Non-linear relationship between body mass index and labor market outcomes: new evidence from China

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Non-Linear Relationship between Body Mass Index and Labor Market Outcomes: New Evidence from China[1]

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Abstract: Using data from a most recent national household survey in China, we provide new evidence for the relationship between body mass index (BMI) and labor market attainments. In contrast to previous studies, we find a non-linear relationship between BMI and employment / wages, especially for women. There is no substantial heterogeneity across occupation in the effect of BMI on women's wages.

Key words: Body mass index, Unemployment, Wage, Non-linear correlation

JEL: I12, J31, J64

1. Introduction

Previous literature shows that individuals' physical appearances such as beauty, height and body weight affect labor attainments (e.g. Hamermesh and Biddle, 1994). In terms of body weight, overweight or obese people, especially women, are less likely to be employed, and are paid lower wages once employed (Harper, 2000; Cawley, 2004; Morris, 2006). These studies usually use either US or European data, while there is little evidence for developing countries. Furthermore, researchers generally found a negative effect or no effect of BMI on employment or wages.

Our study updates evidence on the relationship between BMI and labor market attainments for China using the China Family Panel Survey (CFPS), a most recent national household survey, for the first time and finds a significant non-linear relationship. While our robust results call for the importance of considering possible

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non-linear effects in this literature, non-linearity in the effects of BMI on labor market attainments is in itself intriguing.

2. Data and method

The CFPS that we use is by far the largest and latest comprehensive household survey with information on demographic, economic, and health aspects of households in China. The first wave was conducted from April 2010 to August 2010, covering approximately 16,000 households in 25 provinces.

The sample used here is restricted to those in the labor force, and shall be further restricted to those aged between 18 to 60 years old as working age adults. The two dependent variables capturing labor market attainments are employment status and monthly wage. Covariates in estimating the probability of employment include age, *hukou*[4] status, ethnicity, education attainment, marital status, and self-reported health status. Covariates in the wage equation further include years of working experience and its squared term. There are 8,227 observations in the final sample, though the exact number of observations varies with model specification.

Table 1 presents summary statistics. In particular, average BMI for Chinese men and women are 23.2 and 21.9, respectively, both lower than American or European counterparts. For example, average BMI of the whole US population is reported as 26.5 in Mocan and Tekin (2009), while that for European men and women are 25.2 and 23.3 in Brunello and Hombres (2007). However, we would like to note that the difference is not that large, and later results suggest that non-linearity comes in not just because Chinese have lower average BMI.

3. Results and discussions

We first present estimation results for employment in Table 2. Results in the first three columns consistently suggest that men's probability of employment significantly increases with BMI for lower values, but decreases after a cutoff point. Controlling for parents' characteristics and county fixed effects only increases the significance of the effect. The last three columns display parallel robust and more significant results

[4] That is, household registration status.

for women. The larger coefficients for women suggest that women's employment is more sensitive to BMI than for men. Results for men and women both suggest a non-linear effect, in contrast with all previous studies which either found no significant effects or linear negative effects. To the best of our knowledge, few previous studies take into account of the possibility of a non-linear relationship, with some exceptions such as Mocan and Tekin (2009) considering quadratic terms of BMI but finding insignificant effects.

We calculate the effects of BMI on employment for various values of BMI based on coefficients displayed in column 3 and column 6 of Table 2, for both genders respectively. The pattern is depicted in Figure 1. For men, the probability of employment increases with BMI until around 28. For women, the turning point is about 24. Turning points for both genders are higher than average values in western countries, which suggests the increasing part of the non-linear effects does not come solely from a lower average BMI in developing countries.

We further examine the effect of BMI on wages of currently employed workers. Table 3 shows the effects of men's BMI on wages are all insignificant across various model specifications. In contrast to men, effects for women are highly significant and non-linear. We calculate the effects of women's BMI on wages based on coefficients in column 8 of Table 3 and plot them in Figure 1. Interestingly, the turning points for the employment probability estimation and wage equations for women are very close, which suggests that the effects of BMI on women's labor market attainments are uniform, no matter the person is on the job or in search for a job.

Previous studies hypothesized that effects of BMI on wages may come from occupation sorting, or have roots in the different physical requirements for production in different occupations (Harper, 2000). Some studies do find heterogeneous effects of physical appearances on labor market attainments, although "pure discrimination effects" after partialling out occupational effects still exist (Hamermesh and Biddle 1994; Harper, 2000). In our case, results in column 8 of Table 3 with occupation dummies controlled for are almost the same as those in column 7. Moreover, we estimate the wage equation for white-collar workers and blue-collar workers of both genders in Table 4. Estimates for men are still insignificant, while estimates for women are significant for both white-collar and blue-collar workers. Different magnitudes in columns 2 and 4 suggest subtle differences across occupations, though

a formal *t* test does not reject the equality between two coefficients statistically. The slightly larger effect in the blue-collar group may suggest that BMI is related to productivities somehow, particularly for women. But the still large and significant effect of BMI in the white-collar group might suggest a pure discrimination effect exists according to Hamermesh and Biddle (1994). The fact that BMI plays a significant role in determining women's wages but not men's might also suggest that discrimination on the job is more serious for females. An alternative explanation suggested by Mocan and Tekin (2009) is that wages are influenced by obesity through the channel of obesity to self-esteem, then to wages. We test this argument but find no significant effects of BMI on self-esteem, although self-esteem is positively related to wages.

4. Conclusion

This study re-examines the relationship between BMI and labor market outcomes using data from a most recent nationally-representative household survey in China. The results reinforce the existing literature that BMI has significant impacts on employment status and wages, especially for women. However, in contrast to almost all previous empirical studies, effects of BMI on both employment and wage are non-linear, suggesting being either overweight or too skinny brings a penalty on labor market outcomes. Our results are very robust to different specifications, thus call for the importance of considering non-linear effects in this literature, as leaving out the non-linear term might lead to inconsistent estimates.

We also look at potential channels of this non-linear effect, and find some suggestive evidence for pure discrimination and against occupation sorting, though more substantial evidence is needed in future to be conclusive. The contrast of our results for China and those in previous literature on western countries – if non-linear effects indeed do not exist for the latter – might come from the gap in average BMI between developing countries and developed ones, though the fact that turning points of non-linear effects are higher than average BMI in western countries seems to provide some counter evidence for this claim. Fundamental differences between the labor markets of developing and developed countries, such as in what way discrimination takes place, in this aspect of BMI are worth further investigation.

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Table 1 Descriptive statistics

	Men		Women	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
BMI	23.22	3.278	21.85	2.975
% employed	0.742	0.437	0.722	0.448
Monthly wage	2217	2371.5	1616.5	1578.4
Age	39.21	11.25	36.45	10.19
Education levels (%)				
Illiterate	0.073	0.261	0.088	0.284
Primary school	0.148	0.356	0.146	0.353
Middle school	0.368	0.482	0.338	0.473
High school	0.224	0.417	0.207	0.406
College or above	0.186	0.389	0.221	0.415
Working experience (year)	15.37	11.78	12.56	10.72
% urban	0.497	0.5	0.512	0.5
% minority	0.047	0.212	0.05	0.218
Marital status (%)				
Unmarried	0.171	0.377	0.160	0.366
Married	0.804	0.397	0.801	0.399
Separated or widowed	0.024	0.154	0.039	0.194
% poor health	0.074	0.261	0.079	0.270
Obs. #	4795		3420	

Table 2 BMI and probability of employment

	Dependent Variable: Employment status					
	Men			Women		
	(1)	(2)	(3)	(4)	(5)	(6)
BMI	0.031*	0.031*	0.033**	0.061**	0.063**	0.074***
	(0.018)	(0.018)	(0.016)	(0.026)	(0.026)	(0.024)
BMI squared	-0.001	-0.001	-0.001*	-0.001**	-0.001**	-0.002***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Parents' characteristics	No	Yes	Yes	No	Yes	Yes
County fixed-effects	No	No	Yes	No	No	Yes
Observations	4795	4795	4795	3420	3420	3420
R-squared	0.073	0.077	0.263	0.088	0.090	0.298

Notes: Robust standard errors in parentheses. *** p < .01, ** p < .05, * p < 0.1. All regressions include age, education levels, ethnicity, *hukou*, marital status, and self-rated health status as controls.

Table 3 BMI and monthly wage

	Dependent Variable: Log value of monthly wage							
	Men				Women			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BMI	0.008	0.015	-0.001	-0.000	0.403**	0.404**	0.436***	0.436***
	(0.056)	(0.056)	(0.057)	(0.056)	(0.157)	(0.158)	(0.156)	(0.156)
BMI square	-0.000	-0.000	0.000	-0.000	-0.008**	-0.008**	-0.009***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)	(0.003)
Parents' characteristics	No	Yes	Yes	Yes	No	Yes	Yes	Yes
County fixed-effects	No	No	Yes	Yes	No	No	Yes	Yes
Occupation	No	No	No	Yes	No	No	No	Yes
Observations	3239	3239	3239	3239	2284	2284	2284	2284
R-squared	0.077	0.085	0.162	0.171	0.083	0.086	0.195	0.196

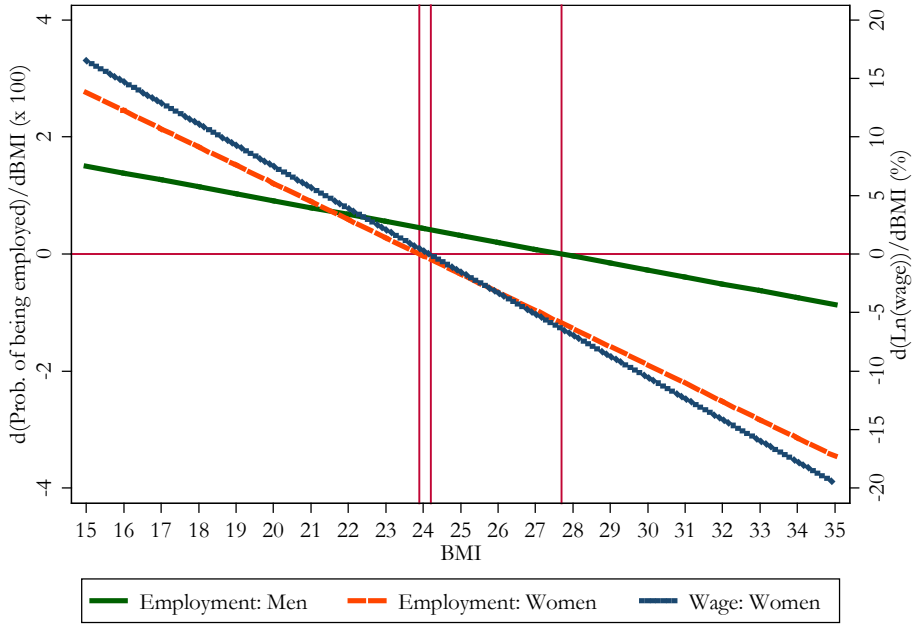
Notes: Robust standard errors in parentheses. *** p < .01, ** p < .05, * p < .1. All regressions include age, education levels, working experience, square of working experience, ethnicity, *hukou*, marital status, and self-rated health status as controls. Occupations are defined at the one digit level due to our limited sample size.

Table 4 Women's BMI and monthly wage: by occupation

	Dependent Variable: Log value of monthly wage			
	White-collar		Blue-collar	
	Men	Women	Men	Women
BMI	-0.002	0.466*	-0.011	0.554**
	(0.087)	(0.262)	(0.081)	(0.220)
BMI square	-0.000	-0.010*	0.000	-0.012**
	(0.002)	(0.005)	(0.002)	(0.005)
Observations	1176	887	1993	1360
R-squared	0.320	0.306	0.151	0.206

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions include age, education levels, working experience, square of working experience, ethnicity, *hukou*, marital status, self-rated health status, parents' education, parents' occupation, and county dummies as controls.

Figure 1 Effects of BMI on probability of employment and monthly wages



Notes: The vertical line denotes the reflection points.