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THE INCIDENCE OF THE HEALTHCARE COSTS OF OBESITY

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ABSTRACT

The incidence of obesity has increased dramatically in the U.S. Obese individuals tend to be sicker and spend more on health care, raising the question of who bears the incidence of obesity-related health care costs. This question is particularly interesting among those with group coverage through an employer given the lack of explicit risk adjustment of individual health insurance premiums in the group market. In this paper, we examine the incidence of the healthcare costs of obesity among full time workers. 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 in firms without employer-sponsored insurance do not have a wage offset relative to their non-obese counterparts. Our estimate of the wage offset exceeds estimates of the expected incremental health care costs of these individuals for obese women, but not for men. We find that a substantial part of the lower wages among obese women attributed to labor market discrimination can be explained by the higher health insurance premiums required to cover them.

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1.0 Introduction

Obese individuals tend to be sicker and to spend more on health care.[1] But on whom do these costs fall? Since the majority of the under-65 U.S. population receives health insurance coverage through their employers, it is tempting to conclude that fellow workers in a firm pay for the health care costs of obesity. However, obesity is easily observable by insurers[2], and, in models with competitive insurance markets and no unobservable risk information, equilibrium prices never ignore relevant and easily observable data about the insured (Arrow, 1963). Nevertheless, little evidence exists that the obese pay higher premiums for employer-sponsored health insurance. Under pooled group health insurance, the insured group pays for higher medical expenditures, such as those associated with obesity, through higher premiums. Experience rated adjustments to yearly premiums permit insurers to recover increases in costs that are due to changes in the risk profile of the pool as a whole. Yet, in practice employee contributions to plan premiums are rarely risk adjusted for obesity or any other observable risk factor, implying that all individuals within the pool pay for these premiums increases equally (see Keenan et al., 2001).

An absence of risk rating of health insurance premiums potentially has two important welfare implications. First, 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 (Pauly, 1970). High risk individuals purchase too much health insurance because the premium is low relative to the actuarially fair premium, while low risk individuals purchase too little. Second, a lack of risk rating of premiums may lead to moral hazard in risky behaviors that affect health expenditures. When premiums reflect risk, individuals have incentives to expend resources on self-protection (Ehrlich and Becker, 1972). A lack of risk rating of premiums within a group may reduce these incentives. 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 (see

[1] We include a short review of the literature on the medical costs of obesity below.

[2] Even if BMI is 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.

Bhattacharya and Sood, 2004). In summary, insurance underwriting procedures that ignore body weight yield inefficient outcomes for both the obese and the non-obese.

The lack of risk rating of employee contributions to premiums for employer-sponsored coverage, however, does not necessarily imply that different individuals with different health risks pay similar premiums for coverage. An alternative explanation is that variation in individual expected expenditures is passed on to individual workers in the form of differential wage offsets.[3]

In this paper, we examine this explanation for the lack of explicit risk rating of premiums for employer-sponsored coverage in the context of the health care costs of obesity. We argue that, though nominal premiums do not depend upon body weight, obese individuals receiving employer provided health insurance pay for their higher medical costs through reduced wages. The main idea underlying our approach is that the relative wages of obese and non-obese individuals in employment relationships where health insurance is not provided serve as a control for the relative wages of obese and non-obese individuals in employment relationships where health insurance is provided. 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.

Using the 1989-1999 National Longitudinal Survey of Youth (NLSY), we generate evidence consistent with the proposition that the obese pay for their higher expected medical care expenditures through lower wages. We find that while obese individuals who receive health insurance through their employer earn lower wages than their non-obese colleagues, obese individuals who receive health insurance through other sources or are uninsured earn about the same as their thinner colleagues. That is, wage penalties for obesity are found mostly at firms that provide health insurance. Furthermore, using evidence from the linked Medical Expenditure

[3] A traditional solution to the related puzzle of why pooling occurs at all in the face of health status information unobserved by health insurance firms is that other features of the employment relationship that are bundled with the offer of health insurance induce unobservably healthy individuals to consent to pooling with the unobservably sick (see Bhattacharya and Vogt, 2004). This explanation cannot rationalize charging *observably* low risk individuals the same premiums as observably high risk individuals.

Panel Survey (MEPS) and National Health and Interview Survey (NHIS), 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.

Our results 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. In theory, in a competitive spot labor market, where wages equal marginal product, increased health insurance costs are passed on to workers directly in the form of lower wages (Rosen, 1986). However, empirical evidence of this relationship is sparse, primarily because it is difficult to disentangle empirically the provision of health insurance and cash wages from unobserved characteristics of workers that affect their productivity (Gruber, 2000; Rapaport, 2003). We propose a difference-in-difference approach to estimating the wage offset for health insurance that allows us to control for differences in unobserved worker productivity that have plagued other studies.

The second finding is that the wages of obese workers are lower than those of their normal weight peers and the wage differential is not easily explained by differences in productivity. A large literature in labor economics examines labor market discrimination based upon physical attractiveness.[4] One of the conclusions of research in this area is that obese women receive lower wages than non-obese women due to invidious discrimination, but the lower wages of obese men can be explained by differences in job choice and productivity for obese and non-obese men (Cawley, 2000; Pagan and Davila, 1997). The evidence in this paper supports a reinterpretation of this literature. We argue that a large part of the wage differences that have been attributed to invidious discrimination against the obese is in fact due to their higher health insurance costs.

[4] See Hamermesh and Biddle (1994) on the returns to beauty in the labor market. Register and William (1990), Pagan and Davila (1997), and Cawley (2000) use the National Longitudinal Survey of Youth (NLSY) to examine wage discrimination related directly to obesity using the NLSY, but do not consider health insurance coverage as an explanation.

2.0 Background

Americans are increasingly overweight or obese. The standard measure used to determine an appropriate weight in the medical literature is body mass index (BMI).[5] Individuals with a BMI of 25 to 29.9 are considered overweight, while those with a BMI of 30 or more are considered obese (National Institute on Health, 1998). The proportion of adults classified as obese increased from 12.0% in 1991 to 20.9% in 2001 (Mokdad et al., 1999; Mokdad et al., 2003).

Because obesity is associated with increased risk of a range of chronic conditions (Sturm, 2002), health care costs are higher for obese than for normal weight individuals. A number of studies examining insured populations either working for particular companies or obtaining insurance from a particular source conclude that obese individuals spend more on medical care than normal weight individuals (Bungam et al., 2003; Burton et al., 1998; Musich et al., 2004; Quesenberry, Jr. et al., 1998; Thompson et al., 2001; Wang et al., 2003). Estimates based on nationally representative data from the linked National Health Interview Survey (NHIS) and Medical Expenditure Panel Survey (MEPS) indicate that annual medical expenditures are $732 higher on average for obese than normal weight individuals (Finkelstein, et al. 2003). On an aggregate level, approximately half of the estimated $78.5 billion in medical care spending in 1998 attributable to excess body weight was financed through private insurance (38%) and patient out-of-pocket payments (14%) (Finkelstein et al., 2003).

Because the vast majority of the under 65 population with health insurance in the U.S. receives coverage through an employer, the incidence of the health care costs of obesity is largely a question of the incidence of the costs of employer-sponsored health insurance. Standard economic theory clearly 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). Directly applying the theory of compensating differentials to the provision of employer-sponsored health insurance, however, is complicated by certain features of the employer-sponsored market. In particular, the standard theory would assume that insurance is perfectly experience-rated at the individual level, that firms face identical worker-specific

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

insurance price schedules, and that compensation packages are determined at the level of the individual worker. Under these conditions, employers will offer health insurance to a worker if the worker's value of the coverage exceeds the cost to the employer of providing it (Gruber, 2000). Assuming the labor market is perfectly competitive, the wage differential for health insurance will be equal to the cost of providing health insurance to a particular worker.

The assumption that employers are able to set worker-specific compensating differentials is central to our analysis of the incidence of the health care costs of obesity.[6] The question is whether employers adjust the cash wages of obese workers with health insurance in order to account for the higher cost of insuring these workers. Although theory predicts that employers would have incentives to do so, in practice, it is not clear that they would be able to make these adjustments. According to Gruber (2000), "….the problems of preference revelation in this context are daunting; it is difficult in reality to see how firms could appropriately set worker specific compensating differentials." In summary, although theory clearly predicts that workers, not employers or firms, bear the incidence of the costs of fringe benefits, it is not clear how these costs are allocated across workers when the cost of providing the fringe benefit varies across individuals.

In practice, however, the empirical evidence of the existence of *any* wage offset for health insurance is limited, with even less information on the extent to which it 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), although this is likely due to the empirical challenges facing researchers in identifying the relationship. The primary issue is that workers differ in important but unobserved ways that determine whether they will find jobs that both pay high wages and offer health insurance. Because these unobserved determinants of the job match are positively correlated with both cash wages and health insurance, empirical work that does not adequately control for these differences may produce biased estimates of the relationship between cash wages and health insurance.

[6] Other important assumptions include that the firm is able to provide employee-specific quantities of health insurance and that the cost of providing health insurance for a particular worker does not vary across firms. Both assumptions are violated in practice. In order to receive the tax benefits associated with employer-sponsored health insurance, employers are required to offer the same benefit packages to particular classes of workers. In addition, premiums for coverage vary substantially by firm size.

The results of early cross sectional studies found a positive relationship between health insurance premiums or the availability of health insurance and wages for individual workers, consistent with this type of omitted variables bias (Leibowitz, 1983; Monheit et al., 1985). Even studies adopting more sophisticated methods, such as using longitudinal data to control for time-invariant individual characteristics (Levy, 1997) and examining the effect of mass layoffs on changes in the allocation of compensation between wages and health insurance (Simon, 2001), have not found evidence consistent with the existence of a tradeoff between wages and health insurance. These authors attribute their non-findings or "wrong-signed" estimates to unobserved changes in worker productivity (Levy, 1997) or the quality of the match between the worker and the firm (Simon, 2001). In short, many empirical studies exist that provide no or weak evidence of the existence of *any* wage offset for health insurance, let alone whether the wage offset varies by individual characteristics, although most authors of these studies attribute their findings to an inability to adequately control for unobserved differences in worker productivity.

The few studies providing evidence consistent with the theory of compensating differentials leave open the question of whether variation among individuals in their expected health care expenditures is passed on to workers with employer-sponsored coverage through differential wage offsets. While a firm level study of compensation provides evidence of wages offsets for fringe benefits including health insurance (Woodbury, 1983), firm level data do not provide a test of whether variation in the wage offset exists across workers. Research examining wage incidence at the individual level finds evidence of the existence of these types of wage offsets for easily identifiable demographic groups. In particular, using variation in local health care costs as an instrument to identify wage offsets, Sheiner (1999) finds that wages rise more slowly for high risk workers when health care costs rise, and Pauly and Herring (1999) find that wages rise more slowly with age for workers with health insurance from an employer than uninsured workers. In her as yet unpublished dissertation, Rapaport (2003) finds evidence that workers pay for health insurance in the relative wage paths of new hires and longstanding employees. Perhaps the strongest evidence of premium incidence related to demographic characteristics is from a study of the adoption of mandated maternity benefits which finds that the cost of the mandate fell primarily on workers likely to benefit from the coverage, women of child-bearing age and their

husbands (Gruber, 1994). This finding is particularly noteworthy because in the case of a mandated benefit, we would expect full incidence only if workers fully valued the coverage (Summers, 1989). While these studies indicate that wage offsets may exist for easily identifiable demographic groups, they fall short of proving that workers pay for their health care costs through nominally reduced wages.

3.0 Data

The empirical work in this paper is based on 2 data sources, including the National Longitudinal Survey of Youth (NLSY), collected by Bureau of Labor Statistics, for our analysis of worker wages, and the Medical Expenditure Panel Survey (MEPS) for our analysis of obesity and medical expenditures.[7]

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 2000. The retention rate was 91.2% of the eligible respondents in 1989 and 84.4% in 1998.[8] Our study uses NLSY data from 1989-1998. 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 particular survey year. After these restrictions on the survey years, 64,994 person-year observations are eligible to be included in the study sample. We further restrict the sample to individuals employed full-time 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=49,666 person years). Finally, we exclude pregnant women from our study sample. After these restrictions, 46,770 person-year observations remain for analysis. After accounting for observations missing wage data, we have 45,201 observations

[7] The 1998 MEPS does not have height and weight information in the main data set. However, the MEPS can be linked to the National Health and Interview Survey (NHIS), which does have self-reported height and weight available. The MEPS uses the NHIS as its sampling frame.

[8] Looking for evidence of differential attrition on the basis of wages, earnings, and education, MaCurdy, Mroz, and Gritz (1998) conduct an exhaustive examination of the NLSY 1979. They conclude that their "analysis offers little basis for suspecting that the NLSY[79] presents an inaccurate picture of youths' labor market experiences."

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.[9] The NLSY includes measures of individual weight in each year and height in 1985 for each respondent. We recode this into Body Mass Index (BMI) and use it to derive the categorical indicators of overweight ($25 \leq BMI < 30$) and obese ($BMI \geq 30$) as is standard in the medical literature.

Health insurance status is defined by the NLSY questionnaire as coverage "by any kind of private or government health or hospitalization plans or health maintenance organization (HMO) plans."[10] Health insurance plan 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 classified those indicating more than one source into a single source using a hierarchical method. The hierarchy is employer-sponsored coverage in own name, other source of employer-sponsored coverage, individual coverage, public coverage, and finally other coverage.

Our main analysis sample is limited to workers indicating they either had employer-sponsored health insurance in their own name from their current employer or were uninsured. This further limits our sample to 35,750 person-years. In adjusted models, this reduces to 24,085 due to missing data for control variables. We present summary statistics for this sample in Table 1. People in this sample earned about $13 per hour, on average; 16.7% were obese; 21.5% were uninsured; 61% were male; and as a group, they had higher AFQT[11] than a random sample of Americans—34% scored in the top quartile. Most commonly (40% of responses), respondents in this sample worked in firms with 50 to 999 employees. Between 1989 and 1998, obesity rates in this population rose precipitously from 11% to 23% of the sample. This rise in obesity reflects

[9] Cawley (2000) follows this same procedure.
[10] 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.
[11] AFQT is the Armed Forces Qualifying Test, which is arguably a measure of IQ.

the aging of the sample, as well as the general increase in American body weight over this period.

To perform specification tests, which we describe below, we alter the sample in two ways. First, we expand it to include workers with coverage from other sources. This sample includes 34,815 person-years after accounting for missing data for control variables. Secondly, we restrict the sample of full-time workers either with employer-sponsored coverage in their own name or uninsured to those who were continuously employed throughout the study period. This sample includes 13,276 person-years after excluding missing data for control variables. Appendix Table A1 presents descriptive statistics for these additional analysis samples and compares them to the main study sample.

3.2 Medical Expenditure and Obesity Data

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 1998 Medical Expenditure Panel Survey (MEPS) collects nationally representative data on how much non-institutionalized Americans spend on medical care. 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.[12]

The sample frame for the MEPS is drawn from the National Health Interview Survey (NHIS), which is a nationally representative dataset designed to represent the non-institutionalized population. The NHIS includes self-reported information on both height and body weight, which is unavailable in the public use version of the 1998 MEPS.[13] Because the MEPS sample is

[12] Unlike the Consumer Expenditure Survey, which is conducted by the federal government with the objective of constructing of inflation measures, the MEPS includes expenditures on medical care for individuals that are financed by insurance, as well as out-of-pocket expenditures.

[13] Both men and women systematically misreport their weight—see Lakdawalla and Philipson (2002). Heavy men and women tend to under report their weight, while underweight men tend to over report their weight. Lakdawalla

drawn from the NHIS, it is possible to link the 1998 MEPS to the 1996 and 1997 NHIS data.[14] Thus, the linked data set includes nationally representative micro data on both weight and medical expenditures. 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. There are 7,077 adults in the final merged dataset after all the exclusions.

4.0 Empirical Framework

Our basic theoretical setting for our analysis is Rosen's (1974) model of equalizing wage differentials adapted to the provision of health insurance by employers. In a competitive spot labor market where worker compensation is only in the form of cash wages, the wages of worker i, w_i, will equal her marginal revenue product, MRP_i.[15] In firms that provide health insurance to their employees, this equality between wages and marginal product will be modified in equilibrium by the fact that health insurance provision is costly to firms. Suppose that health insurance premiums are actuarially fair.[16] In this case, premiums charged to the firm for the coverage of worker i, say p_i, will exactly equal the expected medical costs of coverage, Em_i.[17] The equilibrium condition is:

$$(1) \qquad w_i = MRP_i - p_i = MRP_i - Em_i .$$

Equation (1) implies that the worker pays the full cost of health insurance coverage through decreased wages, even though the employer nominally provides the coverage, and that the wage offset varies by individual risk.

Our test of the extent to which the incidence of health insurance is based on individual characteristics is based on whether individual variation in Em_i affects the cash wages of workers

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and Philipson (2002) find that this misreporting is small enough that it does not affect the qualitative conclusions of their empirical work.

[14] We thank Eric Finkelstein for kindly providing this linked data set for our use.

[15] 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.

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

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

with employer-sponsored health insurance. To test this, we parameterize the worker's marginal revenue product as a linear function of observable characteristics, X_i, that are correlated with productivity:

$$(2) \qquad MRP_i = \alpha + X_i\beta$$

Substituting this into equation (1), we obtain

$$(3) \qquad w_i = \alpha + X_i\beta - p_i$$

Ideally, we would have information on p_i and $\bar{p}$ which would allow us to test directly the relationship between health insurance premiums and wages and the extent to which it operates at the level of the individual or the group as follows:

$$(4) \qquad w_i = \alpha + X_i\beta - \bar{p} - (p_i - \bar{p})$$

However, we observe neither p_i nor $\bar{p}$. Instead, we observe whether an individual is enrolled in health insurance through her employer and whether the individual is obese, which causes individual variation in expected health expenditures. Let ε_i represent a zero mean regression error, assumed uncorrelated with X_i, HI_i, and O_i, and α, β, δ, γ, and λ represent the parameters of the regression. We parameterize the empirical model as follows:

$$(6) \qquad w_i = \alpha + X_i\beta + \delta HI_i + \gamma O_i + \lambda HI_i \cdot O_i + \varepsilon_i$$

where HI_i indicates whether worker i enrolls[18] 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 wage difference attributable to insuring obesity. This is our measure of the incidence of the health care costs of obesity and the parameter estimate of primary interest in our analysis.

[18] In our main results, our employer-provided health insurance coverage variable reflects whether the worker enrolled in the health insurance plan offered by the employer. As a sensitivity check, we also present models that redefine the insurance variable as reflect whether the employer offered health insurance.

In other words, our empirical strategy is to use the wage differences between obese and non-obese workers with employer-sponsored health insurance to measure the extent to which the obese pay for employer-sponsored health insurance in the form of lower wages, using the wage differences between obese and non-obese workers in the non-insured group as a control for unobserved differences between obese and non-obese workers in the insured group. The main effect of obesity in our empirical model, γ, controls for these differences.

One potential source of differences in wages between obese and non-obese workers, independent of the effect of health insurance, is the relationship between worker productivity and body weight. Obese workers are potentially less productive than their non-obese counterparts. However, the existing literature casts doubt on whether observed differences in the wages of obese and non-obese workers can be attributed to differences in productivity, particularly for men. Both Register and William (1990) and Pagan and Davila (1997) find obesity-wage gradients in different years of the NLSY for women, but not for men, and both sets of authors attribute the lower wages of obese women to labor market discrimination, rather than to differences in productivity. Using the NLSY, but using a different identifying assumption, Cawley (2000) also finds lower wages for obese white women compared with normal weight white women. He does not find the same gradients for black and Hispanic women. He concludes:

> It should be stressed that the finding that weight lowers wages is not conclusive evidence of workplace discrimination. Another hypothesis also consistent with these findings is that heavier workers are less productive at work. It has repeatedly been found, for example, that obese workers are more likely to miss work due to illness. However, this explanation is complicated by the fact that this paper finds no evidence that weight lowers wages for black women. (p.19)

In other words, maintaining the position that obese workers are less productive requires *ad hoc* assumptions about how obesity affects men and women and whites and blacks differently.[19]

[19] The evidence that Cawley cites about the correlation between obesity and sick days makes only a prima facie case that obesity reduces productivity. More evidence establishing that obese workers are equally or less productive, all else equal, on non-sick days is needed to make the case for productivity differences.

These findings, however, introduce an alternative mechanism by which obesity may affect wages – through wage discrimination. In our specification, γ represents difference in wages between obese and non-obese workers at firms that do not provide insurance; and $\lambda+\gamma$ represents the difference in wages between obese and non-obese workers at firms that provide health insurance. If $P_{insured}$ is the proportion of the population that is insured, then $\gamma(1-P_{insured})+(\gamma+\lambda)P_{insured}$ is the usual measure of wage discrimination against the obese reported in the literature. Our simple theoretical framework, in contrast, implies that whether obese workers have lower wages will depend upon whether they work at firms that provide health insurance, and whether insurance premiums pool health risks across workers within firms. Thus, our empirical specification will allow us to differentiate between these two potential explanations of lower wages among the obese. If the assumption of negligible differences in productivity between obese and non-obese workers is correct, then any wage difference we observe associated with obesity in the non-insured group (γ) represents the effects of discrimination against the obese, and the wage differences between the obese and non-obese with insurance measures the extent to which the obese who are insured with employer-sponsored coverage pay for their higher expected health expenditures through lower cash wages (λ).

The key parameter in our regression is the coefficient on the interaction term between health insurance coverage and obesity—λ—which we expect to be negative. An important assumption underlying our analysis is that both productivity differences between obese and non-obese workers and the extent to which discrimination affects the compensation of obese workers are the same in insured and non insured jobs.[20] Although this assumption seems plausible, we cannot test it directly. Instead, we analyze here the consequences for our results of deviations from this assumption. If differences in productivity exist between obese and non-obese workers and these differences are greater in jobs that provide health insurance, then we will *overestimate* the incidence of the health care costs of obesity on the wages of obese workers. In contrast, if

[20] For example, one possibility is that health increases the marginal productivity of obese workers by providing access to effective medical care. In this paper, we are assuming that access to health insurance does not increase the marginal productivity of obese workers. An empirical justification for this assumption is that in the RAND Health Insurance Experiment, Newhouse (1996), the marginal health effects of generous first-dollar health insurance coverage over more stingy insurance are small. Levy and Meltzer (2003) survey the literature on the health effects of health insurance coverage and also conclude that the effects are small on the margin.

productivity differences between obese and non-obese workers are greater in jobs that do not provide health insurance than those that do, we will *underestimate* the extent to which obese workers pay for their higher expected medical expenditures in the form of lower cash wages. Our estimates of wage incidence will be similarly biased if the extent of wage discrimination associated with obesity differs between insured and uninsured workers. Greater discrimination against insured workers will result in an overestimate of wage incidence, while greater discrimination among uninsured workers will results in an underestimate of wage incidence. We conduct a number of specification checks, which are presented in the results sections, to assess whether our estimates are affected by these types of biases.

The control variables that we include in X_{it} are the survey year, gender, race (white, black, and other), marital status (never married, married with spouse present, and other), age category (25-29 years, 30-32 years, 33-35 years, and 36-40 years), education level measured by highest 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).

Although the dependent variable, hourly wage, is skewed, we do not use a log transformation for our main analyses because it is not the correct specification to test the hypothesized relationship between obesity and wages. In particular, the wage offset represents the incremental health care costs of obesity, and its magnitude does not necessarily depend on the level of the wage of the worker. 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 estimate a version of our model using the log transformed hourly wage as the dependent variable as a specification check. We estimate our models using ordinary least squares, applying the sample weights and allowing for within person clustering when calculating the standard errors. We also conduct a number of specification checks which are discussed in the results section below.

5.0 Results

Broadly speaking, our results indicate that the insured obese pay for their higher expected health care expenditures in the form of lower wages. In this section, we describe these results alongside a series of specification checks that we conducted to check the robustness of and alternate explanations for our findings.

Difference in Difference Findings

Recall that our analytic strategy entails using the difference in wages between obese and non-obese individuals at firms which do not provide insurance as a control group for the analogous wage difference at firms which do. Table 2 presents the difference-in-difference estimates of the effect of obesity on hourly wages using our main sample. When the data are pooled across all the years (1989-1998) the unadjusted difference-in-difference estimate of the incidence of obesity on wages is $1.30, and the estimate is statistically significant at the 5% level. The magnitude of the wage offset appears to have increased over time. In the unadjusted cross-sectional estimates by year, the estimate for 1989 is positive ($0.97) and not statistically significant, while the direction of the effect changes and its magnitude becomes larger over time. By 1998, the unadjusted estimate is -$3.86 and statistically significant. This is primarily because the wages of the obese with health insurance grew less quickly than the non-obese with health insurance. The difference in average wages between the obese and the non-obese with health insurance grew from -$1.08 in 1989 to -$3.41 in 1998. Among workers without health insurance, in contrast, we do not observe a consistent time trend in the relative wages of the obese and the non-obese. While in most years, obese individuals earn less than non-obese individuals, this difference is rarely statistically significant, and in 1992 and 1998, obese individuals earned more than non-obese individuals in our sample. When we adjust for an extensive set of control variables, the estimate of the wage incidence of obesity declines in

magnitude to -$1.20, but remains statistically significant. Our qualitative results for the time trend in the wage differential also remain the same.

We can think of three plausible explanations for the time trend in the obesity wage penalty. First, the costs of treating obesity may have increased over time. Better, but more costly, treatments for the health consequences of obesity may have diffused into standard medical practice during this period, raising the cost of treatment conditional on being obese. Alternatively, those classified as obese may be increasingly disabled and require more medical care. This explanation is consistent with evidence that body weight at the 95th percentile of the weight distribution has increased more rapidly than median body weight (Anderson et al., 2003). Second, the trend may be attributed to the aging of the panel since the incremental medical expenditures associated with obesity increase with age (Finkelstein, Flebelkorn and Wang, 2003). The average age of individuals in the panel increased from 28.51 in 1989 to 37.54 in 1998. Finally, the mechanism by which wages adjust may be that the wages of obese workers with health insurance rise more slowly than other workers. This is consistent with the composition of our panel in the sense that they enter the study near the beginning of their working years and are tracked over time.

In Table 3, Model 1 presents the regression results we use to develop the adjusted estimates in Table 2. The key coefficient to look at is the interaction term between obesity and employer coverage, which represents our adjusted difference in difference estimate. Unsurprisingly in Model 1, we find a large, positive relationship between the indicator of employer-sponsored coverage and wages.[21] We also find little evidence of the existence of wage discrimination against the obese at firms that do not provide insurance.

Robustness Checks

We next test the robustness of our main findings by varying the definition of insurance coverage and the definition of obesity. The idea underlying the results presented in Model 2 (Table 3) is that obese workers who receive health insurance from sources other than their own employer

[21] Rather than providing evidence of employer incidence, 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.

should see no wage decline relative to their non-obese colleagues, since the obese and non-obese workers are in different health insurance pools. Correspondingly, we expand our sample to include all full-time workers regardless of health insurance status and include both the main effects of different types of coverage (health insurance through another employer, individual coverage, and public coverage) and their interactions with the obesity indicator.[22]

We find that the wage effect of obesity among insured workers declines to -$0.96, and is not statistically significant at conventional levels. However, we find that, for workers obtaining coverage through an alternative employer, the point estimate of the interaction between coverage source and obesity is much smaller (-$0.11) and statistically insignificant, essentially zero. This latter result confirms that it is employer coverage that is driving our results, since there are virtually no wage differences between obese and non-obese among those who receive coverage from sources other than their employer. The absence of differential wage offsets for other sources of coverage provides evidence that our results are not driven by unobserved characteristics correlated with health insurance and obesity. It also suggests that invidious discrimination against the obese may play a limited role in explaining wage differences—why should there be discrimination against the obese only when they enroll in employer-provided health insurance? For those who receive their insurance through the individual health insurance market or through the government, the point estimates of the interaction terms indicate larger negative effects but these coefficients are not statistically significant, likely because of limited statistical power.

Model 3 in Table 3 addresses a potential problem caused by differences in perceived time frame between the insurance coverage questions and the wage question. While the insurance questions are likely to be interpreted as referring to coverage at a point in time, the wage question asks about "usual hourly wage" which is likely to refer to an ongoing process over some period of time. For workers who transition between individual or public coverage and employer-sponsored plans, our estimates may reflect wages when they had employer-sponsored coverage. This is particularly plausible since workers are likely to use Medicaid coverage when it is available or coverage from the individual market as a source of coverage between employment

[22] See Appendix Table A1 for descriptive statistics for the study sample.

transitions (Ziller, 2004). To address the possibility that such movement is contaminating our results, we estimate Model 3 (Table 3), in which we restrict the sample to survey respondents who were employed full-time continuously during the years we study. In this model, the point-estimate of the effect of obesity on wages of the insured remains negative and indicates a sizable effect, although it is not statistically significant. However, the sample size is also much smaller in this specification check, with only 14% of the sample uninsured and 2.3% of the sample obese and uninsured, which suggests that our ability to obtain precise estimates is also lower.

Finally, Models 4 and 5 in Table 3 return to our main sample of full-time workers either with coverage through their employer or uninsured. In Model 4, we include indicators of both overweight (BMI 25-30) and obesity (BMI 30+) in the regression, along with the interaction of these indicators with 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, Flebelkorn and Wang, 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. The results in Model 4 indicate that this is indeed the case. While the obese in jobs that provide health insurance earn a statistically and economically $1.56 less than normal weight individuals in similar jobs, overweight individuals earn a statistically insignificant 83 cents less. These results are consistent with our story that health expenditures are in part responsible for the obesity wage penalty.

Obesity Driven Productivity Differences?

Our identification strategy relies on the wage differences between obese and non-obese workers without health insurance to serve as controls for these differences at firms that do. These controls are necessary because we are concerned observed wage differences between obese and non-obese workers reflect unobserved productivity differences, rather than medical expenditure differences or invidious discrimination. In our interpretation of our main results, we assume that the obesity wage difference among workers without employer provided insurance measures whatever productivity difference there is between obese and non-obese workers. We then

subtract this measured difference among the control workers from the wage difference among the insured workers. However, this linearity assumption may not be right since workers who receive insurance through their employer tend to work at different jobs than workers who do not. We include industry and occupation dummies in our regressions to address this issue, but perhaps this is not enough.

In Model 5 (Table 3), we test whether our results are robust to relaxing this linear control assumption. We re-estimate the Model 1 using a log transformation of the hourly wage. In this log version of our original model, we are still assuming that the obesity wage difference for workers without employer-provided insurance serve as a control for workers with such insurance, but rather than linearly subtracting this wage difference from the insured workers' difference, we are reducing the insured workers' wage difference by the same proportion as we observe for the uninsured workers' wage difference. In this model, the point estimate indicates 2% average wage reduction, which is not statistically significant. The wages of workers in our sample, however, vary tremendously from $7.22 at the 25th percentile to $15.00 at the 75th percentile. The log specification of the dependent variable would imply a corresponding positive wage offset for obesity $\$1.22 = \exp\left(-.02 + {}^{0.44}\!/_{2}\right)$ for these workers (that is obese workers at insured firms earn more than their thinner colleagues), a range which we believe represents an implausible association between wages and the health care expenditures associated with obesity.[23]

To more directly test whether obesity wage differences for workers without employer-provided insurance are a good measure of productivity losses from due to the worse health of the obese, and also to check whether the linear control or the proportional control assumption is correct, we examine data on sick days from the MEPS. Sick days are the primary mechanism by which productivity differences between obese and non-obese are likely to manifest themselves. Our empirical strategy is the same as in our main results—a difference-in-difference approach comparing obese-non-obese differences at insured and uninsured jobs. We standardize sick days by dividing by the total number of days at work, and we include only full-time workers in our

[23] We assume log normal errors in this calculation. The mean squared error of the log regression is 0.44.

regression. In a regression of standardized sick days on a similar set of control variables that are included in the NLSY wage regressions, we find no evidence that the obesity-related productivity differential, as measured by sick days, differs between workers with and without health insurance.[24] Unsurprisingly, we find that obese workers have more sick days than their non-obese counterparts.[25] This more direct test of productivity differences suggests our estimates of the incidence of the healthcare costs of obesity are not biased by unobserved productivity differences.

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.[26] Obese workers should suffer 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 we used previously 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,

[24] Because the NLSY does not measure the number of sick days among survey respondents, we use an alternative data source, the MEPS, for this analysis. The study sample is full-time workers aged 25-41 who are not self employed. In a regression of the sick day rate on obesity, an indicator of employer-sponsored health insurance, the interaction between the two, and a range of control variables (similar to those in our NLSY models), we find that the sick day rate is 0.008 higher among the obese than the non-obese, but the coefficient on the interaction between obesity and employer-sponsored health insurance is small (-0.004) and not statistically significant.

[25] The full set of sick-day regression results is available upon request from the authors.

[26] While obese individuals do have shorter life spans than non-obese individuals, these differences are substantially smaller than the differences in medical expenditures. Consequently, life insurance premiums differences are substantially smaller as well.

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 benefit. Overall, these results provide strong support that our main findings are not driven by omitted variables that affect the availability of many types of benefits, such as unobserved productivity differences.

Gender Differences in Obesity Wage Penalties

Next, we examine the implications of our findings for the literature relating obesity to workers wages. When we estimate the model with an indicator of obesity but without the controls for health insurance status (Table 5, Pooled Sample-Model 1), we find a large, statistically negative significant effect of obesity on wages. Obese workers earn on average $0.82 per hour less than normal or overweight workers. When we add the control for health insurance (Model 2), the effect of obesity on wages is similar to the model without the insurance control. However, when we enter the interaction between obesity and employer-sponsored coverage into the model, the effect of obesity on wages essentially disappears. The point estimate is small ($0.04) and not statistically significant. These findings suggest that, in our sample, a substantial part of the effect of obesity on wages can be explained by the higher costs of providing employer-sponsored health insurance to these individuals.

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. Since many of these studies also rely upon the NLSY, it is not surprising that we are able to replicate these results. In Table 5, we analyze the effects of including 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 68 cents per hour less than non-obese men, while obese women earn $1.38 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 $2.89 penalty. In firms that do not provide health insurance, obese women earn 85 cents more than non-obese

women, though the result is not statistically significant. For men, on the other hand, the 70 cent obesity wage penalty above is the same in firms that do and do not provide insurance. The wage penalty associated with obesity is much smaller for men than for women and not concentrated among men with employer-sponsored health insurance.

Although the results in Table 5 present important new evidence that suggests a rethinking of the conclusion that the obesity wage penalty for women is due mostly to discrimination, the finding that the wage penalty for the obese can be explained by the availability of employer-sponsored health insurance for women but not for men is potentially inconsistent with our interpretation of our findings regarding the incidence of health insurance premiums. However, an important premise of this argument 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 6 reports our calculations from the linked 1998 NHIS/MEPS data set, 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 $983 more per year on healthcare than did non-obese women; the analogous difference for men is $551. When we examine adults 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 women, however, the incremental medical expenditures associated with obesity are approximately $700. These differences provide an explanation for our findings of the absence of a wage offset for obesity among male workers with health insurance. The absence of the offset is explained by the fact that the medical expenditures and resulting risk adjusted health insurance premium are not higher for obese men than their normal weight counterparts.

In Table 7, we provide some additional information on the sources of differences between men and women in medical expenditures associated with obesity. The incremental medical expenditures associated with obesity are higher for women than for men for both inpatient and outpatient expenditures, although the absolute value of the incremental spending is greatest for

outpatient expenditures. Both obese men and women spend more on pharmaceuticals than their normal weight counterparts. Among women, the incremental health expenditures associated with obesity are financed primarily by private health insurance, as opposed to out-of-pocket payments.

The results in Table 6 and 7 provide an explanation for our finding that the obesity wage penalty is concentrated among women, rather than men, with health insurance through an employer. This is because the incremental health care costs associated with obesity are higher for women than for men. Our estimates 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 health insurance work an average of 2041 hours per year. The yearly income penalty from being obese is $5,898 = 2041 * $2.89. The results from the MEPS/NHIS indicate that approximately $700 of this penalty can actually be attributed to higher expected medical expenditures. Although the magnitude of the difference between these estimates appears to be large, the calculation is subject to a number of qualifications. First, the estimates are from different samples covering different time periods which may contribute to the differential. Second, the parameter estimates, particularly that of the wage offset, are noisy. Much smaller estimates of the wage offset, which would be more consistent with the estimate of the incremental medical expenditures, are within the 95% confidence interval of our estimate. In addition, premiums are unlikely to be actuarially fair and accounting for the loading 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. However, our findings cast doubt on this explanation for two reasons. First, we find no evidence of similar wage discrimination for obese women without health insurance or obese men with coverage. We would need an explanation of why discrimination is apparent only for obese insured women. In addition, we find no evidence of similar wage offsets for different types of benefits or for the working obese with coverage from alternative sources. For these reasons, we believe any residual wage offset is unlikely to be due to discrimination.

6.0 Conclusions

Our results indicate that obese workers with employer-sponsored health insurance pay for their higher expected medical expenditures through lower cash wages. This conclusion is strengthened by our findings that these types of wage offsets do not exist either for obese workers with coverage through an alternative employer 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. Assuming that obese workers are not highly concentrated within particular firms, this suggests that the wage offset for health insurance varies across individuals within a firm based on their health risk.

It is important to keep in mind that 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 employee incidence—that employees pay for individual characteristics that make them high cost to insure. Our results imply that having insurance provided through an employer does not guarantee the pooling of health risks across employees.

Our findings on the incidence of obesity related medical care costs among workers with employer-sponsored coverage have important implications for research on the relationship between obesity and wages. These studies have generally found that obese workers have lower wages and that the wage reductions cannot be explained by variation in worker productivity. The underlying implication is that obese workers, particularly women, face significant labor market discrimination. Our results point to and provide empirical evidence supporting an

alternative explanation. For workers in jobs where health insurance is not provided by employers, there is only a small obesity wage penalty. The wage penalty is largest in jobs where health insurance is provided. Hence, the cash wages for obese workers are lower than those for non-obese workers because the cost to employers of providing health insurance for these workers is higher.

In fact, our evidence suggests that for both obese male and obese female workers, the magnitude of the wage penalty exceeds the expected marginal cost of insuring an obese individual. The traditional explanations for the obesity wage penalty can be applied to this excess wage penalty over the expected medical costs of obesity, though it is beyond the scope of this paper to sort them out. These explanations include invidious discrimination against the obese, mainly in the 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.

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 (KD Brownell and KB 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.[27] 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.

[27] 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.

References

Anderson, P.M.; Butcher, K.F. and Levine, P.B. "Economic Perspectives on Childhood Obesity." *Economic Perspectives 3Q*, 2003, pp. 30-48.

Arrow, Kenneth J. "Uncertainty of the Welfare Economics of Medical Care." *American Economic Review*, 1963, *53*(5), pp. 941-73.

Brownell, KD and Horgan, KB. *Food Fight : The inside Story of the Food Industry, America's Obesity Crisis, and What We Can Do About It*. New York, NY: McGraw-Hill/Contemporary Books, 2003.

Bungam, T; Satterwhite, M; Jackson, AW and Morrow, JR. "The Relationship of Body Mass Index, Medical Costs, and Job Absenteeism." *American Journal of Health Behavior*, 2003, *27*(4), pp. 456-62.

Burton, WN; Chen, CY; Schultz, AB and Edington, DW. "The Economic Costs Associated with Body Mass Index in a Workplace." *Journal of Occupational and Environmental Medicine*, 1998, *40*(9), pp. 786-92.

Cawley, J. "An Instrumental Variables Approach to Measuring the Effect of Body Weight on Employment Disability." *Health Services Research*, 2000, *35*(5 Pt 2), pp. 1159-79.

Ehrlich, Isaac and Becker, Gary S. "Market Insurance, Self-Insurance, and Self-Protection." *Journal of Political Economy*, 1972, *80*(July/August), pp. 623-48.

Finkelstein, E.A.; Flebelkorn, I.C. and Wang, G. "National Medical Spending Attributable to Overweight and Obesity: How Much, and Who's Paying?" *Health Affairs*, 2003, pp. W3-219-26.

Gruber, Jonathon. "Health Insurance and the Labor Market," A. J. Cuyler and J. P. Newhouse, *Handbook of Health Economics.* Elsevier, 2000, 645-700.

____. "The Incidence of Mandated Maternity Benefits." *American Economic Review*, 1994, *84*(3), pp. 622-41.

Health, National Institute on. "Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report," National Heart, Lunch and Blood Institute in cooperation with The National Istitute of Diabetes and Digestive and Kidney Diseases, 1998.

Keenan, Patricia Seliger; Buntin, Melinda J. Beeuwkes; McGuire, Thomas G. and Newhouse, Joseph P. "The Prevalence of Formal Risk Adjustment in Health Plan Purchasing." *Inquiry*, 2001, *38*(Fall), pp. 245-59.

Leibowitz, A. "Fringe Benefits in Employee Compensation," J. E. Triplett, *The Measurement of Labor Cost.* Chicago: The University of Chicago Press, 1983.

Levy, Helen and Feldman, Roger. "Does the Incidence of Group Health Insurance Fall on Individual Workers?" *International Journal of Health Care Finance and Economics*, 2001, *1*, pp. 227-47.

Levy, Helen and Meltzer, David. "What Do We Really Know About How Health Insurance Affects Health?" in *Health Policy and the Uninsured*, CG McLaughlin (ed). Washington, DC: Urban Institute Press, 2004.

MaCurdy, Thomas; Mroz, Thomas; Gritz, R. Mark. "An Evaluation of the National Longitudinal Survey on Youth." *Journal of Human Resources*, Vol. 33, No. 2, Spring 1998

Miller, Richard D. "Estimating the Compensating Differential for Employer-Provided Health Insurance." *International Journal of Health Care Finance and Economics*, 2004, *4*, pp. 27-41.

Mokdad, A.H.; Serdula, M.K.; Dietz, W.H.; Bowman, B.A.; Marks, J.S. and Koplan, J.P. "The Spread of the Obesity Epidemic in the United States, 1991-1998." *JAMA*, 1999, *282*(16), pp. 1519-22.

Mokdad, Ali H.; Ford, Earl S.; Bowman, Barbara A.; Dietz, WIlliam H.; Vinicor, Frank; Bales, Virginia S. and Markes, James S. "Prevalence of Obesity, Diabetes, and Obesity-Related Health Risk Factors, 2001." *JAMA*, 2003, *289*(1), pp. 76-79.

Monheit, A.; Hagan, M.; Berk, M. and Farley, P. "The Employed and the Uninsured and the Role of Public Policy." *Inquiry*, 1985, *22*, pp. 348-64.

Musich, S; Lu, C; McDonald, T; Champagne, LJ and Edington, DW. "Association of Additional Health Risks on Medical Charges and Prevalence of Diabetes within Body Mass Index Categories." *American Journal of Health Promotion*, 2004, *18*(3), pp. 264-68.

Newhouse, J.P. *Free for All?: Lessons from the Rand Health Insurance Experiment*. Cambridge, MA: Harvard University Press, 1996.

Pagan, JA and Davila, A. "Obesity, Occupational Attainment, and Earnings." *Social Science Quarterly*, 1997, *78*(3), pp. 756-70.

Pauly, Mark V. "The Welfare Economics of Community Rating." *The Journal of Risk and Insurance*, 1970, *37*(3), pp. 407-18.

Quesenberry, C. P., Jr.; Caan, B. and Jacobson, A. "Obesity, Health Services Use, and Health Care Costs among Members of a Health Maintenance Organization." *Archives of Internal Medicine*, 1998, *158*(5), pp. 466-72.

Rapaport, Dana "The Incidence of Employer-Provided Health Insurance" Unpublished dissertation, Stanford University Department of Economics, 2003.

Rosen, Sherwin. "The Theory of Equalizing Differences," O. Ashenfelter and R. Layard, *Handbook of Labor Economics.* Elsevier Science Publishers, 1986,

Simon, Kosali Ilayperuma. "Displaced Workers and Employer-Provided Health Insurance: Evidence of a Wage/Fringe Benefit Tradeoff?" *International Journal of Health Care Finance and Economics*, 2001, *1*, pp. 249-71.

Sturm, R. "The Effects of Obesity, Smoking, and Drinking on Medical Problems and Costs." *Health Affairs*, 2002, *21*(2), pp. 245-53.

Summers, Lawrence H. "Some Simple Economics of Mandated Benefits." *American Economic Review*, 1989, *79*(2), pp. 177-83.

Thompson, D; Brown, JB; Nichols, GA; Elmer, PJ and Oster, G. "Body Mass Index and Future Healthcare Costs: A Retrospective Cohort Study." *Obesity Research*, 2001, *9*(3), pp. 210-18.

Wang, F; Schultz, AB; Musich, S; McDonald, T; Hirschland, D and Edington, DW. "The Relationship between National Heart, Lung, and Blood Institute Weight Guidelines and Concurrent Medical Costs in a Manufacturing Population." *American Journal of Health Promotion*, 2003, *17*(3), pp. 183-89.

Woodbury, S.A. "Substitution between Wage and Nonwage Benefits." *The American Economic Review*, 1983, *73*(1), pp. 166-82.

Ziller, Erika; Coburn, Andrew; McBride, Timothy and Andrews, Courtney. "Who Uses Individual Health Insurance and for How Long?," *AcademyHealth Annual Research Meeting.* San Diego, CA, 2004.

Table 1: Study sample descriptive statistics

Study Sample: Fulltime workers with employer sponsored coverage or uninsured

Variable	Category	N	Mean	SD
Hourly Wage		35,750	13.352	14.218
Insurance Status	Uninsured	35,746	0.215	0.411
	Current Employer	35,750	0.785	0.411
BMI	Obesity	34,223	0.167	0.373
	Overweight	34,223	0.354	0.478
Gender	Male	35,750	0.612	0.487
	Female	35,750	0.388	0.487
Race	White	35,544	0.832	0.374
	Black	35,544	0.140	0.347
	Other	35,544	0.028	0.164
Marital Status	Never	35,747	0.280	0.449
	Married	35,747	0.530	0.499
	Formerly	35,747	0.190	0.392
Age Category	<29	35,750	0.219	0.414
	29-32	35,750	0.283	0.450
	33-35	35,750	0.264	0.441
	36-41	35,750	0.234	0.424
Education Status	0-8 years	35,601	0.023	0.149
	9-12 years	35,601	0.517	0.500
	13+ years	35,601	0.460	0.498
AFQT Quartile	1	34,284	0.145	0.353
	2	34,284	0.224	0.417
	3	34,284	0.288	0.453
	4 (Highest Quartile)	34,284	0.343	0.475
Urban/Rural Residence	Urban	35,440	0.766	0.423
Job Tenure	<48 weeks	31,721	0.220	0.414
	48 - 143 weeks	31,721	0.240	0.427
	144 - 287 weeks	31,721	0.211	0.408
	288+ weeks	31,721	0.328	0.470
# Employees	0 - 9	34,569	0.211	0.408
	10 - 24	34,569	0.135	0.342
	25 - 49	34,569	0.120	0.324
	50 - 999	34,569	0.404	0.491
	1000+	34,569	0.130	0.336

Note: Distribution of the study sample by survey year, industry and occupation is available in Appendix Table A1.

Table 2: Difference-in Difference Estimates of the Wage Offset for Obesity

Sample: Full-time workers either with current employer-sponsored coverage in their own name or uninsured

	Insured			Uninsured			Difference-in-Difference	
	Obese	Not Obese	Difference	Obese	Not Obese	Difference	Unadjusted	Adjusted
All Years	13.08	14.78	-1.70	8.79	9.19	-0.40	-1.30	-1.20
			(0.31)***			(0.51)	(0.59)**	(0.70)*
1989	10.73	11.81	-1.08	6.16	8.20	-2.05	0.97	1.45
			(0.71)			(0.72)***	(1.01)	(1.05)
1990	10.38	12.83	-2.45	6.80	8.77	-1.97	-0.48	-0.60
			(0.46)***			(0.82)**	(0.94)	(0.65)
1992	12.28	13.58	-1.30	9.76	8.82	0.94	-2.23	-1.95
			(1.01)			(2.32)	(2.52)	(2.82)
1993	12.34	14.67	-2.33	8.01	8.65	-0.64	-1.69	-1.33
			(0.43)***			(0.48)	(0.64)***	(1.18)
1994	12.81	15.12	-2.31	8.85	10.09	-1.24	-1.07	-0.96
			(0.41)***			(0.92)	(1.00)	(1.65)
1996	14.00	16.87	-2.87	9.71	10.26	-0.55	-2.32	-2.49
			(0.42)***			(0.82)	(0.92)**	(1.08)**
1998	15.89	19.29	-3.41	10.58	10.12	0.46	-3.86	-2.58
			(0.63)***			(0.96)	(1.15)***	(1.24)**

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

Note: Standard errors in parentheses. Standard errors are adjusted for repeated observations of individuals. Adjusted estimates include controls for marital status, urban residence, age, firm size, job tenure, education, sex, race, year, AFQT score, industry and occupation. See Appendix Table A2.

Table 3: Adjusted Difference-in-Difference Estimates and Specification Checks

Variable	(1) Fulltime workers with employer-sponsored or no coverage	(2) All full-time workers regardless of coverage source	(3) Continuous fulltime workers with employer-sponsored or no coverage	(4) The effect of Overweight: Fulltime workers with employer-sponsored or no coverage	(5) Log transformed wages: Fulltime workers with employer-sponsored or no coverage
Obese	0.04	-0.17	-0.71	0.19	-0.04
	(0.64)	(0.55)	(0.64)	(0.64)	(0.03)
Current Employer Coverage	2.01	2.37	2.04	2.36	0.22
	(0.29)***	(0.29)***	(0.53)***	(0.33)***	(0.01)***
Obese*Employer Coverage	-1.20	-0.96	-0.99	-1.56	-0.02
	(0.70)*	(0.61)	(0.76)	(0.71)**	(0.03)
Overweight				0.39	
				(0.49)	
Overweight*Employer Coverage				-0.83	
				(0.57)	
Employer Coverage from Other Source		0.49			
		(0.42)			
Obese*Other Employer		-0.11			
		(0.89)			
Individual Coverage		2.15			
		(0.61)***			
Obese*Individual		-0.72			
		(1.21)			
Public		0.41			
		(1.27)			
Obese*Public		-1.79			
		(1.42)			
Constant	7.43	7.48	7.94	7.20	1.74
	(1.98)***	(1.62)***	(2.57)***	(1.95)***	(0.11)***
Observations	24085	34815	13276	24085	24085
R-squared	0.11	0.10	0.10	0.11	0.42

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

Note: Standard errors in parentheses. Standard errors are adjusted for repeated observations of individuals. Adjusted estimates include controls for marital status, urban residence, age, firm size, job tenure, education, sex, race, year, AFQT score, industry and occupation.

Table 4: Difference in difference estimates of the effect of incidence of other benefits on wages

	Unadjusted			Adjusted		
Fringe Benefit	n	Coefficient	SEs	n	Coefficient	SEs
Life Insurance	32643	-0.079	0.465	22914	0.111	0.499
Dental Insurance	32915	-0.518	0.492	23122	-0.838	0.543
Maternity Benefits	30801	-0.305	0.599	21405	-0.862	0.733
Retirement	32518	-0.121	0.532	22809	-0.414	0.618
Profit Sharing	32637	-0.602	0.596	22911	-0.382	0.682
Training/Education	32506	-0.300	0.487	22841	-0.183	0.556
Childcare	32292	0.888	1.520	22657	1.577	1.987
Flexible Working Hours	32985	-0.638	0.497	23187	-0.125	0.580

*** 1%, ** 5%, * 10% stat sig

Note: Standard errors adjusted for clustering within individual. We estimate these models on the sample of workers employed full-time in each year either with employer sponsored coverage or uninsured and present both unadjusted and adjusted estimates. The table entries show the coefficients and standard errors from the interaction terms between obesity and fringe benefits offered from employers. Each table entry represents a different regression. Full regression results are available in Appendix A4.

Table 5: The Effect of Obesity on Wages

Sample: Full-time workers either with current employer-sponsored coverage in their own name or uninsured

	Pooled Sample			Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Obese	-0.87	-0.89	0.04	-0.68	-0.70	-0.64	-1.38	-1.38	0.85
	(0.30)***	(0.30)***	(0.64)	(0.40)*	(0.39)*	(0.50)	(0.47)***	(0.47)***	(1.41)
Employer Coverage		1.81	2.01		2.10	2.12		1.27	1.78
		(0.29)***	(0.29)***		(0.38)***	(0.42)***		(0.50)**	(0.37)***
Obese*Employer Coverage			-1.20			-0.08			-2.89
			(0.70)*			(0.69)			(1.40)**
Constant	7.37	7.63	7.43	5.61	6.11	6.10	9.79	9.68	9.16
	(2.09)***	(1.99)***	(1.98)***	(2.49)**	(2.39)**	(2.39)**	(3.31)***	(3.21)***	(3.17)***
Observations	24085	24085	24085	14203	14203	14203	9882	9882	9882
R-squared	0.10	0.11	0.11	0.11	0.11	0.11	0.09	0.09	0.09

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

Note: Standard errors in parentheses. Standard errors are adjusted for repeated observations of individuals. Estimates include controls for marital status, urban residence, age, firm size, job tenure, education, sex, race, year, AFQT score, industry and occupation.

Table 6: Average Health Expenditures by Sex and Weight

	Male			Female		
Sample	Normal Weight	Obese	Difference	Normal Weight	Obese	Difference
Aged 18-64	$1,721	$2,271	$551 *	$2,294	$3,277	$983 ***
Aged 20-50	$1,106	$1,061	-$45	$1,536	$2,284	$748 ***
Privately Insured and Aged 20-50	$1,086	$1,011	-$76	$1,521	$2,190	$669 **

Data Source: 1998 Medical Expenditure Panel Survey

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

Table 7: Incremental Medical Expenditures Associated with Obesity by Type of Service and Source of Payment

Sample: Privately Insured Individuals age 20-50

	Male	Female
Total expenditure	-$76	$669 **
By Type of Expenditure		
Inpatient	-$31	$234 *
Outpatient	-$45	$435 **
Emergency	-$1	$24
Prescription Drugs	$74 *	$103 **
By Source of Payment		
Self-pay	-$16	-$17
Insured	-$60	$686 ***

Data Source: 1998 Medical Expenditure Panel Survey

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

Appendix A1: Study sample descriptive statistics

		Main Study Sample			Study Sample 2			Study Sample 3		
Variable	**Category**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Hourly Wage		35,750	13.352	14.218	51,812	12.881	14.272	19,970	14.559	15.003
Insurance Status	Uninsured	35,746	0.215	0.411	45,175	0.165	0.371	19,967	0.137	0.344
	Current Employer	35,750	0.785	0.411	45,201	0.613	0.487	19,970	0.863	0.344
BMI	Obesity	34,223	0.167	0.373	43,198	0.166	0.372	19,438	0.174	0.379
	Overweight	34,223	0.354	0.478	43,198	0.344	0.475	19,438	0.368	0.482
Gender	Male	35,750	0.612	0.487	51,812	0.570	0.495	19,970	0.653	0.476
	Female	35,750	0.388	0.487	51,812	0.430	0.495	19,970	0.347	0.476
Race	White	35,544	0.832	0.374	51,526	0.839	0.368	19,873	0.851	0.356
	Black	35,544	0.140	0.347	51,526	0.134	0.340	19,873	0.125	0.330
	Other	35,544	0.028	0.164	51,526	0.028	0.164	19,873	0.024	0.155
Marital Status	Never	35,747	0.280	0.449	51,809	0.252	0.434	19,969	0.251	0.434
	Married	35,747	0.530	0.499	51,809	0.577	0.494	19,969	0.582	0.493
	Formerly	35,747	0.190	0.392	51,809	0.171	0.377	19,969	0.167	0.373
Age Category	<29	35,750	0.219	0.414	51,812	0.234	0.423	19,970	0.211	0.408
	29-32	35,750	0.283	0.450	51,812	0.292	0.455	19,970	0.277	0.448
	33-35	35,750	0.264	0.441	51,812	0.264	0.441	19,970	0.267	0.442
	36-41	35,750	0.234	0.424	51,812	0.210	0.407	19,970	0.246	0.431
Education Status	0-8 years	35,601	0.023	0.149	51,590	0.022	0.146	19,901	0.018	0.133
	9-12 years	35,601	0.517	0.500	51,590	0.518	0.500	19,901	0.510	0.500
	13+ years	35,601	0.460	0.498	51,590	0.460	0.498	19,901	0.472	0.499
AFQT Quartile	1	34,284	0.145	0.353	49,668	0.142	0.349	19,381	0.122	0.327
	2	34,284	0.224	0.417	49,668	0.225	0.418	19,381	0.211	0.408
	3	34,284	0.288	0.453	49,668	0.293	0.455	19,381	0.291	0.454
	4 (Highest Quartile)	34,284	0.343	0.475	49,668	0.340	0.474	19,381	0.377	0.485
Urban Residence		35,440	0.766	0.423	51,262	0.765	0.424	19,856	0.751	0.432
Job Tenure	<48 weeks	31,721	0.220	0.414	46,699	0.239	0.426	17,459	0.161	0.367
	48 - 143 weeks	31,721	0.240	0.427	46,699	0.250	0.433	17,459	0.209	0.406
	144 - 287 weeks	31,721	0.211	0.408	46,699	0.209	0.406	17,459	0.216	0.412
	288+ weeks	31,721	0.328	0.470	46,699	0.303	0.459	17,459	0.414	0.493
# Employees	0 - 9	34,569	0.211	0.408	50,114	0.257	0.437	19,442	0.182	0.386
	10 - 24	34,569	0.135	0.342	50,114	0.141	0.348	19,442	0.127	0.333
	25 - 49	34,569	0.120	0.324	50,114	0.115	0.319	19,442	0.119	0.324
	50 - 999	34,569	0.404	0.491	50,114	0.368	0.482	19,442	0.430	0.495
	1000+	34,569	0.130	0.336	50,114	0.119	0.324	19,442	0.143	0.350

(continued)

Appendix A1: Study sample descriptive statistics (continued)

		Main Study Sample			Study Sample 2			Study Sample 3		
Variable	**Category**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Survey Year	1989	35,750	0.144	0.351	51,812	0.122	0.328	19,970	0.134	0.341
	1990	35,750	0.152	0.359	51,812	0.130	0.336	19,970	0.146	0.353
	1991	35,750	0.000	0.000	51,812	0.131	0.337	19,970	0.000	0.000
	1992	35,750	0.140	0.347	51,812	0.122	0.327	19,970	0.141	0.348
	1993	35,750	0.142	0.350	51,812	0.123	0.329	19,970	0.143	0.350
	1994	35,750	0.135	0.342	51,812	0.116	0.320	19,970	0.136	0.342
	1996	35,750	0.139	0.346	51,812	0.124	0.329	19,970	0.145	0.352
	1998	35,750	0.148	0.355	51,812	0.133	0.339	19,970	0.156	0.362
Industry	Agriculture	31,454	0.021	0.144	46,560	0.023	0.149	17,088	0.020	0.141
	Forestry	31,454	0.001	0.033	46,560	0.001	0.033	17,088	0.001	0.035
	Mining	31,454	0.008	0.087	46,560	0.007	0.084	17,088	0.008	0.090
	Construction	31,454	0.079	0.270	46,560	0.086	0.280	17,088	0.077	0.267
	Manufacturing	31,454	0.220	0.414	46,560	0.199	0.399	17,088	0.251	0.434
	Transportation	31,454	0.083	0.276	46,560	0.075	0.264	17,088	0.086	0.281
	Wholesale Trade	31,454	0.032	0.176	46,560	0.034	0.180	17,088	0.035	0.183
	Retail Trade	31,454	0.124	0.329	46,560	0.132	0.338	17,088	0.100	0.300
	Finance	31,454	0.068	0.252	46,560	0.066	0.248	17,088	0.069	0.254
	Business Services	31,454	0.075	0.263	46,560	0.077	0.267	17,088	0.071	0.256
	Personal Services	31,454	0.026	0.159	46,560	0.034	0.182	17,088	0.015	0.120
	Entertainment	31,454	0.012	0.107	46,560	0.013	0.113	17,088	0.010	0.101
	Professional Services	31,454	0.191	0.393	46,560	0.200	0.400	17,088	0.185	0.388
	Public Administration	31,454	0.061	0.239	46,560	0.053	0.224	17,088	0.072	0.258
Occupation	Management	32,979	0.275	0.446	48,385	0.266	0.442	18,172	0.292	0.455
	Technical	32,979	0.129	0.335	48,385	0.134	0.341	18,172	0.130	0.337
	Administrative	32,979	0.149	0.356	48,385	0.152	0.359	18,172	0.151	0.358
	Service	32,979	0.106	0.308	48,385	0.119	0.324	18,172	0.079	0.270
	Farming	32,979	0.021	0.142	48,385	0.023	0.150	18,172	0.019	0.136
	Production	32,979	0.141	0.348	48,385	0.134	0.341	18,172	0.151	0.359
	Operation	32,979	0.179	0.384	48,385	0.170	0.376	18,172	0.176	0.381
	Military	32,979	0.001	0.024	48,385	0.001	0.024	18,172	0.001	0.026

Main Study Sample: Fulltime workers with current employer sponsored insurance or uninsured with non-missing wage data

Study Sample 2: Fulltime workers with non-missing wage data

Study Sample 3: Continuous fulltime workers holding current employer sponsored insurance or uninsured with non-missing wage data

Appendix A2: Full results for Year Specific Regressions

Part 1: Unadjusted Difference-in Difference Estimates of the Wage Offset for Obesity

	All Years	**1989**	**1990**	**1992**	**1993**	**1994**	**1996**	**1998**
Obese	-0.40	-2.05	-1.97	0.94	-0.64	-1.24	-0.55	0.46
	(0.51)	(0.72)***	(0.82)**	(2.32)	(0.48)	(0.92)	(0.82)	(0.96)
Health Coverage	5.59	3.60	4.06	4.76	6.02	5.03	6.61	9.17
	(0.27)***	(0.74)***	(0.82)***	(0.58)***	(0.39)***	(0.54)***	(0.59)***	(0.50)***
Obese*Health Coverage	-1.30	0.97	-0.48	-2.23	-1.69	-1.07	-2.32	-3.86
	(0.59)**	(1.01)	(0.94)	(2.52)	(0.64)***	(1.00)	(0.92)**	(1.15)***
Constant	9.19	8.20	8.77	8.82	8.65	10.09	10.26	10.12
	(0.22)***	(0.67)***	(0.73)***	(0.49)***	(0.24)***	(0.48)***	(0.53)***	(0.28)***
Observations	34219	5657	5864	4577	4709	4289	4476	4647
R-squared	0.02	0.01	0.01	0.02	0.04	0.04	0.06	0.06

Standard errors in parentheses

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

Appendix A2: Full Results for Year Specific Regressions
Part 2: Adjusted Difference-in Difference Estimates of the Wage Offset for Obesity

	All Years	1989	1990	1992	1993	1994	1996	1998
Obese	0.03	-1.61	-1.16	1.66	0.13	0.02	0.64	0.71
	(0.64)	(0.74)**	(0.50)**	(2.66)	(0.93)	(1.58)	(0.91)	(1.06)
Health Coverage	2.01	1.03	2.20	1.77	2.88	1.13	2.42	3.87
	(0.29)***	(0.75)	(0.50)***	(0.78)**	(0.76)***	(0.77)	(0.67)***	(0.47)***
Obese*Health Coverage	-1.20	1.45	-0.60	-1.95	-1.33	-0.96	-2.49	-2.58
	(0.70)*	(1.05)	(0.65)	(2.82)	(1.18)	(1.65)	(1.08)**	(1.24)**
Marital Status: Married	0.71	0.80	-0.75	0.67	1.87	0.37	1.28	1.56
	(0.33)**	(0.53)	(0.88)	(0.64)	(0.95)**	(0.61)	(0.65)**	(0.96)
Marital Status: Other	-0.53	1.41	-1.69	-0.96	0.01	-0.24	-0.66	-0.03
	(0.36)	(1.18)	(0.80)**	(0.66)	(0.72)	(0.63)	(0.58)	(0.84)
Urban Residence	1.55	1.48	2.32	1.90	2.73	1.68	1.95	0.77
	(0.25)***	(0.68)**	(0.43)***	(0.73)***	(0.78)***	(0.45)***	(0.56)***	(0.49)
Age Category: 30-32	0.00	-0.27	0.21	0.55	1.05	-0.96	-0.70	0.00
	(0.31)	(0.52)	(0.60)	(0.57)	(0.77)	(0.74)	(0.52)	(0.00)
Age Category: 33-35	0.46	0.00	0.07	1.20	1.15	-0.14	0.00	0.00
	(0.40)	(0.00)	(0.64)	(0.74)	(0.65)*	(0.83)	(0.00)	(0.00)
Age Category: 36-41	0.97	0.00	0.00	0.00	0.52	0.00	0.16	0.56
	(0.53)*	(0.00)	(0.00)	(0.00)	(0.97)	(0.00)	(0.52)	(0.54)
Employer Size: 10-24 people	-0.65	-0.18	-0.85	-1.25	0.86	-2.63	-0.04	-0.66
	(0.41)	(0.87)	(0.84)	(1.26)	(1.85)	(1.02)**	(0.88)	(0.92)
Employer Size: 25-49 people	-0.24	0.66	-0.44	-1.69	-0.66	-0.56	-0.12	0.10
	(0.54)	(1.34)	(1.13)	(1.53)	(0.73)	(1.31)	(0.76)	(1.20)
Employer Size: 50-999 people	-0.29	-0.33	-0.97	-0.57	-0.98	-0.88	0.27	0.06
	(0.43)	(0.88)	(0.97)	(1.32)	(0.67)	(1.10)	(0.74)	(0.71)
Employer Size: >999 people	1.31	0.71	1.94	-0.21	-0.40	1.79	2.00	1.66
	(0.53)**	(0.94)	(1.35)	(1.33)	(0.96)	(1.48)	(1.11)*	(0.87)*
Job Tenure: 1-3 years	0.36	0.76	0.47	1.60	0.65	-0.65	0.39	-1.02
	(0.28)	(0.65)	(0.69)	(0.97)*	(1.05)	(0.60)	(0.50)	(0.75)
Job Tenure: 3-6 years	1.09	2.20	0.71	1.41	-0.43	1.20	1.28	0.78
	(0.32)***	(0.80)***	(0.57)	(0.83)*	(0.70)	(0.84)	(0.85)	(0.87)
Job Tenure: >6 years	2.31	2.42	2.51	2.17	0.37	1.49	3.03	1.70
	(0.34)***	(0.60)***	(0.92)***	(0.77)***	(0.89)	(0.69)**	(0.70)***	(0.88)*
Education: 9-12 years	0.24	0.17	0.56	0.53	1.29	0.61	-1.38	0.28
	(0.39)	(0.71)	(0.46)	(0.62)	(1.71)	(0.83)	(1.53)	(0.76)
Education: >12 years	2.11	0.48	2.03	1.65	3.62	2.92	1.01	4.04
	(0.46)***	(0.84)	(0.97)**	(0.82)**	(1.88)*	(0.97)***	(1.57)	(0.81)***
Gender: Female	-2.12	-0.71	-1.65	-1.98	-1.00	-2.32	-2.43	-3.61
	(0.29)***	(0.54)	(0.68)**	(0.59)***	(0.54)*	(0.61)***	(0.66)***	(0.64)***
Race: Black	-0.91	-0.42	-1.39	-0.37	-1.56	-0.86	-0.76	-1.10
	(0.23)***	(0.39)	(0.47)***	(0.54)	(1.07)	(0.42)**	(0.44)*	(0.45)**
Race: Other	-0.28	0.12	-0.74	-0.78	0.70	-0.96	-1.15	0.58
	(0.40)	(0.89)	(0.60)	(0.56)	(1.14)	(0.65)	(0.90)	(1.20)
Survey Year: 1990	0.52	-	-	-	-	-	-	-
	(0.38)							
Survey Year: 1992	1.12	-	-	-	-	-	-	-
	(0.37)***							
Survey Year: 1993	1.25	-	-	-	-	-	-	-
	(0.48)***							
Survey Year: 1994	1.86	-	-	-	-	-	-	-
	(0.40)***							
Survey Year: 1996	2.85	-	-	-	-	-	-	-
	(0.46)***							
Survey Year: 1998	4.85	-	-	-	-	-	-	-
	(0.51)***							

(continued)

Appendix A2: Full Results for Year Specific Regressions

Part 2: Adjusted Difference-in Difference Estimates of the Wage Offset for Obesity (continued)

	All Years	1989	1990	1992	1993	1994	1996	1998
AFQT Quartile: 2	0.83	0.19	0.94	2.00	-0.79	1.12	0.10	0.82
	(0.27)***	(0.56)	(0.54)*	(0.73)***	(2.05)	(0.54)**	(0.44)	(0.36)**
AFQT Quartile: 3	1.71	2.08	1.67	2.00	-0.75	1.61	1.12	2.15
	(0.32)***	(0.93)**	(0.63)***	(0.46)***	(2.20)	(0.63)**	(0.58)*	(0.48)***
AFQT Quartile: 4 (Highest)	3.31	2.71	2.89	4.62	-0.50	3.58	3.89	3.72
	(0.43)***	(0.97)***	(0.83)***	(1.00)***	(2.23)	(0.85)***	(0.72)***	(0.88)***
Industry: agriculture	-1.88	0.37	-1.89	-0.85	-0.67	-1.82	-2.88	-3.35
	(0.55)***	(0.88)	(0.75)**	(0.76)	(1.43)	(1.30)	(1.19)**	(1.60)**
Industry: forestry	3.92	-1.73	0.86	0.91	0.00	25.32	2.49	-1.56
	(3.21)	(1.02)*	(2.49)	(2.45)	(0.00)	(15.85)	(2.41)	(3.17)
Industry: mining	0.83	0.99	1.58	2.49	-0.89	8.58	-2.11	-1.06
	(0.94)	(0.75)	(1.05)	(1.15)**	(1.53)	(6.06)	(1.48)	(2.54)
Industry: construction	1.89	3.13	2.04	2.88	2.56	1.21	1.67	0.22
	(0.50)***	(1.40)**	(0.83)**	(1.29)**	(1.26)**	(0.96)	(1.11)	(0.88)
Industry: manufacturing	0.63	1.08	2.28	1.32	1.46	0.59	-0.63	-1.17
	(0.45)	(0.52)**	(1.13)**	(1.04)	(1.05)	(0.96)	(1.00)	(0.93)
Industry: transportation	1.96	3.16	2.09	1.93	4.52	3.32	2.14	0.00
	(0.54)***	(1.41)**	(0.87)**	(0.65)***	(3.72)	(1.48)**	(1.67)	(1.00)
Industry: wholesale trade	-0.51	-0.48	-0.21	1.58	-0.78	-1.89	-1.45	-1.87
	(0.60)	(0.75)	(0.60)	(2.26)	(1.05)	(1.21)	(1.32)	(1.42)
Industry: retail trade	-1.80	-0.10	-1.45	-0.32	-1.37	-2.29	-2.98	-4.14
	(0.43)***	(0.93)	(0.53)***	(1.03)	(0.80)*	(1.19)*	(0.98)***	(0.92)***
Industry: finance	1.83	1.27	0.04	3.47	1.75	1.15	0.27	4.44
	(0.74)**	(0.71)*	(0.74)	(2.04)*	(1.28)	(1.22)	(1.26)	(2.48)*
Industry: personal services	-2.43	-1.58	-1.54	-2.69	-1.48	-0.93	-1.93	-4.24
	(0.48)***	(0.56)***	(0.68)**	(0.89)***	(0.90)	(2.15)	(1.09)*	(1.07)***
Industry: entertainment	-1.69	-0.79	-2.57	-1.45	1.30	-3.18	10.23	-4.42
	(0.89)*	(0.97)	(0.82)***	(0.94)	(3.45)	(1.49)**	(9.65)	(1.39)***
Industry: professional services	-0.54	1.02	0.95	-0.18	-0.18	0.34	-1.03	-3.06
	(0.51)	(0.96)	(1.12)	(0.89)	(0.91)	(1.28)	(1.13)	(1.24)**
Industry: public administration	-0.46	1.97	-0.31	0.18	1.08	0.75	-0.96	-3.49
	(0.45)	(1.30)	(0.62)	(0.76)	(1.00)	(1.03)	(1.40)	(0.96)***
Occupation: management	-0.06	3.90	1.87	3.40	2.72	-5.58	3.62	7.65
	(1.90)	(1.16)***	(1.00)*	(1.01)***	(1.55)*	(3.32)*	(1.90)*	(1.38)***
Occupation: technical	-1.40	2.87	1.69	3.15	1.20	-4.27	2.21	4.09
	(1.93)	(1.03)***	(0.97)*	(0.93)***	(1.57)	(3.81)	(2.14)	(1.47)***
Occupation: administrative	-3.53	1.54	1.81	1.00	-1.02	-9.36	-1.38	0.00
	(1.92)*	(1.18)	(1.46)	(1.14)	(1.54)	(3.36)***	(1.88)	(1.36)
Occupation: services	-3.19	0.96	1.05	2.29	-0.34	-8.24	-0.77	1.15
	(1.91)*	(0.98)	(0.87)	(1.52)	(1.43)	(3.41)**	(1.75)	(1.34)
Occupation: farming	-4.38	0.00	0.00	0.00	0.18	-10.84	-2.41	0.00
	(1.94)**	(0.00)	(0.00)	(0.00)	(1.43)	(3.54)***	(1.90)	(0.00)
Occupation: production	-2.73	2.03	2.62	1.42	-0.23	-7.99	0.17	1.75
	(1.92)	(0.89)**	(1.39)*	(0.88)	(1.48)	(3.47)**	(1.80)	(1.33)
Occupation: operators	-4.04	0.99	0.52	0.17	0.68	-9.10	-1.18	-0.09
	(1.92)**	(0.92)	(0.88)	(0.90)	(1.17)	(3.54)**	(1.86)	(1.31)
Constant	24081	5119	5276	4207	1172	2148	2044	4115
	0.11	0.04	0.05	0.07	0.10	0.22	0.31	0.23
Observations								
R-squared								

Standard errors in parentheses

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

Appendix A3: Adjusted Difference-in-Difference Estimates and Specification Checks

	Fulltime workers with employer-sponsored or no coverage	All full-time workers	Continuous fulltime workers with employer-sponsored or no coverage	The effect of Overweight: Fulltime workers with employer-sponsored or no coverage	Log transformed wages: Fulltime workers with employer-sponsored or no coverage
Obese	0.04	-0.17	-0.71	0.19	-0.04
	(0.64)	(0.55)	(0.64)	(0.64)	(0.03)
Current Employer Coverage	2.01	2.37	2.04	2.36	0.22
	(0.29)***	(0.29)***	(0.53)***	(0.33)***	(0.01)***
Obese*Employer Coverage	-1.20	-0.96	-0.99	-1.56	-0.02
	(0.70)*	(0.61)	(0.76)	(0.71)**	(0.03)
Overweight				0.39	
				(0.49)	
Overweight*Employer Coverage				-0.83	
				(0.57)	
Other Employer Coverage		0.49			
		(0.42)			
Obese*Other Employer Coverage		-0.11			
		(0.89)			
Individual Insurance Coverage		2.15			
		(0.61)***			
Obese*Individual Coverage		-0.72			
		(1.21)			
Public Insurance Coverage		0.41			
		(1.27)			
Obese*Public Coverage		-1.79			
		(1.42)			
Marital Status: Married	0.71	0.88	0.52	0.73	0.05
	(0.33)**	(0.30)***	(0.50)	(0.33)**	(0.01)***
Marital Status: Other	-0.53	-0.27	-0.73	-0.52	-0.02
	(0.36)	(0.33)	(0.56)	(0.36)	(0.01)
Urban Residence	1.55	1.65	1.48	1.54	0.11
	(0.25)***	(0.22)***	(0.38)***	(0.25)***	(0.01)***
Age Category: 30-32	-0.00	0.40	-0.11	0.00	0.01
	(0.31)	(0.26)	(0.42)	(0.31)	(0.01)
Age Category: 33-35	0.46	0.98	0.15	0.46	0.03
	(0.40)	(0.32)***	(0.55)	(0.40)	(0.02)
Age Category: 36-41	0.97	1.90	1.56	0.98	0.02
	(0.53)*	(0.52)***	(0.76)**	(0.53)*	(0.02)
Employer Size: 10-24 people	-0.65	-0.27	-1.16	-0.66	0.01
	(0.41)	(0.39)	(0.66)*	(0.41)	(0.02)
Employer Size: 25-49 people	-0.24	-0.34	0.04	-0.25	0.04
	(0.54)	(0.41)	(0.89)	(0.54)	(0.02)**
Employer Size: 50-999 people	-0.29	-0.03	-0.74	-0.28	0.07
	(0.43)	(0.35)	(0.68)	(0.43)	(0.01)***
Employer Size: >999 people	1.31	1.39	0.90	1.30	0.17
	(0.53)**	(0.43)***	(0.79)	(0.53)**	(0.02)***
Job Tenure: 1-3 years	0.36		0.63	0.36	0.05
	(0.28)		(0.50)	(0.28)	(0.01)***
Job Tenure: 3-6 years	1.09		0.65	1.09	0.12
	(0.32)***		(0.44)	(0.32)***	(0.01)***
Job Tenure: >6 years	2.31		1.80	2.31	0.20
	(0.34)***		(0.48)***	(0.34)***	(0.01)***

(continued)

Appendix A3: Adjusted Difference-in-Difference Estimates and Specification Checks (continued)

	Fulltime workers with employer-sponsored or no coverage	All full-time workers	Continuous fulltime workers with employer-sponsored or no coverage	The effect of Overweight: Fulltime workers with employer sponsored or no coverage	Log transformed wages: Fulltime workers with employer-sponsored or no coverage
Education: 9-12 years	0.24	-0.25	0.38	0.26	0.04
	(0.39)	(0.89)	(0.60)	(0.39)	(0.03)
Education: >12 years	2.11	1.64	2.21	2.13	0.19
	(0.46)***	(0.91)*	(0.68)***	(0.46)***	(0.03)***
Gender: Female	-2.13	-2.47	-2.17	-2.19	-0.17
	(0.29)***	(0.27)***	(0.45)***	(0.29)***	(0.01)***
Race: Black	-0.91	-1.07	-0.83	-0.89	-0.06
	(0.23)***	(0.22)***	(0.34)**	(0.23)***	(0.01)***
Race: Other	-0.28	0.02	-0.21	-0.28	0.01
	(0.40)	(0.46)	(0.64)	(0.40)	(0.02)
AFQT Quartile: 2	0.83	1.02	1.17	0.84	0.10
	(0.27)***	(0.29)***	(0.44)***	(0.27)***	(0.01)***
AFQT Quartile: 3	1.72	1.68	1.89	1.73	0.17
	(0.32)***	(0.30)***	(0.46)***	(0.32)***	(0.02)***
AFQT Quartile: 4 (Highest)	3.31	3.32	3.61	3.32	0.24
	(0.43)***	(0.37)***	(0.60)***	(0.43)***	(0.02)***
Survey Year: 1990	0.53	0.54	0.59	0.53	0.06
	(0.38)	(0.34)	(0.51)	(0.38)	(0.01)***
Survey Year: 1992	1.12	0.89	1.73	1.13	0.12
	(0.37)***	(0.32)***	(0.52)***	(0.37)***	(0.01)***
Survey Year: 1993	1.25	1.68	2.09	1.27	0.16
	(0.48)***	(0.34)***	(0.76)***	(0.48)***	(0.02)***
Survey Year: 1994	1.86	1.58	2.41	1.86	0.20
	(0.40)***	(0.37)***	(0.54)***	(0.41)***	(0.02)***
Survey Year: 1996	2.85	2.51	3.42	2.88	0.29
	(0.46)***	(0.45)***	(0.66)***	(0.46)***	(0.02)***
Survey Year: 1998	4.86	4.27	5.80	4.89	0.40
	(0.51)***	(0.48)***	(0.72)***	(0.51)***	(0.02)***
Industry: agriculture	-1.88	-2.24	-2.34	-1.86	-0.18
	(0.55)***	(0.72)***	(0.83)***	(0.55)***	(0.04)***
Industry: forestry	3.92	2.09	0.66	3.88	0.35
	(3.21)	(2.26)	(1.47)	(3.20)	(0.14)**
Industry: mining	0.83	1.40	0.67	0.86	0.09
	(0.94)	(0.96)	(1.25)	(0.95)	(0.06)
Industry: construction	1.89	1.96	0.73	1.90	0.16
	(0.50)***	(0.45)***	(0.64)	(0.51)***	(0.02)***
Industry: manufacturing	0.63	0.77	0.64	0.65	0.02
	(0.45)	(0.41)*	(0.65)	(0.45)	(0.02)
Industry: transportation	1.96	2.06	1.74	1.98	0.12
	(0.54)***	(0.50)***	(0.79)**	(0.54)***	(0.02)***
Industry: wholesale trade	-0.51	0.13	-0.16	-0.48	-0.05
	(0.60)	(0.63)	(0.92)	(0.61)	(0.03)**
Industry: retail trade	-1.80	-2.02	-2.40	-1.78	-0.18
	(0.43)***	(0.37)***	(0.71)***	(0.43)***	(0.02)***
Industry: finance	1.83	1.64	2.02	1.83	0.07
	(0.74)**	(0.61)***	(1.04)*	(0.74)**	(0.03)***
Industry: personal services	-2.43	-1.75	-3.15	-2.41	-0.28
	(0.48)***	(0.63)***	(0.94)***	(0.48)***	(0.03)***
Industry: entertainment	-1.69	-1.49	-2.03	-1.67	-0.14
	(0.89)*	(0.92)	(1.50)	(0.89)*	(0.05)***
Industry: professional services	-0.54	-0.33	-0.70	-0.53	-0.08
	(0.51)	(0.47)	(0.77)	(0.51)	(0.02)***
Industry: public administration	-0.46	0.27	-0.99	-0.43	0.00
	(0.45)	(0.49)	(0.60)*	(0.45)	(0.02)

(continued)

Appendix A3: Adjusted Difference-in-Difference Estimates and Specification Checks (continued)

	Fulltime workers with employer-sponsored or no coverage	All full-time workers	Continuous fulltime workers with employer-sponsored or no coverage	The effect of Overweight: Fulltime workers with employer-sponsored or no coverage	Log transformed wages: Fulltime workers with employer-sponsored or no coverage
Occupation: management	-0.06	0.66	0.13	-0.04	0.01
	(1.90)	(1.39)	(2.35)	(1.87)	(0.10)
Occupation: technical	-1.40	-0.67	-1.42	-1.38	-0.06
	(1.93)	(1.40)	(2.44)	(1.90)	(0.11)
Occupation: administrative	-3.53	-3.10	-3.60	-3.50	-0.21
	(1.92)*	(1.39)**	(2.39)	(1.90)*	(0.11)**
Occupation: services	-3.19	-2.83	-3.21	-3.14	-0.24
	(1.91)*	(1.40)**	(2.41)	(1.89)*	(0.11)**
Occupation: farming	-4.38	-3.03	-4.92	-4.35	-0.31
	(1.94)**	(1.57)*	(2.47)**	(1.92)**	(0.11)***
Occupation: production	-2.73	-2.28	-2.68	-2.70	-0.12
	(1.92)	(1.40)	(2.42)	(1.90)	(0.11)
Occupation: operators	-4.04	-3.41	-4.32	-4.02	-0.25
	(1.92)**	(1.40)**	(2.43)*	(1.89)**	(0.11)**
Constant	7.43	7.48	7.94	7.20	1.74
	(1.98)***	(1.62)***	(2.57)***	(1.95)***	(0.11)***
Observations	24085	34815	13276	24085	24085
R-squared	0.11	0.10	0.10	0.11	0.42

Robust standard errors in parentheses

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

Appendix A4: Adjusted Difference in difference estimates of the effect of incidence of other benefits on wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Obese	-0.909	-0.401	-0.147	-0.577	-0.677	-0.751	-0.921	-0.760
	(0.353)**	(0.469)	(0.666)	(0.531)	(0.336)**	(0.381)**	(0.301)***	(0.295)**
Life Insurance	1.455							
	(0.294)***							
Obese*Life Insurance	0.111							
	(0.499)							
Dental Insurance		1.605						
		(0.319)***						
Obese*Dental Insurance		-0.838						
		(0.543)						
Maternity Benefits			0.634					
			(0.309)**					
Obese*Maternity Benefits			-0.862					
			(0.733)					
Retirement Benefits				1.538				
				(0.304)***				
Obese*Retirement Benefits				-0.414				
				(0.618)				
Profit Sharing					1.295			
					(0.300)***			
Obese*Profit Sharing					-0.382			
					(0.682)			
Training/Education						1.383		
						(0.287)***		
Obese*Training/Education						-0.183		
						(0.556)		
Childcare Benefits							0.102	
							(0.501)	
Obese*Childcare Benefits							1.577	
							(1.987)	
Flexible Hours								0.885
								(0.282)***
Obese*Flexible Hours								-0.125
								(0.580)
Marital Status: Married	0.830	0.901	0.752	0.749	0.851	0.779	0.858	0.911
	(0.341)**	(0.321)***	(0.365)**	(0.341)**	(0.341)**	(0.343)**	(0.346)**	(0.341)***
Marital Status: Other	-0.581	-0.496	-0.674	-0.630	-0.621	-0.612	-0.629	-0.608
	(0.347)*	(0.334)	(0.373)*	(0.353)*	(0.352)*	(0.354)*	(0.356)*	(0.349)*
Urban Residence	1.715	1.514	1.724	1.706	1.699	1.677	1.704	1.681
	(0.238)***	(0.232)***	(0.250)***	(0.238)***	(0.238)***	(0.238)***	(0.240)***	(0.235)***
Age Category: 30-32	0.033	-0.030	0.067	0.070	0.099	0.123	0.006	0.081
	(0.308)	(0.288)	(0.328)	(0.313)	(0.312)	(0.312)	(0.315)	(0.309)
Age Category: 33-35	0.557	0.331	0.600	0.530	0.542	0.590	0.441	0.501
	(0.407)	(0.377)	(0.431)	(0.407)	(0.410)	(0.410)	(0.408)	(0.405)
Age Category: 36-41	1.142	0.963	1.348	1.156	1.170	1.228	1.018	1.123
	(0.539)**	(0.525)*	(0.562)**	(0.539)**	(0.541)**	(0.543)**	(0.540)*	(0.537)**

(continued)

Appendix A4: Adjusted Difference in difference estimates of the effect of incidence of other benefits on wages (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Employer Size: 10-24 people	-0.454	-0.170	-0.178	-0.441	-0.299	-0.305	-0.257	-0.212
	(0.429)	(0.377)	(0.449)	(0.427)	(0.422)	(0.425)	(0.422)	(0.415)
Employer Size: 25-49 people	-0.198	0.273	0.383	-0.017	0.237	0.169	0.295	0.338
	(0.517)	(0.508)	(0.576)	(0.541)	(0.538)	(0.538)	(0.543)	(0.528)
Employer Size: 50-999 people	-0.163	0.180	0.395	-0.197	0.191	0.068	0.387	0.400
	(0.435)	(0.365)	(0.451)	(0.441)	(0.424)	(0.424)	(0.428)	(0.414)
Employer Size: >999 people	1.458	1.716	1.883	1.376	1.788	1.591	1.983	1.980
	(0.546)***	(0.474)***	(0.558)***	(0.547)**	(0.537)***	(0.536)***	(0.559)***	(0.531)***
Job Tenure: 1-3 years	0.419	0.462	0.615	0.496	0.558	0.541	0.597	0.615
	(0.286)	(0.282)	(0.317)*	(0.298)*	(0.297)*	(0.297)*	(0.296)**	(0.291)**
Job Tenure: 3-6 years	1.145	1.221	1.266	1.117	1.239	1.189	1.350	1.366
	(0.296)***	(0.291)***	(0.304)***	(0.302)***	(0.292)***	(0.295)***	(0.293)***	(0.288)***
Job Tenure: >6 years	2.401	2.436	2.506	2.357	2.532	2.491	2.635	2.655
	(0.339)***	(0.319)***	(0.338)***	(0.352)***	(0.339)***	(0.338)***	(0.340)***	(0.333)***
Education: 9-12 years	0.699	0.597	0.652	0.615	0.649	0.614	0.684	0.606
	(0.346)**	(0.334)*	(0.350)*	(0.353)*	(0.340)*	(0.341)*	(0.343)**	(0.335)*
Education: >12 years	2.756	2.700	2.547	2.579	2.626	2.555	2.692	2.609
	(0.431)***	(0.419)***	(0.438)***	(0.442)***	(0.423)***	(0.432)***	(0.432)***	(0.427)***
Gender: Female	-2.118	-2.063	-2.256	-2.071	-2.119	-2.127	-2.179	-2.109
	(0.297)***	(0.294)***	(0.321)***	(0.299)***	(0.298)***	(0.298)***	(0.298)***	(0.296)***
Race: Black	-1.009	-1.000	-0.974	-0.983	-0.977	-0.973	-1.014	-0.971
	(0.237)***	(0.233)***	(0.245)***	(0.236)***	(0.237)***	(0.236)***	(0.235)***	(0.235)***
Race: Other	-0.408	-0.413	-0.383	-0.383	-0.363	-0.380	-0.365	-0.376
	(0.404)	(0.403)	(0.426)	(0.413)	(0.412)	(0.406)	(0.417)	(0.406)
AFQT Quartile: 2	0.795	0.829	0.973	0.855	0.891	0.841	0.887	0.858
	(0.283)***	(0.278)***	(0.293)***	(0.287)***	(0.283)***	(0.280)***	(0.280)***	(0.278)***
AFQT Quartile: 3	1.616	1.572	1.767	1.678	1.782	1.662	1.762	1.742
	(0.314)***	(0.300)***	(0.324)***	(0.316)***	(0.315)***	(0.315)***	(0.315)***	(0.312)***
AFQT Quartile: 4 (Highest)	3.220	3.307	3.664	3.373	3.523	3.359	3.534	3.453
	(0.423)***	(0.419)***	(0.462)***	(0.434)***	(0.435)***	(0.436)***	(0.439)***	(0.431)***
Survey Year: 1990	0.726	0.591	0.631	0.722	0.744	0.713	0.675	0.706
	(0.375)*	(0.352)*	(0.402)	(0.378)*	(0.374)**	(0.376)*	(0.378)*	(0.370)*
Survey Year: 1992	1.238	1.213	1.190	1.278	1.263	1.310	1.273	1.292
	(0.350)***	(0.350)***	(0.383)***	(0.365)***	(0.365)***	(0.366)***	(0.367)***	(0.360)***
Survey Year: 1993	1.470	1.431	1.327	1.332	1.358	1.369	1.430	1.358
	(0.491)***	(0.483)***	(0.516)**	(0.496)***	(0.493)***	(0.494)***	(0.494)***	(0.487)***
Survey Year: 1994	1.905	1.928	1.641	1.816	1.859	1.871	1.880	1.886
	(0.395)***	(0.387)***	(0.416)***	(0.397)***	(0.398)***	(0.398)***	(0.400)***	(0.393)***
Survey Year: 1996	3.052	3.049	2.804	2.939	3.023	2.943	3.010	2.994
	(0.462)***	(0.448)***	(0.484)***	(0.464)***	(0.464)***	(0.468)***	(0.465)***	(0.460)***
Survey Year: 1998	5.105	5.063	4.805	4.977	5.113	5.017	5.123	5.059
	(0.513)***	(0.507)***	(0.542)***	(0.514)***	(0.513)***	(0.521)***	(0.520)***	(0.513)***

(continued)

Appendix A4: Adjusted Difference in difference estimates of the effect of incidence of other benefits on wages (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Industry: agriculture	-2.097	-2.072	-2.161	-2.173	-2.308	-2.111	-2.225	-2.297
	(0.589)***	(0.586)***	(0.602)***	(0.585)***	(0.586)***	(0.569)***	(0.584)***	(0.585)***
Industry: forestry	4.265	4.211	3.915	4.055	3.863	4.055	3.990	4.048
	(3.298)	(3.302)	(3.326)	(3.320)	(3.324)	(3.305)	(3.287)	(3.286)
Industry: mining	0.708	0.618	0.756	0.545	0.720	0.838	0.858	0.804
	(0.966)	(0.934)	(1.100)	(0.951)	(0.991)	(0.989)	(0.991)	(0.991)
Industry: construction	1.608	1.847	1.708	1.660	1.709	1.761	1.651	1.697
	(0.499)***	(0.529)***	(0.563)***	(0.540)***	(0.544)***	(0.546)***	(0.543)***	(0.541)***
Industry: manufacturing	0.479	0.170	0.467	0.443	0.477	0.504	0.609	0.638
	(0.456)	(0.399)	(0.483)	(0.458)	(0.458)	(0.460)	(0.464)	(0.458)
Industry: transportation	1.433	1.331	1.652	1.403	1.563	1.515	1.532	1.584
	(0.499)***	(0.487)***	(0.525)***	(0.501)***	(0.498)***	(0.500)***	(0.497)***	(0.493)***
Industry: wholesale trade	-0.556	-0.551	-0.813	-0.615	-0.613	-0.391	-0.467	-0.437
	(0.619)	(0.612)	(0.491)*	(0.620)	(0.618)	(0.622)	(0.626)	(0.617)
Industry: retail trade	-1.956	-2.007	-2.017	-2.019	-2.076	-1.842	-1.999	-2.073
	(0.447)***	(0.444)***	(0.463)***	(0.448)***	(0.447)***	(0.459)***	(0.449)***	(0.440)***
Industry: finance	1.702	1.629	1.804	1.632	1.789	1.636	1.890	1.946
	(0.745)**	(0.763)**	(0.765)**	(0.766)**	(0.745)**	(0.752)**	(0.748)**	(0.744)***
Industry: personal services	-2.595	-2.690	-2.602	-2.649	-2.599	-2.662	-2.628	-2.710
	(0.511)***	(0.504)***	(0.532)***	(0.515)***	(0.511)***	(0.511)***	(0.517)***	(0.508)***
Industry: entertainment	-2.072	-2.025	-2.102	-1.949	-1.958	-2.079	-2.099	-2.008
	(0.950)**	(0.954)**	(0.976)**	(0.958)**	(0.965)**	(0.961)**	(0.959)**	(0.936)**
Industry: professional services	-0.705	-0.797	-0.642	-0.836	-0.356	-0.741	-0.562	-0.566
	(0.517)	(0.508)	(0.543)	(0.517)	(0.517)	(0.516)	(0.521)	(0.515)
Industry: public administration	-0.622	-0.678	-0.333	-0.803	-0.046	-0.557	-0.400	-0.316
	(0.465)	(0.459)	(0.491)	(0.466)*	(0.471)	(0.468)	(0.470)	(0.464)
Occupation: management	0.218	0.159	0.458	0.120	0.733	0.160	0.500	0.266
	(1.928)	(1.886)	(1.968)	(1.911)	(1.983)	(1.924)	(2.008)	(1.923)
Occupation: technical	-1.136	-1.054	-1.043	-1.224	-0.648	-1.169	-0.864	-1.092
	(1.964)	(1.916)	(2.002)	(1.945)	(2.013)	(1.958)	(2.036)	(1.953)
Occupation: administrative	-3.309	-3.289	-3.056	-3.451	-2.803	-3.325	-2.993	-3.218
	(1.951)*	(1.908)*	(1.992)	(1.937)*	(2.003)	(1.949)*	(2.029)	(1.944)*
Occupation: services	-3.034	-3.060	-3.056	-3.167	-2.605	-3.153	-2.960	-3.132
	(1.948)	(1.905)	(1.987)	(1.936)	(2.004)	(1.944)	(2.022)	(1.941)
Occupation: farming	-4.277	-4.222	-4.304	-4.451	-3.803	-4.258	-4.257	-4.243
	(1.971)**	(1.923)**	(2.016)**	(1.957)**	(2.023)*	(1.964)**	(2.045)**	(1.965)**
Occupation: production	-2.424	-2.407	-2.137	-2.473	-1.810	-2.409	-2.181	-2.234
	(1.953)	(1.905)	(1.997)	(1.940)	(2.002)	(1.952)	(2.027)	(1.947)
Occupation: operators	-3.821	-3.689	-3.750	-4.004	-3.324	-3.751	-3.741	-3.721
	(1.949)**	(1.901)*	(1.989)*	(1.934)**	(1.998)*	(1.945)*	(2.023)*	(1.941)*
Constant	6.781	6.847	6.798	7.142	6.387	6.948	6.972	6.668
	(1.996)***	(1.955)***	(2.033)***	(1.986)***	(2.048)***	(1.992)***	(2.064)***	(1.991)***
Observations	22914	23122	21405	22809	22911	22841	22657	23187
R-squared	0.11	0.12	0.11	0.11	0.11	0.11	0.11	0.11

Standard errors in parentheses

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

Appendix A5: The Effect of Obesity on Wages

Sample: Full-time workers either with current employer-sponsored coverage in their own name or uninsured

	Pooled Sample			Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Obese	-0.87	-0.89	0.04	-0.68	-0.70	-0.64	-1.38	-1.38	0.85
	(0.30)***	(0.30)***	(0.64)	(0.40)*	(0.39)*	(0.50)	(0.47)***	(0.47)***	(1.41)
Employer Coverage		1.81	2.01		2.10	2.12		1.27	1.78
		(0.29)***	(0.29)***		(0.38)***	(0.42)***		(0.50)**	(0.37)***
Obese*Employer Coverage			-1.20			-0.08			-2.89
			(0.70)*			(0.69)			(1.40)**
Marital Status: Married	0.87	0.72	0.71	1.43	1.17	1.17	-0.20	-0.22	-0.23
	(0.33)***	(0.33)**	(0.33)**	(0.39)***	(0.38)***	(0.38)***	(0.59)	(0.59)	(0.59)
Marital Status: Other	-0.55	-0.53	-0.53	-0.65	-0.68	-0.68	-0.68	-0.60	-0.59
	(0.36)	(0.36)	(0.36)	(0.44)	(0.44)	(0.44)	(0.60)	(0.61)	(0.61)
Urban Residence	1.59	1.56	1.55	1.55	1.55	1.55	1.69	1.64	1.64
	(0.25)***	(0.25)***	(0.25)***	(0.36)***	(0.36)***	(0.36)***	(0.34)***	(0.34)***	(0.34)***
Age Category: 30-32	-0.03	-0.00	-0.00	0.11	0.14	0.14	-0.22	-0.19	-0.19
	(0.31)	(0.31)	(0.31)	(0.39)	(0.39)	(0.39)	(0.51)	(0.51)	(0.51)
Age Category: 33-35	0.39	0.45	0.46	0.62	0.71	0.71	0.02	0.05	0.06
	(0.40)	(0.40)	(0.40)	(0.55)	(0.55)	(0.55)	(0.54)	(0.54)	(0.54)
Age Category: 36-41	0.92	0.96	0.97	1.19	1.25	1.25	0.47	0.49	0.52
	(0.53)*	(0.53)*	(0.53)*	(0.68)*	(0.68)*	(0.68)*	(0.84)	(0.84)	(0.84)
Employer Size: 10-24 people	-0.40	-0.66	-0.65	-0.34	-0.66	-0.65	-0.63	-0.81	-0.80
	(0.42)	(0.41)	(0.41)	(0.52)	(0.52)	(0.52)	(0.69)	(0.67)	(0.67)
Employer Size: 25-49 people	0.08	-0.26	-0.24	-0.08	-0.52	-0.52	0.23	0.06	0.06
	(0.53)	(0.54)	(0.54)	(0.68)	(0.70)	(0.70)	(0.88)	(0.87)	(0.86)
Employer Size: 50-999 people	0.15	-0.29	-0.29	0.30	-0.23	-0.23	-0.13	-0.40	-0.40
	(0.42)	(0.43)	(0.43)	(0.52)	(0.54)	(0.54)	(0.72)	(0.70)	(0.69)
Employer Size: >999 people	1.72	1.31	1.31	1.83	1.35	1.35	1.48	1.20	1.22
	(0.53)***	(0.53)**	(0.53)**	(0.68)***	(0.69)*	(0.69)*	(0.86)*	(0.84)	(0.84)
Job Tenure: 1-3 years	0.63	0.37	0.36	0.15	-0.15	-0.15	1.38	1.19	1.18
	(0.28)**	(0.28)	(0.28)	(0.40)	(0.40)	(0.40)	(0.35)***	(0.35)***	(0.34)***
Job Tenure: 3-6 years	1.46	1.09	1.09	1.07	0.64	0.64	2.04	1.79	1.78
	(0.30)***	(0.32)***	(0.32)***	(0.40)***	(0.43)	(0.43)	(0.44)***	(0.48)***	(0.47)***
Job Tenure: >6 years	2.75	2.30	2.31	2.46	1.94	1.94	3.22	2.93	2.94
	(0.33)***	(0.34)***	(0.34)***	(0.45)***	(0.46)***	(0.46)***	(0.48)***	(0.49)***	(0.49)***
Education: 9-12 years	0.43	0.24	0.24	0.58	0.29	0.29	0.43	0.39	0.45
	(0.39)	(0.39)	(0.39)	(0.52)	(0.52)	(0.52)	(0.47)	(0.48)	(0.48)
Education: >12 years	2.41	2.12	2.11	2.69	2.29	2.29	2.17	2.08	2.12
	(0.46)***	(0.46)***	(0.46)***	(0.62)***	(0.61)***	(0.61)***	(0.58)***	(0.60)***	(0.60)***
Gender: Female	-2.16	-2.12	-2.13	0.00	0.00	0.00	0.00	0.00	0.00
	(0.30)***	(0.29)***	(0.29)***	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Race: Black	-0.91	-0.93	-0.91	-1.39	-1.41	-1.41	-0.26	-0.27	-0.25
	(0.23)***	(0.23)***	(0.23)***	(0.32)***	(0.31)***	(0.31)***	(0.37)	(0.36)	(0.36)
Race: Other	-0.32	-0.27	-0.28	-1.02	-0.93	-0.93	0.75	0.76	0.80
	(0.40)	(0.40)	(0.40)	(0.53)*	(0.52)*	(0.52)*	(0.64)	(0.63)	(0.62)
AFQT Quartile: 2	0.93	0.82	0.83	1.02	0.90	0.90	0.82	0.73	0.80
	(0.27)***	(0.27)***	(0.27)***	(0.41)**	(0.41)**	(0.41)**	(0.27)***	(0.27)***	(0.28)***
AFQT Quartile: 3	1.92	1.71	1.72	1.82	1.59	1.59	1.96	1.81	1.85
	(0.31)***	(0.32)***	(0.32)***	(0.46)***	(0.47)***	(0.47)***	(0.35)***	(0.35)***	(0.35)***
AFQT Quartile: 4 (Highest)	3.52	3.30	3.31	2.74	2.50	2.50	4.50	4.33	4.37
	(0.43)***	(0.43)***	(0.43)***	(0.55)***	(0.56)***	(0.56)***	(0.66)***	(0.67)***	(0.67)***

(continued)

Appendix A5: The Effect of Obesity on Wages (continued)

	Pooled Sample			Men			Women		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Survey Year: 1990	0.52	0.53	0.53	0.93	0.94	0.94	-0.02	-0.03	-0.02
	(0.38)	(0.38)	(0.38)	(0.44)**	(0.44)**	(0.44)**	(0.68)	(0.68)	(0.68)
Survey Year: 1992	1.07	1.13	1.12	1.50	1.58	1.58	0.54	0.57	0.56
	(0.37)***	(0.37)***	(0.37)***	(0.47)***	(0.48)***	(0.48)***	(0.59)	(0.59)	(0.59)
Survey Year: 1993	1.18	1.25	1.25	1.37	1.47	1.47	1.03	1.07	1.07
	(0.48)**	(0.48)***	(0.48)***	(0.65)**	(0.65)**	(0.65)**	(0.63)	(0.62)*	(0.62)*
Survey Year: 1994	1.82	1.85	1.86	2.14	2.19	2.20	1.35	1.34	1.35
	(0.40)***	(0.40)***	(0.40)***	(0.51)***	(0.51)***	(0.51)***	(0.66)**	(0.67)**	(0.66)**
Survey Year: 1996	2.81	2.86	2.85	3.27	3.34	3.34	2.16	2.16	2.16
	(0.46)***	(0.46)***	(0.46)***	(0.61)***	(0.61)***	(0.60)***	(0.72)***	(0.72)***	(0.72)***
Survey Year: 1998	4.85	4.86	4.86	5.58	5.58	5.58	3.74	3.73	3.74
	(0.52)***	(0.51)***	(0.51)***	(0.67)***	(0.67)***	(0.67)***	(0.83)***	(0.83)***	(0.83)***
Industry: agriculture	-1.95	-1.89	-1.88	-1.70	-1.65	-1.65	-1.41	-1.32	-1.16
	(0.55)***	(0.55)***	(0.55)***	(0.60)***	(0.60)***	(0.60)***	(1.60)	(1.60)	(1.60)
Industry: forestry	3.94	4.28	3.92	5.42	6.13	6.10	-4.46	-4.89	-4.96
	(3.12)	(3.15)	(3.21)	(4.14)	(4.11)	(4.15)	(0.91)***	(0.96)***	(0.95)***
Industry: mining	0.88	0.79	0.83	1.72	1.58	1.58	-2.63	-2.52	-2.40
	(0.95)	(0.95)	(0.94)	(1.06)	(1.05)	(1.05)	(1.81)	(1.77)	(1.75)
Industry: construction	1.68	1.87	1.89	2.29	2.50	2.50	-1.05	-0.96	-0.95
	(0.52)***	(0.51)***	(0.50)***	(0.58)***	(0.56)***	(0.56)***	(0.82)	(0.79)	(0.83)
Industry: manufacturing	0.79	0.62	0.63	1.50	1.32	1.32	-0.99	-1.12	-1.11
	(0.45)*	(0.45)	(0.45)	(0.58)**	(0.57)**	(0.57)**	(0.70)	(0.70)	(0.71)
Industry: transportation	2.08	1.95	1.96	2.71	2.57	2.58	0.33	0.24	0.25
	(0.54)***	(0.55)***	(0.54)***	(0.72)***	(0.72)***	(0.72)***	(0.76)	(0.76)	(0.76)
Industry: wholesale trade	-0.37	-0.52	-0.51	0.24	0.09	0.09	-1.76	-1.90	-1.89
	(0.61)	(0.60)	(0.60)	(0.78)	(0.77)	(0.77)	(0.65)***	(0.65)***	(0.65)***
Industry: retail trade	-1.88	-1.82	-1.80	-1.54	-1.50	-1.50	-2.74	-2.64	-2.57
	(0.43)***	(0.43)***	(0.43)***	(0.54)***	(0.54)***	(0.54)***	(0.74)***	(0.74)***	(0.74)***
Industry: finance	2.04	1.83	1.83	3.56	3.38	3.38	0.10	-0.08	-0.10
	(0.73)***	(0.74)**	(0.74)**	(1.27)***	(1.28)***	(1.28)***	(0.88)	(0.92)	(0.91)
Industry: personal services	-2.60	-2.44	-2.43	-2.42	-2.26	-2.26	-3.45	-3.32	-3.27
	(0.48)***	(0.48)***	(0.48)***	(0.82)***	(0.83)***	(0.83)***	(0.62)***	(0.62)***	(0.62)***
Industry: entertainment	-1.77	-1.70	-1.69	-1.20	-1.07	-1.07	-3.06	-3.03	-2.98
	(0.90)**	(0.89)*	(0.89)*	(1.28)	(1.28)	(1.28)	(1.03)***	(1.03)***	(1.03)***
Industry: professional services	-0.38	-0.54	-0.54	-0.21	-0.38	-0.38	-1.33	-1.45	-1.44
	(0.52)	(0.51)	(0.51)	(0.78)	(0.77)	(0.77)	(0.71)*	(0.71)**	(0.71)**
Industry: public administration	-0.19	-0.49	-0.46	0.16	-0.18	-0.17	-1.31	-1.49	-1.46
	(0.46)	(0.45)	(0.45)	(0.65)	(0.64)	(0.64)	(0.62)**	(0.62)**	(0.62)**
Occupation: management	0.55	-0.10	-0.06	1.83	0.95	0.96	-2.70	-2.98	-3.00
	(2.01)	(1.92)	(1.90)	(2.43)	(2.34)	(2.34)	(3.16)	(3.05)	(3.01)
Occupation: technical	-0.78	-1.43	-1.40	-0.13	-1.04	-1.03	-3.17	-3.43	-3.48
	(2.04)	(1.94)	(1.93)	(2.46)	(2.37)	(2.36)	(3.27)	(3.16)	(3.12)
Occupation: administrative	-2.93	-3.58	-3.53	-2.94	-3.80	-3.79	-5.16	-5.43	-5.43
	(2.03)	(1.94)*	(1.92)*	(2.49)	(2.39)	(2.39)	(3.19)	(3.08)*	(3.04)*
Occupation: services	-2.86	-3.23	-3.19	-1.90	-2.52	-2.51	-5.65	-5.68	-5.75
	(2.03)	(1.93)*	(1.91)*	(2.45)	(2.35)	(2.35)	(3.17)*	(3.07)*	(3.03)*
Occupation: farming	-4.13	-4.41	-4.38	-3.35	-3.85	-3.85	-6.53	-6.43	-6.41
	(2.05)**	(1.96)**	(1.94)**	(2.45)	(2.35)	(2.35)	(3.53)*	(3.43)*	(3.39)*
Occupation: production	-2.21	-2.77	-2.73	-1.44	-2.22	-2.22	-5.14	-5.37	-5.45
	(2.03)	(1.94)	(1.92)	(2.44)	(2.34)	(2.34)	(3.20)	(3.09)*	(3.06)*
Occupation: operators	-3.57	-4.08	-4.04	-2.94	-3.66	-3.65	-5.57	-5.78	-5.79
	(2.03)*	(1.94)**	(1.92)**	(2.44)	(2.35)	(2.35)	(3.23)*	(3.13)*	(3.09)*
Constant	7.37	7.63	7.43	5.61	6.11	6.10	9.79	9.68	9.16
	(2.09)***	(1.99)***	(1.98)***	(2.49)**	(2.39)**	(2.39)**	(3.31)***	(3.21)***	(3.17)***
Observations	24085	24085	24085	14203	14203	14203	9882	9882	9882
R-squared	0.10	0.11	0.11	0.11	0.11	0.11	0.09	0.09	0.09

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

Note: Standard errors in parentheses. Standard errors are adjusted for repeated observations of individuals. Estimates include controls for marital status, urban residence, age, firm size, job tenure, education, sex, race, year, AFQT score, industry and occupation.