Who Pays for the Medical Costs of Obesity? New Evidence from the Employer Mandate

Conor Lennon, June 2017

Abstract

Theory predicts that the medical costs of obesity should be passed on to workers, in the form of lower wages, whenever health coverage is a part of employee compensation. However, existing work on this topic lacks sharp exogenous variation and reports implausibly large wage offsets. This paper first establishes that the difference in medical expenditures due to obesity is small and should be hard to detect. It supports this claim by exploiting the variation provided by the Affordable Care Act’s employer mandate. Findings suggest that obese workers do bear the cost of their own medical expenditures. However, the observed effects on wages are relatively small and often insignificantly different from zero.

Keywords: Obesity, Wages, Employment-based Health Insurance

JEL: I13, J23, J24, J31, J32, J33

1 Introduction

Obesity can affect wages for American workers in at least three ways. First, obesity might reduce productivity. Second, obese workers may face discrimination.1 Third, the focus of this paper, wages for obese workers should account for the additional cost of providing employer-sponsored health insurance (ESI).

ESI could differentially affect obese workers wages because it is experience-rated at the firm level. Experience rating ensures that the cost of health coverage reflects the actual medical expenditures of each firms’ workers. This creates a cost-wedge between any two groups of workers with varying medical expenditures unless wages are free to adjust for the difference (Summers, 1989). While

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1These explanations and their consequences (for example, workers should internalize some of these effects and alter their choices about educational attainment and occupation) have received a lot of attention from researchers. Examples from just the last decade in one journal include Greve (2008), Villar and Quintana-Domenque (2009), Johansson et al. (2009), Lindeboom et al. (2010), Han et al. (2011), Mosca (2013), Tafreschi (2015), Larose et al. (2016), Caliendo and Gershitz (2016), and Chu and Ohinmaa (2016).
Baum and Ford (2004) and Han et al. (2009) show that obese workers in the United States earn lower wages than non-obese workers, only Bhattacharya and Bundorf (2009) and Bailey (2013) focus on ESI-related effects. These authors find that the medical costs of obesity are borne by obese workers in the form of lower wages. However, there are reasons to be cautious about their findings due to implausibly large wage offsets and a lack of exogenous variation. This paper resolves both of these issues.

To do so, the paper first examines why the existing literature overestimates the ESI-related wage offset due to obesity. It then establishes an upper bound on the effect obesity could have on wages due to ESI. The effect obesity could play is small because the inter-relationship between obesity, demographic characteristics, occupational and educational choices, medical expenditures, and wages is complex and because medical expenditures are a tax deduction for employers.\(^2\)

The paper then reexamines how the ESI-related costs of obesity are distributed across obese and non-obese workers using an improved source of exogenous variation: the Affordable Care Act’s (ACA) employer mandate. The mandate, announced in 2010, requires all firms with 50 workers or more to provide ESI to full-time workers from 2014. Because ESI is experience-rated, the mandate makes some workers relatively more expensive to employ, such as obese workers. Given employment is an ongoing relationship, theory suggests evidence of wage offsets should be apparent prior to the mandate’s implementation in 2014.

The paper uses data from the Medical Expenditure Panel Survey (MEPS) in a difference-in-difference framework to examine how the relationship between obesity and hourly wages changes at firms affected by the employer mandate. This approach provides identification because the mandate does not affect productivity or taste-based discrimination. Estimates show that the employer mandate is associated with a fall in wages for obese workers relative to non-obese workers. In contrast to the existing literature on the effect of ESI on wages, the effect is approximately equal to the after-tax cost of obesity. However, the estimates are statistically not different from zero, likely due to sample size limitations. Workers at firms that are not affected by the mandate provide natural control groups, including those who already received coverage before the mandate and workers at firms who are not covered by the mandate (fewer than 50 employees).\(^3\)

\(^2\)Specifically, and explored in greater detail later, obesity is not randomly assigned and obese and non-obese workers differ on many dimensions which affect both medical expenditures and wages.

\(^3\)It is tempting to try to use the 50 employee cut-off as an alternate source of variation. However, several aspects of the ACA’s changes and available data preclude such an approach. In particular, it is always possible to construct a sample which identifies only firms with more than 50 employees in the MEPS data. However, the MEPS data asks respondents two questions that contribute to firm size. First, how many employees work at your work location? Second, how many locations does your employer have? For an individual who reports 30 employees at their location but also
2 Background

Obese individuals are defined as those who have a body-mass index (BMI) greater than 30.$^4$ Obesity is itself a disease but medical expenditure data suggests obesity causes higher medical expenditures mainly because obese individuals are more likely to require expensive and ongoing treatment for related conditions such as diabetes, hypertension, and high cholesterol. Table 1 illustrates this empirical regularity. Specifically, it first shows how the prevalence and associated medical expenditures of various chronic conditions varies among those who are and are not obese. The table shows obese workers are much more likely to report at least one chronic health condition and shows that chronic conditions are strongly associated with higher medical expenditures.

Summary statistics for the MEPS data used in this paper are also provided in the table. Notice that annual medical expenditures of obese workers are $822 ($3,434 - $2,612) higher than those of non-obese workers.$^5$ However, obesity and related conditions are not the only cause of this difference. Obese workers are older, more likely to be female, less likely to have a college degree, and less likely to be white. Each of these is associated with differences in medical expenditures (and wages) for all workers, regardless of BMI. Additionally, employee-related medical expenditures (such as insurance premiums) are a tax deduction for firms at the marginal corporate tax rate (35% at the federal level). Employee cost-sharing in the form of co-pays and co-insurance would further limit the portion of that $882 difference employers would be exposed to.

The appropriate takeaway from Table 1 is that the effect obesity could have on wages is small and should be isolated to a sub-group of obese workers. For example, for those who do not report any chronic conditions, annual medical expenditures are $57 less for obese males and only $7 more for obese females compared to non-obese workers. For those who report a chronic condition, medical expenditures are $392 higher for obese males and $867 higher for obese females. Given the tax treatment of these expenditures and that some portion will be paid by workers, any effects on wages should be difficult to detect - especially for males.

Instead, researchers have claimed that the costs of obesity are clearly borne by obese workers in the form of lower wages. Bhattacharya and Bundorf (2009) examined the gap between obese and non-obese workers’ wages at firms that do and do not offer health coverage. They find hourly wages for obese workers are relatively lower at firms that offer ESI. However, the wage offsets they

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$^4$BMI formula: $703 \times \text{weight/height}^2$.

$^5$This aligns well with Finkelstein et al. (2003).
Table 1: Medical Expenditures and Prevalence of Chronic Conditions by Obesity

<table>
<thead>
<tr>
<th>Condition</th>
<th>Non-Obese (BMI &lt; 30)</th>
<th>Obese (BMI ≥ 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prevalence</td>
<td>Medical Expenditures</td>
</tr>
<tr>
<td></td>
<td>Condition=0</td>
<td>Condition=1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>3.82%</td>
<td>$2,433</td>
</tr>
<tr>
<td>Hypertension</td>
<td>17.70%</td>
<td>$2,238</td>
</tr>
<tr>
<td>Arthritis</td>
<td>11.45%</td>
<td>$2,231</td>
</tr>
<tr>
<td>Angina</td>
<td>0.65%</td>
<td>$2,505</td>
</tr>
<tr>
<td>Myocardial Infarction</td>
<td>0.88%</td>
<td>$2,490</td>
</tr>
<tr>
<td>High Cholesterol</td>
<td>19.48%</td>
<td>$2,241</td>
</tr>
<tr>
<td>Coronary Heart Disease</td>
<td>1.18%</td>
<td>$2,468</td>
</tr>
<tr>
<td>Emphysema</td>
<td>0.46%</td>
<td>$2,524</td>
</tr>
<tr>
<td>Asthma</td>
<td>6.47%</td>
<td>$2,403</td>
</tr>
<tr>
<td>Any Chronic Condition</td>
<td>41.29%</td>
<td>$1,607</td>
</tr>
<tr>
<td>Any Chronic Condition - Males</td>
<td>42.51%</td>
<td>$1,161</td>
</tr>
<tr>
<td>Any Chronic Condition - Females</td>
<td>40.02%</td>
<td>$2,371</td>
</tr>
</tbody>
</table>

| Age                             | 42.4        |                   | 43.2         |                   |
| % Male                          | 50.48%      |                   | 48.76%       |                   |
| Hourly Wages                    | $23.49      |                   | $20.91       |                   |
| % College                       | 62.64%      |                   | 54.89%       |                   |
| % White                         | 67.45%      |                   | 65.80%       |                   |
| Annual Medical Expenditures     | $2,612      |                   | $3,434       |                   |
| Annual Medical Expenditures - Males | $2,069 |                   | $2,674       |                   |
| Annual Medical Expenditures - Females | $3,172 |                   | $4,159       |                   |

Observations 29,655 14,597

Note: Table reports annual medical expenditures and prevalence of chronic conditions from Medical Expenditure Panel Survey, 2006-2014, for workers aged 27-59. All dollar values have been adjusted to 2014 values using the CPI (www.bls.gov).

observe are implausible. For example, medical expenditures for obese males were only $605 more than non-obese workers in Table 1. Despite this, Bhattacharya and Bundorf find that obese males are paid $1.27 less per hour than non-obese males at firms with ESI. For a full-time worker (2,000 hours per year), that amounts to a $2,540 annual wage offset.

Even if the estimates were aligned with the expected costs, Bailey (2013) notes that Bhattacharya and Bundorf’s empirical strategy is questionable: employers who offer ESI are different from those not offering it. Firms who offer health coverage tend to be larger, more established, and pay higher monetary wages to all workers. This is a problem because Bhattacharya and Bundorf’s approach relies on obesity affecting wages via productivity in the same way at all firms.

To resolve that issue, Bailey relies on the fact that diabetes is more common in obese individuals. Bailey then uses data from the NLSY79 to compare obese workers’ wages in states that did and did not pass diabetes coverage mandates. If obese workers tend to pay for the cost of their care, they should see a wage offset due to these diabetes mandates. Bailey finds a -3.3% effect on hourly wages for obese workers in states that have diabetes mandates.

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6See Table 1 and Mokdad et al. (2003).
While Bailey’s empirical strategy is a significant improvement on Bhattacharya and Bundorf’s, the wage offset he reports is several times larger than the upper bound of the expected cost of these diabetes mandates. Even at the federal minimum wage, a 3.3% reduction in hourly wages amounts to a $478 annual wage offset for a typical full time worker ($7.25 \times 2,000 \text{ hours} \times 3.3\%$). However, the average wage at a firm that offers health coverage is $23.42 in the MEPS data used in this paper. Bailey’s estimates would therefore imply a total wage offset of $1,545 in today’s dollars.\footnote{Bailey uses data from every other year from 1990 to 2010 but does not report medical expenditures or wages from the time period studied. Using today’s dollars favors Bailey’s estimates as medical expenditures have risen faster than wages.} However, given the costs and prevalence of diabetes across obese and non-obese workers, the expected cost of a diabetes mandate is no more than $242 ($3,286 \times 10.67\% \text{ minus } 2,833 \times 3.82\%)$. That is an upper bound because of cost-sharing and the tax treatment of medical expenditures.\footnote{Bailey calculates the expected cost as $611 but erroneously bases this on data provided by Bhattacharya and Bundorf about the total cost of medical expenditures for diabetics rather than the differential between diabetics and non-diabetics.} The expected cost is also lower if some employers already covered diabetes expenditures voluntarily or if they are exempt due to self-insurance.\footnote{Self-insured firms are exempt from state insurance mandates under the Employee Retirement Income Security Act of 1974.} Diabetes mandates therefore cannot be the sole cause of the wage offset observed.

Bailey notes that his identification strategy relies on mandates not being correlated with obesity prevalence. However, voluntary coverage of diabetes expenditures could be determined by obesity prevalence in a state and, in turn, both could affect the likelihood of a mandate. This could be why his estimates are so much larger than the expected cost. On the econometric side, Bailey has to use a fixed effects difference-in-difference specification. This allows him to exploit changes in wages and BMI over time in states that do and do not have diabetes coverage mandates. However, it limits his ability to include non-time-varying controls which could be correlated with wages and BMI or which might be interacting with other mandates or policy changes.

In sum, the estimates reported by Bhattacharya and Bundorf (2009) and Bailey (2013) are implausible relative to the expected cost differences between obese and non-obese workers. It is worth noting here that the effects they report are better-aligned with the cost of obesity determined by Cawley and Meyerhoefer (2012). Cawley and Meyerhoefer correctly note that obesity is endogenous and the right comparison group for determining the cost of obesity is not non-obese workers. Instead, it is an obese worker’s fictional non-obese counterpart. Using the weight of a biological relative as an instrument for own weight, they find obesity has a large causal effect on
medical expenditures. This has important implications for the public policy debate about obesity reduction interventions but it is not the relevant comparison employers or health insurers care about. They are tasked with setting wages and coverage premiums which reflect the cost of medical expenditures for obese versus non-obese workers. The fact that obese workers might have lower medical expenditures than non-obese workers, were they not obese, is not relevant to the choice they are facing.

### 3 Empirical Framework

Economic theory predicts that workers, rather than employers, will bear the costs of employment-based health coverage. Following Bhattacharya and Bundorf, in a competitive labor market where wages are the only form of compensation, the wage of worker $i$, $w_i$, will equal the value of her marginal product ($MRP_i$). If health insurance is provided as an employment benefit, a competitive labor market would require wages to be modified to account for the cost of coverage. If premiums are actuarially fair a worker with medical expenditures $e_i$ adds premium $p_{ik}$ to firm $k$'s costs and an employer could pool all medical costs across their $N$ employees so that wages for worker $i$ at firm $k$ are

$$w_{ik} = MRP_{ik} - \bar{p}_k.$$  

In this case, wages are equal to the value of marginal product minus the firm-level average cost of providing coverage $\bar{p}_k$ where $\bar{p}_k = \frac{1}{N} \sum_{i=1}^{N} e_i = \frac{1}{N} \sum_{i=1}^{N} p_{ik}$. However, in a competitive labor market, this would leave arbitrage opportunities open for workers and firms.

For that reason, the literature has supposed that a firm’s $N$ employees can be partitioned into $j \leq N$ subgroups.\(^{10}\) Let each of the subgroups be denoted as $n_j$. For $i \in n_j$, then wages (excusing the abuse of notation) for worker $i$ would be

$$w_{ijk} = MRP_{ijk} - \frac{1}{n_j} \sum_{i=1}^{n_j} p_{ijk} = MRP_{ijk} - \bar{p}_{jk}.$$  

In such a case, the wages of each member of each group will be adjusted by the average medical expenditures of the group ($\bar{p}_{jk}$). This is potentially an equilibrium if the costs of searching for profitable deviations exceed the benefits.

\(^{10}\)If $j = N$ then subgroups are individual workers. Generally, authors who study how health coverage affects wages have dismissed this possibility without evidence. For more details on the ability of employers to pass along health care costs at the individual level, see Lennon (2017).
Many authors have found evidence of this kind of group-specific wage offset, including Gruber (1993), Sheiner (1999), Jensen and Morrisey (2001), Lahey (2012), and Bailey (2014). This paper complements their work by examining how the relationship between obesity and wages changes for working adults aged 27-59 at firms affected by the employer mandate in the years after the mandate was announced. This approach improves on the existing literature because the employer mandate requires coverage exogenously at the federal level. As a result, it avoids comparisons across firms who do and do not choose to offer coverage. It also allows the researcher to control for a rich set of demographic characteristics and avoids the potentially confounding bias introduced by using mandates passed at different times in different states that have different underlying obesity rates and other potentially-correlated coverage mandates.

3.1 Sample Selection

The paper reports estimates based on MEPS data from 2006 to 2014 for workers at firms affected by the employer mandate. MEPS is a nationally-representative rotating panel of U.S. individuals. Each respondent is part of MEPS for two years and MEPS reports information on each respondent’s health and employment status. Importantly, it reports the number of employees where the individual works and whether health coverage is offered or not. This allows the researcher to identify which respondents are working at firms who must provide coverage due to the employer mandate.

Those under 27 are excluded from the empirical estimates because the ACA affected them via the dependent coverage mandate.\textsuperscript{11} Workers aged 60 and over are excluded because they might retire prior to or very shortly after the mandate’s implementation. The data used in the paper includes several years either side of the ACA’s passage in 2010 with 2011 to 2014 considered to be the “After ACA” period.\textsuperscript{12}

In the data, between 80 and 85 percent of respondents who work for employers with more than 50 workers were offered health coverage by their employer in each year. The paper focuses on the remaining 15 to 20 percent of respondents who work for employers that do not offer coverage but must do so because of the ACA’s mandate. The mandate requires these employers to consider the costs of employee health coverage for the first time, providing a causal estimate of the effect of the medical costs of obesity on wages.

\textsuperscript{11}See Antwi et al. (2013), Depew (2015), Hahn and Yang (2016), and Goda et al. (2016) for how the dependent mandate affected younger workers’ labor supply.

\textsuperscript{12}Data from 2014 is the most recent MEPS has released.
3.2 Anticipatory Effects

Relying on the employer mandate for identification means that the paper is focused on anticipatory effects. This forward-looking approach is not unique to this paper. Garrett and Kaestner (2015), Even and MacPherson (2015), and Mathur et al. (2016) consider how the ACA affected part-time employment because only workers who work more than 30 hours per week would have to be provided coverage.

A forward-looking approach is valid because the employer mandate required coverage to be in place for all full-time workers by 2014. Given employment is an ongoing relationship, forward-looking firms should have reacted immediately by reducing their demand for workers who would be more costly to cover. However, the cost of coverage for 2014 was to be based on the expected costs of a firm's employee pool in 2013 ensuring that early action could minimize the cost of complying with the mandate. If firms are not forward-looking, then any observed effects will be understated.

The focus on anticipatory effects has the advantage of avoiding other ACA provisions which might affect labor market outcomes after 2014. The most obvious one would be the ACA's health insurance exchanges. These exchanges provide affordable coverage options outside of employment. Examining the period after 2014 could cloud identification if these exchanges or other ACA provisions affected self-employment patterns, job search efforts, or alleviated health coverage-related job lock differentially for obese workers.

3.3 Estimation

The way the employer mandate impacts the labor market lends itself to a difference-in-difference approach to estimation. The basic estimating equation is as below;

$$\text{Hourly Wage}_{it} = \beta_0 + \beta_1 \text{Obese}_{it} + \beta_2 \text{After ACA}_{it} + \beta_3 \text{Obese} \times \text{After ACA}_{it} + \Pi X_{it} + \epsilon_{it}. $$

In the equation, $\text{Hourly Wage}_{it}$ is the hourly wage of person $i$ at time $t$. The right hand side includes controls for the pre-existing relationship between wages and obesity using a dummy for obesity ($\text{Obesity}_{it}$) equal to one for those with BMI>30. Then, the estimating equation controls

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13In the data used in this paper, more than 60% of workers at firms affected by the employer mandate had employment tenure of 2 years or more.

14The estimates presented in the paper include data from 2014 as the employer mandate was later delayed to 2015. Excluding or including 2014 does little to the results presented.
for the main effect of the Affordable Care Act \((\text{After ACA}_{it})\), which equals one after the ACA is announced (2011 to 2014). The coefficient of interest concerns the interaction of these two terms. It provides a measure of the change in obese workers’ wages in the period after the ACA. The estimating equation is completed by allowing for a set of typical demographic controls \(X_{it}\) such as age, sex, education, marital status, race, location, and industry.

The equation is estimated for workers at firms who have more than 50 employees but do not already offer health coverage. These workers must be provided coverage from 2014 onwards under the ACA’s employer mandate or pay hefty financial penalties. Given the small role obesity could play in wages, the wage offset can be expected to be relatively small, hard to detect, and should be largest for females.

4 Main Estimates

Table 2 presents a series of estimates on how obesity affects medical expenditures and wages for workers at firms who are affected by the ACA’s employer mandate. All estimations presented use two year-end observations for each worker (when available) and cluster standard errors at the individual level. In columns one through four, the dependent variable is medical expenditures. Obesity is associated with a $647.70 increase in medical expenditures in a regression with no demographic controls. The effect is $546.60 once demographic controls are included. In the third column, the effect of obesity is positive but not significantly different from zero when the sample is restricted to just males (as would be predicted by the summary statistics presented in Table 1). That means that the effect of obesity on medical expenditures is being driven by female medical expenditures (as seen in the fourth column). The estimated effect of obesity of $827.30 is not trivial but the advantageous tax treatment of medical expenditures plus cost sharing at the point of service limits the amount employers would be exposed to.

The table then reports how the relationship between obesity and (log) hourly wages changes for workers at firms affected by the employer mandate. Note that the ACA mandates that all workers who work at these kinds of firms must receive health coverage in the near future. As a sanity check, if employees tend to bear the cost of health coverage, then wages should fall for all workers, regardless of BMI. Column five shows a parsimonious estimation with no demographic controls. Column six adds a full set of typical controls for age, education, gender, marital status,

\footnote{Enforcement and penalties for non-compliance were delayed to 2015. Firms were unaware of this until February 2014.}
**Table 2: Main Estimates**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males Only</td>
<td>Females Only</td>
<td>Males Only</td>
<td>Females Only</td>
<td>Males Only</td>
<td>Females Only</td>
<td>Males Only</td>
<td>Females Only</td>
</tr>
<tr>
<td>Obese (BMI &gt; 30)</td>
<td>647.7***</td>
<td>546.6**</td>
<td>285.9</td>
<td>827.3***</td>
<td>-0.0281</td>
<td>0.00450</td>
<td>0.0228</td>
<td>-0.0110</td>
</tr>
<tr>
<td></td>
<td>(240.7)</td>
<td>(248.9)</td>
<td>(418.5)</td>
<td>(289.2)</td>
<td>(0.0225)</td>
<td>(0.0205)</td>
<td>(0.0309)</td>
<td>(0.0269)</td>
</tr>
<tr>
<td>After ACA</td>
<td>-0.0496**</td>
<td>-0.0440**</td>
<td>-0.0285</td>
<td>-0.0567**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0201)</td>
<td>(0.0181)</td>
<td>(0.0263)</td>
<td>(0.0249)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After ACA × Obese</td>
<td>-0.0201</td>
<td>-0.0317</td>
<td>-0.0186</td>
<td>-0.0435</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0303)</td>
<td>(0.0277)</td>
<td>(0.0431)</td>
<td>(0.0361)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>5,893</td>
<td>5,757</td>
<td>2,626</td>
<td>3,131</td>
<td>5,889</td>
<td>5,757</td>
<td>2,626</td>
<td>3,131</td>
</tr>
<tr>
<td>Demographic Controls</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mean of Dep. Var. (Obese)</td>
<td>$2,488</td>
<td>$2,488</td>
<td>$1,828</td>
<td>$2,996</td>
<td>$13.29</td>
<td>$13.29</td>
<td>$14.92</td>
<td>$12.04</td>
</tr>
<tr>
<td>Mean of Dep. Var. (Non-Obese)</td>
<td>$1,840</td>
<td>$1,840</td>
<td>$1,390</td>
<td>$2,245</td>
<td>$14.27</td>
<td>$14.27</td>
<td>$14.89</td>
<td>$13.70</td>
</tr>
<tr>
<td>No. Obese</td>
<td>1,986</td>
<td>1,986</td>
<td>865</td>
<td>1,121</td>
<td>1,986</td>
<td>1,986</td>
<td>865</td>
<td>1,121</td>
</tr>
</tbody>
</table>

*** p < 0.01, ** p < 0.05, * p < 0.1. Note: Estimates based on Medical Expenditure Panel Survey, 2006-2014, for workers aged 27-59. All dollar values have been adjusted to 2014 values using the CPI (www.bls.gov). Standard errors are clustered at the individual level. Controls include age (cubic), gender, location, race, industry, education, and marital status.

Both sets of estimates illustrate that wages fall for workers at firms affected by the employer mandate after 2010. In particular, column six suggests a negative wage effect of 4.4% (significant at the 5% level). Given hourly wages are $13.94 at firms affected by the mandate that amounts to a $1,382 wage offset for a worker who works 2,000 hours per year. A $1,382 wage offset is a reasonable approximation of the expected after-tax cost of providing coverage given annual medical expenditures for workers at these firms were $2,058 per year (as reported towards the end of the table), particularly if medical expenditures were to increase a little after workers receive health coverage (essentially, an income effect). The negative wage effect for all workers after 2010 highlights that the ACA’s mandate had bite and works as a valid source of identification.

The interaction term, After ACA × Obese, shows an additional effect on the wages of obese workers after 2010. In column six the estimate of -.0317 suggests obesity is associated with an additional 3.17% fall in hourly wages. For an obese worker, this amounts to an additional $842.59 annual wage offset ($13.29 × .0317 × 2,000). However, the effect is not statistically different from zero at conventional measures. The magnitude of the estimate is a little more than the $546.60 difference in medical expenditures that is associated with obesity in column two but might align quite well with expenditures after health coverage is provided.\(^{17}\)

\(^{16}\)Estimates are unchanged if the estimating equation allows the effect of these controls to change after 2010 by interacting each with the dummy for “After ACA”.

\(^{17}\)It is not possible to be sure how much health care individuals who will obtain coverage will consume. It is tempting to assume their expenditures will begin to resemble the expenditure of those who already are offered coverage. However,
The effects of obesity on medical expenditures in columns three and four suggest that obese females are the source of expenditure differences between obese and non-obese workers. Females also tend to have higher expenditures regardless of BMI. This means that, if the ACA is a valid source of identification, the main effect of the ACA's mandate on females should be larger than for males. In column eight the main effect of the ACA's mandate is a 5.67% fall in relative wages for females. At the mean wage of $13.12 this would imply an annual wage offset of about $1,487 for females. The effect for males is about $849 (but is not statistically significant). These estimates are again remarkably close to the expected after-tax cost of the medical expenditures of male and female workers at these firms.

Given obese females have significantly more expenditures than obese males, any additional wage offset due to obesity should be concentrated on females. In column eight, the effect on obese females is 4.35% compared to 1.86% for males in column seven. However, neither is statistically different from zero. The general lack of statistically significant effects is perhaps not that surprising given the main estimates rely on just 5,757 observations over nine years. Of these, only 1,986 are obese workers, only half of these are females, and less than half of all observations are from the years after the ACA's mandate was announced.

If obesity were to be “redefined” as having a BMI of 40 or more, the difference in medical expenditures is larger and the size of the wage offset also increases. However, the number of respondents who meet the sample selection criteria and have a BMI > 40 is only a couple of dozen per year. As a result, the estimates are not statistically significantly different from zero. These estimates are not included in the paper because the medical definition of obesity is BMI > 30 and the paper’s goal is to highlight that the medical costs of obesity (as commonly defined) are not a significant cause of lower wages for working-age obese adults.18

Overall, the estimates in Table 2 show that the costs of obesity and their effect on wages due to ESI has been overestimated in the literature to date. The expected additional cost of obesity is small and only a fraction of that cost would be borne by employers. The estimations in Table 2 were repeated for two control groups - workers at firms who have more than 50 workers already and workers at firms who do not offer coverage but who are exempt from the mandate due to having fewer than 50 employees. Estimates suggest obese workers earn less than non-obese workers at choosing to work at a firm without health coverage might reflect important differences in unobservable health status, innate tastes for health care services, and an individual’s appetite for risk.

18Of course, these are available from the author.
both types of employer but, as expected, there is no change in that relationship after the employer mandate is announced (see Table A1 in the Appendix).

5 Conclusion

Theory suggests obese workers should bear the additional cost of their own medical expenditures in the form of lower wages. However, finding credible evidence of this relationship has proven difficult because obesity also affects wages via tastes and productivity. To get around these identification challenges Bhattacharya and Bundorf (2009) studied wages across firms that do and do not offer ESI while Bailey (2013) examined obesity indirectly via diabetes coverage mandates. However, both report implausibly large wage offsets which casts doubt on their empirical strategies.

This paper contributes to the literature by highlighting that the medical costs of obesity are quite small for working adults and any effect on wages due to ESI should be hard to detect. The paper supports this claim using the ACA’s employer mandate as a source of identification. The costs of the mandate for firms can be reduced by making adjustments prior to the mandate’s implementation in 2014. In particular, employers should prefer non-obese workers and this allows the researcher to examine how the relationship between obesity and wages changes after 2010. As expected, the ESI-related effects of obesity on wages is small and statistically insignificant. However, the size of the effects align well with the expected costs of obesity.

Indeed, the paper’s main contribution is showing that the relationship between obesity and wages is more complex than previously considered by those who studied how ESI affects obese workers’ wages. For example, only obese workers who have other chronic conditions tend to have higher medical expenditures than non-obese workers. Obese workers also differ on observables, they are older and more likely to be female but less likely to be white or college educated. All of these characteristics would be expected to affect both wages and medical expenditures, sometimes in the same direction and sometimes in opposing directions. This creates several problems for empirical strategies which do not rely on sharp exogenous variation.

Using the employer mandate as a source of identification solves these problems because it abstracts from the ways obesity can affect productivity and education or occupation choices. The mandate affected a specific group - obese and non-obese workers at firms who have more than 50 employees but who do not already offer health coverage - which allows the paper to cleanly isolate how the medical costs of obesity affect wages via ESI for the first time.
Lastly, the results in this paper could be explained by a labor supply response: obese workers might be more willing to work at firms affected by the employer mandate in anticipation of receiving health coverage in the future. Even if this is the case, it means the (relatively small) costs of obesity are still borne by obese workers. However, anticipatory effects on labor supply due to the ACA’s mandate are theoretically ambiguous. Any worker who chooses to work at an affected firm in anticipation of receiving coverage would need to be very well-informed of the ACA’s requirements, the employer’s future plans, and the cost of the coverage that would be offered. Firms could charge employees up to 9.5% of their salary for coverage and still be compliant with the mandate. This means that an informed worker might have found working at a firm with fewer than 50 employees (even at a lower wage) and obtaining coverage via the ACA’s insurance exchanges to be a preferable option. This would reduce their willingness to work at firms affected by the mandate. In any case, the relative share of obese workers and employment tenure patterns do not change at affected firms in the years after 2010 (see Appendix Figures 1 and 2).
References


## Table A1: Additional Estimates

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<td>Log Hr. Wage</td>
<td>Log Hr. Wage</td>
<td>Log Hr. Wage</td>
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<tr>
<td><strong>After ACA × Obese (50 workers or fewer)</strong></td>
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<td>-0.00432</td>
<td>-0.0160</td>
<td>0.00884</td>
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<tr>
<td></td>
<td>(0.0146)</td>
<td>(0.0123)</td>
<td>(0.0179)</td>
<td>(0.0169)</td>
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<td>Observations</td>
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<td>18,791</td>
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<td><strong>After ACA × Obese (Already Offered Coverage)</strong></td>
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<td>-0.00190</td>
<td>-0.00961</td>
<td>0.00234</td>
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<td></td>
<td>(0.0366)</td>
<td>(0.0314)</td>
<td>(0.0504)</td>
<td>(0.0398)</td>
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<tr>
<td>Observations</td>
<td>4,722</td>
<td>4,689</td>
<td>1,996</td>
<td>2,693</td>
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</table>

Demographic Controls

|                     | None | Yes | Yes | Yes |

*** p<0.01, ** p<0.05, * p<0.1. Note: Estimates based on Medical Expenditure Panel Survey, 2006-2014, for workers aged 27-59. All dollar values have been adjusted to 2014 values using the CPI (www.bls.gov). Standard errors are clustered at the individual level. Controls include age (cubic), gender, location, race, industry, education, and marital status.

### Appendix

Table A1 reports on how the hourly wages of obese workers changed after the ACA was announced for workers at firms who were essentially unaffected by the ACA’s employer mandate. First, the difference-in-difference estimate (using the same estimation as in Table 2) is provided for workers who are employed at firms with fewer than 50 workers. Those who report less than 50 employees but that their employer has more than one work location are excluded due to the firm size ambiguity it creates. Workers at firms who already offered coverage are also mildly treated by the ACA due to changes in what insurance must cover. However, these intensive margin changes are minor relative to the requirement to provide coverage due to the ACA.

Note that the “Already Offered Coverage” sample is restricted to those who report working at a firm where they are already offered health coverage that has more than 50 workers but less than 250 workers. Firm size is capped at 250 in order to be comparable to the estimates in Table 2 of the paper. In the MEPS data, virtually all those who report working at a firm with 250 or more workers were offered coverage by their employer. Estimates are similar with cut-offs at 150, 200,
The figure shows the share of obese workers over time at firms with 50 employees or more by insurance coverage status. Firms who do not have coverage in place for employees prior to 2014 are denoted as “Must Provide Coverage”.

Figures 1 and 2 examine if obese workers’ behavior changes after 2010. Figure 1 shows the share of obese workers over time at firms with 50 employees or more by insurance coverage status. Firms who do not have coverage in place for employees are denoted as “Must Provide Coverage”. There is no noticeable change in the share of obese workers at firms required to offer coverage. This suggests there is no changes in the labor supply patterns of obese workers towards firms who must offer coverage.

Figure 2 shows the employment tenure of obese and non-obese workers over time at firms affected by the ACA mandate. Identification would be threatened if obese workers' tenure patterns were very different to non-obese workers or if they changed after 2010. The figure shows employment tenure for both obese and non-obese workers is a little noisy (there are only a few hundred observations each year). Average tenure is higher for obese workers in some years both before and after the mandate’s announcement. Importantly, there does not appear to be a marked, permanent change in tenure patterns after 2010. It is therefore unlikely that the results seen in the paper are
The figure shows the tenure of workers over time at firms with 50 employees or more by obesity status.

due to changes in obese workers behavior when they work at firms who have to offer coverage in the near future. Again, even if behavior did change, it would still mean obese workers pay for the small additional cost of their health coverage.