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Body mass and wages: New evidence from quantile estimation

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ABSTRACT

I estimate the effect of body mass index (BMI) on wages across the unconditional distribution of wages. I find that for whites and Hispanics the effect of BMI is generally decreasing across the wage distribution; at the .9 quantile of the wage distribution, a two standard deviation increase in BMI reduces wages by 8% for white males, 13% for white females, 9% for Hispanic males, and 16% for Hispanic females. Conversely, at the .1 quantile, a two standard deviation increase in BMI affects wages by less than 2% for all these groups. For black males, the effect of BMI is positive, and either increasing or non-linear in wages. For black females, the estimates tend to be more uniform across the wage distribution. I discuss possible explanations for these inter-quantile differences including preference discrimination, productivity differences, and statistical discrimination. The results point to a new explanation for the observed correlation between socioeconomic status and body weight: individuals with higher income earning potential have differential incentives to maintain a lower BMI.

1. Introduction

The relationship between wages and seemingly irrelevant personal characteristics such as body weight has perplexed economists. A large literature demonstrates that, at least for some racial groups, body weight negatively affects wages. However, the forces that underlie this relationship are not well understood. This paper contributes to the understanding of this issue by exploring the impact of body mass on wages across the unconditional distribution of wages.

Using the unconditional quantile estimator of Firpo et al. (2009a) and data from the 1979 cohort of the National Longitudinal Survey of Youth, I demonstrate that the effect of body mass index (BMI) on wages differs significantly across the wage distribution. For whites and Hispanics the estimated effect of BMI is generally decreasing in wages; at higher wage quantiles the estimates are negative and statistically significant for both males and females. Conversely, black males receive a premium for higher BMI which is either increasing or non-linear in wages. The estimates for black females are of mixed sign but tend to be relatively uniform across the wage distribution. The results are robust to instrumentation and alternate measures of body weight.

This paper makes three primary contributions to the literature. First, I document a glass ceiling effect whereby BMI has a greater impact at high wage levels for non-black individuals. The glass ceiling effect is a common narrative in the discussion of employment discrimination (Cotter et al., 2001), and enjoys empirical support from research examining the impact of gender on labour market outcomes (Albrecht et al., 2003; Arulampalam et al., 2007). As with gender discrimination, the glass ceiling effect with respect to BMI may be caused by either employer preferences or statistical discrimination (Altonji and Blank, 1999). Employers who have a preference for individuals with particular characteristics (be it gender, weight or race) may have greater latitude to act on these preferences when hiring for higher wage positions. Alternatively, employers may use body weight as a coarse screen for characteristics such as self-control and decision making under stress (Nederkoorn et al., 2006; Rydén et al., 2003; Davis et al., 2006), which may be more valuable in high wage positions that require greater levels of decision making and independence.

Second, I connect the literature that examines the causal impact of weight on wages, to the literature that examines the opposite causal question: the impact of wages (or socioeconomic status) on weight. As documented by Sobal and Stunkard (1989), there is a negative relationship between socioeconomic status and weight in developed countries. The results of this paper offer a new explanation for this correlation: individuals with high income earning potential face differential incentives to maintain a low BMI. For example, whites and Hispanics with higher incomes face higher wage penalties if they are obese, giving them a stronger pecuniary motivation to maintain a low body weight.

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Third, I contrast my results with two previous papers, Atella et al. (2008) and Johar and Katayama (2011), that use a conditional (as opposed to unconditional) quantile estimator. While both of these papers reveal some inter-quantile differences neither find the systematic trend that I identify here. I demonstrate that the difference between my results and those of Johar and Katayama (2011), who use the same dataset, stems from the type of estimator used. As its name suggests, the conditional quantile estimator examines the effect of covariates across the distribution of the dependent variable conditioned on the covariates – in other words, across the distribution of the unobservables. Conversely, the unconditional quantile estimator examines the impact of the covariates across the actual distribution of wages.[1] Of course, the point of this article is not simply to swap one estimation technique for another, but to demonstrate that individuals at opposite ends of the wage distribution receive very different treatment based on their weight, and to explore the implications of this result.

Past research has found BMI to be negatively related to wages for females, though generally insignificant for males (Averett and Korenman, 1996; Cawley, 2004). However, as Joliffe (2011) shows, the relationship between BMI and wages is non-linear, with a stronger correlation at higher levels of BMI. Consistent with this non-linearity, Cawley (2004) and Baum and Ford (2004) find that obesity is negatively correlated with wages for both females and non-black males.

The primary empirical issue this literature has struggled with is the potential endogeneity of body mass. Endogeneity may stem from wages affecting body mass or the presence of a third unobserved covariate that influences both wages and body mass. To combat this problem researchers typically instrument with lagged BMI or sibling BMI (Cawley, 2004; Johar and Katayama, 2011). I show that my results are robust to the use of these instruments.

The literature has made less progress in understanding the forces that underlie the apparent causal relationship between body mass and wages. While some papers find the obesity wage penalty to be partially explained by job category (Johar and Katayama, 2011) and investments in training (Baum and Ford, 2004), it seems fair to say that existing covariates are unable to explain the bulk of this relationship. The extensive sociological research into anti-fat bias (summarized by Puhl and Heuer, 2009) suggests that some portion of this effect is attributable to employer discrimination; the results of this paper lend credence to this argument. I also analyze whether the inter-quantile differences can be attributed to jobs at different wage levels involving different skills. For example, lower paying jobs may require more manual labour and a different level of social interaction. However, I do not find that differences in job categories explain the results.

As I show later in this paper, an individual's socioeconomic status (as measured by education or income) is correlated with BMI. Consistent with past research, this correlation is negative for most racial groups, though positive for black males. The most common explanation for the negative correlation between socioeconomic status and BMI is that a healthy lifestyle is expensive: nutritious diets tend to be pricier (Drewnowski and Darmon, 2005) and exercise can be costly (Fallon, 1990). Furthermore, low incomes have been linked to other health issues that may result from higher stress levels in low-income populations (Geronimus et al., 2006). Economists have used wealth shocks (such as lottery wins, inheritances, and changes in social security payments) to test these arguments with mixed findings.[2] This paper adds a new explanation by showing that individuals in different income classes face different pecuniary incentives to maintain a low body weight.

2. Method

To estimate the effect of body mass across the distribution of wages I use the unconditional quantile estimator of Firpo et al. (2009a). The estimator relies on the influence function, denoted $IF(y: v, F_Y)$, which measures the effect of a single observation (y) on some statistic (v) of a particular distribution (F_Y).

Denoting q_τ as the τth quantile of F_Y, the influence of y on q_τ is

$$IF(y; q_\tau, F_Y) = \frac{(\tau - \mathbb{1}\{y < q_\tau\})}{f_Y(q_\tau)}, \quad (1)$$

where $f_Y(q_\tau)$ is the density of Y at q_τ, and $\mathbb{1}\{\cdot\}$ is an indicator variable that takes on a value of one if its argument is true and a value of zero otherwise. The expectation of the influence function is zero.

Adding the statistic to the influence function yields the recentered influence function or RIF: $RIF(y;q_\tau,F_Y) = q_\tau + IF(y;q_\tau, F_Y)$, whose expectation is the statistic itself. Firpo et al. (2009a) show that if the RIF is linear in X, then a least squares regression of the RIF on X yields the marginal effect of X at the τth quantile of Y.[3] The calculation of $RIF(y;q_\tau, F_Y)$ requires an estimate of q_τ and $f_Y(q_\tau)$. I estimate q_τ using the sample quantile and $f_Y(q_\tau)$ using nonparametric kernel density estimation with Silverman's rule of thumb for bandwidth selection.[4]

The unconditional quantile estimator can yield quite different results than the more commonly used conditional quantile estimator, which measures the effect of covariates at different quantiles of the dependent variable conditional on the explanatory variables. While the conditional quantile estimator is not without utility, its estimates generally lack a straightforward economic interpretation. For example, suppose that the coefficient on BMI in a log wage regression was similar across the conditional distribution of wages – this result only demonstrates that the effect of BMI does not change over the distribution of an individual's unobservables; it may still be the case that BMI has a differential impact on individuals in high wage positions.

To deal with the potential endogeneity of BMI, I instrument with sibling BMI. Sibling BMI is the most commonly used instrument in studies examining the impact of BMI on wages (Averett and Korenman, 1996; Cawley, 2004; Johar and Katayama, 2011; Wada and Tekin, 2010). However, one may question whether sibling BMI is a valid instrument as the unobservables that affect both body mass and wages may be correlated between siblings. Cawley (2004) provides several arguments in favour of the validity of sibling BMI. Perhaps the strongest of these arguments is to show that after controlling for age and gender, sibling BMI does not correlate with observable factors that affect an individual's wage,

[1] Joliffe (2011) employs the unconditional quantile estimator to examine the opposite causal question, estimating the relationship between wages and body mass across the distribution of body mass.

[2] Kim and Ruhm (2012) find weak evidence that inheritances cause a decrease in obesity. Conversely, Au and Johnston (2015) show that inheritances and lottery wins increase body weight in females, with no significant impact for males. Cawley et al. (2010) estimate that changes in social security payments have no significant impact on weight. The potential relationship between BMI and unearned income may cause an endogeneity issue in models that regress wages on BMI, as unearned income may impact both these variables. However, the results of this paper are robust to the inclusion of unearned income from welfare receipts, unemployment income, and inheritances.

[3] Firpo et al. (2009a) suggest alternative estimators that do not require the linearity assumption – they find all these approaches yield similar estimates in their application. I also find similar results when I use the alternative logit estimator.

[4] Silverman's rule of thumb sets the bandwidth to $0.9mn^{-1/5}$ where n is the number of observations and m is the minimum of the standard deviation and the interquartile range divided by 1.349.