al., 2003. Why have Americans become more obese? Journal of Economic Perspectives 17 (3), 93–118.
Ehrlich, I., Becker, G.S., 1972. Market insurance, self-insurance, and self-protection. Journal of Political Economy 80 (July/August), 623–648.
Finkelstein, E.A., Flebelkorn, I.C., et al., 2003. National medical spending attributable to overweight and obesity: how much, and who's paying? Health Affairs, W3-219–226.
Flegal, K., Graubard, B., et al., 2006. Excess deaths associated with underweight, overweight, and obesity. Journal of American Medical Association 293, 1861–1867.
GAO, 2003. United States General Accounting Office, Private Health Insurance: Federal and State Requirements Affecting Coverage Offered by Small Businesses, Report to Congressional Requester, September 2003, pages 1–63.
Gruber, J., 1994. The incidence of mandated maternity benefits. American Economic Review 84 (3), 622–641.
Gruber, J., 2000. In: Cuyler, A.J., Newhouse, J.P. (Eds.), Health Insurance and the Labor Market. Handbook of Health Economics. Elsevier, pp. 645–700, 1a.
Keenan, P.S., Buntin, M.J.B., et al., 2001. The prevalence of formal risk adjustment in health plan purchasing. Inquiry 38 (Fall), 245–259.
Lakdawalla, D., Phillipson, T., 2002. The growth of obesity and technological change: a theoretical and empirical examination. National Bureau of Economic Research.
Levy, H., Meltzer, D., 2004. In: McLaughlin, C.G. (Ed.), What Do We Really Know about Whether Health Insurance Affects Health? Health Policy and the Uninsured. The Urban Institute Press, Washington, DC, pp. 179–204.
MaCurdy, T., Mroz, T., et al., 1998. An evaluation of the national longitudinal survey of youth. Journal of Human Resources 33 (2), 345–436.
Newhouse, J.P., 1993. Free for All? Lessons from the RAND Health Insurance Experiment. Harvard University Press.
Pauly, M.V., 1970. The welfare economics of community rating. The Journal of Risk and Insurance 37 (3), 407–418.
Pauly, M.V., Herring, B., 1999. Pooling Health Insurance Risks. AEI Press, Washington, DC.
Rosen, S., 1986. In: Ashenfelter, O., Layard, R. (Eds.), The Theory of Equalizing Differences. Handbook of Labor Economics. Elsevier Science Publishers, p. 1.
Rothschild, M., Stiglitz, J., 1976. Equilibrium in competitive insurance markets: an essay on the economics of imperfect information. Quarterly Journal of Economics 90, 629–649.
Sheiner, L., 1999. Health Care Costs, Wages and Aging. Federal Reserve Board of Governors, Washington, DC.
Summers, L.H., 1989. Some simple economics of mandated benefits. American Economic Review 79 (2), 177–183.