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The impact of body size on urban employment: Evidence from China

Jay PAN [a,e], Xuezheng QIN [b,d,*], Gordon G. LIU [c,d]

[a] West China School of Public Health, Sichuan University, Chengdu, China
[b] School of Economics, Peking University, Beijing, China
[c] Guanghua School of Management, Peking University, Beijing, China
[d] China Center for Health Economic Research, Peking University, Beijing China
[e] Western China Research Center for Rural Health Development, Sichuan University, Chengdu, China

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ABSTRACT

This paper tests whether body size affects employment status in the Chinese urban labor market. Based on Urban Resident Basic Medical Insurance (URBMI) survey data, we find that body size has an inverted U-shaped effect on the probability of being employed when human capital and other factors are controlled, indicating the existence of "body size discrimination". Based on our results, the optimal BMI for employment is estimated to be 22.7 for female and 24.3 for male. Further studies show that the "health channel" and the "esthetic channel" play an important role in forming the body size discrimination among both male and female. Furthermore, we find that the employment type (formal employment vs. informal employment) is also affected by body size. Our paper provides new evidence on the impact of body size on employment, and reveals new characteristics of the Chinese urban labor market.

"Both Yao and Shun are slim, either Jie or Zhou has a fat belly which hangs *down more than a foot* (尧若腊, 舜若腒, 桀、纣之君, 垂腴尺余)" – Chong Wang (86 A.D.)[1]

1. Introduction

People are getting fatter around the world. The increasing prevalence rate of overweight and obesity has become a global health concern, ranking among the 10 leading public health problems in the world (WHO, 1998). China is no exception. After the economic reform in 1978, China experienced a rapid economic development. With the population switching towards a fatter diet, more sedentary jobs and a modern lifestyle, the Chinese keep on gaining weight (Du, Lu, Zhai, & Popkin, 2002). According to Wu (2006), China accounts for about one fifth of the one billion overweight and obese population in the world. In 2005, the number of overweight and obese Chinese reached 303 and 73 million, and the rising trend is widely believed to continue in this decade (Gao, Griffiths, & Chan, 2008).

* Corresponding author at: Rm. 320, School of Economics, Peking University, Beijing, 100871, China. Tel.: +86 10 6275 7237; fax: +86 10 6275 4237.
E-mail address: qin.econpku@gmail.com (X. QIN).

[1] Yao and Shun are ancient sages; Jie and Zhou are ancient tyrants in Chinese history. The legend describing the four historical figures' body size is recorded in Chong Wang (王充)'s book *Lun Heng*. Wang explained saints are hard working, so they could not gain weight, whereas tyrants are derided for the ampleness of their bellies (of course, he thought a foot long fat belly is somehow exaggerating). Like with other cultures around the world, there are various kinds of stereotypes and prejudices associated with being fat, including "laziness, low intelligence, gluttony, and bad health" in Chinese culture.

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The underlying concern behind the problem is whether body size would have an impact on individuals' socioeconomic status, especially their performance in the labor market. The majority of previous studies approached this issue by analyzing whether body size affects the individual's employment rank and wage earnings, but very few studies explicitly address the underlying mechanisms of such effects. One goal of this paper is to identify the (health vs. esthetic) channels through which body size can influence a person's employment status.

In this paper, we aim to identify the causal effect of body size on individual employment status in the Chinese urban labor market, and to explore the factors that may ameliorate or exacerbate such effect. The data used in our paper comes from the Urban Resident Basic Medical Insurance Survey (URBMIS) which is sponsored by the State Council of China and conducted by Peking University Guanghua School of Management. Identification is complicated by the simultaneity and omitted variable problems between body size and employment status. To account for this endogeneity problem, we use the instrumental variable approach with the community based body size prevalence as instrumental variable. Based on our empirical results, we find that (1) the body size has an inverted U-shaped effect on the probability of being employed for both genders, (2) the "health channel" and the "esthetic channel" play an important role in forming the body size discrimination among both male and female, and (3) the employment rank (formal vs. informal) is also affected by body size.

This study contributes to the literature in three aspects. First, it provides new empirical evidence of how body size influences the employment status in China which hosts one of the largest overweight and obese population in the world. Second, we explicitly address the endogeneity problem in identifying the causality between body size and employment status. Finally, two channels of the body size based discrimination are investigated by adding a set of health status indicators and constructing the "body size environment" variables, and the discrimination is shown to display different patterns for male and female.

The remainder of the paper is structured as follows. Section 2 reviews the literature on body size and employment. Section 3 details the data and Section 4 outlines the estimation methodology. Section 5 provides the empirical results. The final section discusses the conclusions.

2. Literature review on body size and employment

In the past 10 years, many empirical studies have been done on body size and employment. Their hypothetical relationship can be summarized as follows:

(1) Body size may affect employment, and the literature suggests that the impact of body size on employment might work through two different channels. The first is the "health channel": body size could affect the individual's health and thus their productivity in the labor market, as underweight is seen as an indication of malnutrition, while overweight and obesity may lead to a number of chronic diseases such as coronary heart disease, type 2 diabetes, hypertension, stroke, and cancer (see for example, NHLBI, 1998; Must et al., 1999; PI-Sunyer, 1999; DODC, 2003; Mokdad, Marks, Stroup, & Gerberding, 2005; WHO, 2000, 2004); meanwhile, Lei, Yin, and Zhao (2012) has also showed that being overweight or obese is significantly and positively correlated with chronic prevalence in China. Grossman's health capital theory (1972) suggests that deteriorating individual health reduces people's working time and their human capital, thus reduces the mean probability of being employed. The second hypothesis argues that body size as a part of physical appearance might be related to others' esthetic view on the individual, thereby affects her/his employment status through the "esthetic channel". As a result, the effect of body size on employment could be due to pure discrimination against unfavorable body shape (either too fat or too thin) (Henry, 2007; Kristen, 2002). Much scholarship (e. g., Hamermesh & Biddle, 1994; Averett & Korenman, 1996; Heineck, 2005; Case & Paxson, 2008; Schick and Steckel, 2010) has supplied evidences that physical appearance affects individual socioeconomic status, while other experimental studies directly confirm that prejudice against obesity from employers, employees, and customers does affect individual employment (Decker, 1987; Klassen, Jasper, & Harris, 1993; Larkin & Pines, 1979).

(2) Employment may also affect body size for two reasons. First, employment may directly affect body size through consumption and expenditure of calories. Based on Schmeiser (2009), the difference in activity across jobs may result in different body weight. The increased working hours may also increase the consumption of high-calorie fast foods and affect body size (Chou et al., 2004). Second, changes in employment may also indirectly alter body size through its impact on wage. As the individual's wage rate rises, the opportunity cost for cooking also increases, and dining out in restaurants becomes more frequent where foods are generally higher in calories (Lin & Frazao, 1997). On the other hand, there is also evidence suggesting that low income people tend to consume cheap high-calorie food and are more likely to be overweight (Basiotis & Lino, 2002; Ranney & McNamara, 2002; Shahar, Shai, Vardi, Shahar, & Fraser, 2005). Additionally, the Chinese culture of business dining could also contribute to the impact of employment on individual body weight. As suggested by Cai, Fang, and Xu (2011), the Chinese business managers commonly use expensive dining and entertainment to bribe government officials and win clients, the cost of which is usually reimbursed under the accounting category of meeting or travel expenses. As a result, being employed in such business firms can significantly increase the individual's chance of being overweight or obese.

(3) Unobserved variables that correlate with both body size and employment might confound the relationship. Such variables include time preference and self-control. For example, myopic behavior might be caused by a high discount rate of future (Fishburn, 1970; Koopmans, 1960; Lancaster, 1963; Samuelson, 1937), so a myopic person might be less concerned about

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the possible long-term health effects of obesity and, consequently may consume more calories and more likely to be obese (Baum II & Ford, 2004; Smith, Bogin, & Bishai, 2005).

The related empirical research typically puts body size variable(s) into the traditional human capital model to analyze the above relationships. Sarlio-Lahteenkorva and Lahelma (1999) use logit model and find that the prevalence of overweight and obesity in U.S. has a significant effect on females' employment (both in short and long term), but has no effect on males. Cawley (2000) finds that individual body mass index (BMI) has a significant negative impact on females' employment prospective, taking into account the endogeneity of obesity. Sousa (2005) uses propensity score matching method and finds that overweight reduces females' employment likelihood in Europe, but increases males'. Garcia and Quintana-Domeque (2006), using multinomial logit model, find that obesity has only a weak negative effect on employment among seven European countries. Morris (2007) uses probit model, propensity score matching and instrumental variable regression to investigate the British labor market, and finds that obesity significantly reduces employment for both genders. Greve (2008) shows that BMI plays a significantly negative role in females' employment and there is an inverted U-shaped effect on males. Johansson, Bockerman, Kiiskinen, and Heliovaara (2009) uses a variety of criteria to measure body size (such as weight/height, waist circumference, BMI), and finds that all obesity indicators have a negative impact on female employment, while only the weight/height variable negatively affects males' employment. Consistent evidence suggests that body size discrimination exists against obese female workers, while the evidence for male is mixed.

Although plenty of empirical studies have been conducted in the developed countries, few have focused on exploring such relationship in the developing countries, which might be different for at least two reasons. First, while malnutrition is uncommon in developed countries, it exists to various extents among developing countries, thus discrimination may exist against underweight rather than overweight. Second, due to the cultural diversity, the esthetic appreciation to body size may be quite different in the developing countries, thus influencing the magnitude or even the nature of the esthetic based discrimination.

3. Data

The data used in this study are from the Urban Resident Basic Medical Insurance Survey (URBMIS) which is sponsored by the State Council of China and conducted by Peking University Guanghua School of Management. After the Urban Resident Basic Medical Insurance was launched in 2007 in 79 pilot cities in China, the URBMI survey was conducted in nine representative cities every year. These cities are selected from the 79 pilot cities based on a number of criteria to be representative of urban China, and these criteria include per capita GDP, total population, population density, average number of hospital beds, etc. The nine cities are Baotou City, Inner-Mongolia Autonomous Region (AR); Changde City, Hunan Province; Chengdu City, Sichuan Province; Jilin City, Jilin Province; Shaoxing City, Zhejiang Province; Xiamen City, Fujian Province; Xining City, Qinghai Province; Urumqi City, Xinjiang AR; and Zibo City, Shangdong Province (Lin, Liu, & Chen, 2009). Then, the probability proportional to size sampling (PPS) method is employed to select the specific communities in these nine cities, and the survey households in one community are collected by geographical distance. From 2007, the URBMIS annually interviews a cohort of about 11,600 households with a total of 32,000 individuals in the nine cities, on average eleven communities in one city with 100 households in each community.[2] Considering the data attrition (e.g. moved out, no one at home, refused to be interviewed), random complementary representative samples were added applying the same sample selection methods as the baseline survey. This survey provides important information on the household demographics, employment status, educational attainment, and health conditions. We use the first four waves of data (2007–2010), which is the most up-to-date available.

As the purpose of our paper is to study the impact of body size on the likelihood of being employed, we exclude people who are out of labor force (children under 18, female older than 55, male above 60,[3] as well as people who are full-time students or retired workers). We also excluded people with disabilities and women who are pregnant during the past year.

We employed two measures of body size in our analysis: one is the BMI as a continuous variable defined as weight in kilograms divided by the squared height in meters; the other is the clinical weight classification (a categorical variable defined by China Center for Disease Control[4]) which includes underweight (BMI $<$ 18.5), normal (18.5 $\leq$ BMI $<$ 24), overweight (24 $\leq$ BMI $<$ 28) and obese (BMI $\geq$ 28). BMI is calculated based on the self-reported height and weight in the survey.[5] As done in previous studies (Atella, Pace, & Vuri, 2008; Brunello & d'Hombres, 2007; Garcia & Quintana-Domeque, 2006), we drop potential outliers by restricting the sample to include only individuals with BMI of 15–35.[6] Our final sample thus contains 60,017 observations (26,471 individual respondents) and 28,686 observations are female.

[2] Community (社区居委会) in this paper refers to the urban neighborhood that represents the lowest level of administrative unit in China, usually encompassing local vicinity with several street blocks. Specifically, there are 105, 119, 129, 134 communities during 2007 to 2010, respectively.

[3] The legal retiring age in China is 60 for male and 55 for female.

[4] See China Ministry of Health Disease Control Division (2003).

[5] URBMI recorded self-reported weight and height data. Some studies argue that measurement error may arise from these self-reported anthropometric data (Cawley, 2004; Chou, Grossman, & Saffer, 2004; Judge, Griffiths, Hill, Lutkepohl, & Lee, 1985; Rowland, 1989): Obese people tend to under-report their weight, and the underweight people tend to over-report. Cawley (2004) and Chou et al. (2004) used information from the NHANES III (the Third National Health and Nutrition Examination Survey) to adjust their data. However, as suggested by Meltzer and Chen (2011), there is no obvious reason that such measurement error would bias the estimation results. Thus we use the unadjusted self-reported anthropometric data in our study.

[6] The dropped very obese (BMI $>$ 35) and very thin (BMI $<$ 15) female samples are 36 and 67, and for male they are 49 and 54.

4. Methodology

4.1. Empirical model of employment and body size

The economic theory suggests that an individual will enter the labor force and be employed if the market wage offer exceeds the individual's reservation wage. In our model, we assume that the prevailing market wage offer *W* is determined by personal human capital *C* (consisting of both knowledge and health) and the body size *S* which affects the individual performance in labor market. So W can be expressed as W (*S*, *C*), where *S* is a vector of variables that measure individual body size, *C* is a vector of variables measuring the individual human capital. In addition, the reservation wage $\underline{W}$ is also affected by other factors related to preference to work. Thus W can be expressed as $\underline{W}$ (*S*, *C*, *F*), where *F* measures the other personal and environmental variables. So the relative tendency of the individual being in the workforce can be measured by:

$$E_i^* = W_i(S_i, C_i) - \underline{W}_i(S_i, C_i, F_i). \tag{1}$$

E^* is an unobserved latent variable indicating the employment tendency, and it determines the observed employment status E_i which is a binary variable taking one if the individual is being employed and zero otherwise. Thus $E_i = 1$ if $E_i^* > 0$, and $E_i = 0$ otherwise. According to the previous literature (Garcia & Quintana-Domeque, 2006; Morris, 2007; Greve, 2008; Johansson et al., 2009; etc.), E_i^* can be expressed as a linear function of body size *S* and other control variables X:

$$E_i^* = S_i\mathrm{d} + X_i\beta + u_i \tag{2}$$

where $X = \{C, F\}$, d and β are coefficients, u_i is an error term. In our regression, *S* is measured in two ways as previously mentioned: by continuous BMI and by body size categories. *C* is measured by educational attainment (categorical) and by health status (including self-rated health as well as presence of chronic diseases and whether falling sick in the past two weeks). *F* is a vector of control variables including age, hukou status (whether registered as agricultural or non-agricultural resident), ethnicity, marital status, whether having kid(s) younger than 6 at home, and a series of year and city dummies.

We focus on consistently estimating d which determines the nature of impact of the individual body size on his/her employment status. If *S* is strictly exogenous, then we can obtain proper estimate of d using the conventional OLS model.

However, the endogeneity problem of body size variables might bias our estimation. As suggested in Section 2, body size might be endogenous for two reasons. First, the reverse causality may lead to endogeneity, as employment can affect body size directly through its effects on the consumption of calories (Chou et al., 2004; Lakdawalla & Philipson, 2002) and indirectly through its impact on income (Basiotis & Lino, 2002; Cawley, Moran, & Simon, 2010; Lin & Frazao, 1997; Ranney & McNamara, 2002; Shahar et al., 2005). Second, unobserved omitted variables that influence both body size and employment can also cause endogeneity bias. Such variables include time preference and self-control (Baum II & Ford, 2004; Smith et al., 2005). For example, those who want to become fashion models must in general try to remain slim. Thus employment choice can be jointly determined with the decisions on what to eat and how often to exercise. If the body size is endogenous, the formulation of the above model becomes:

$$\begin{aligned} \mathrm{E_i}^* &= \mathrm{dS_i} + \mathrm{X_i}\beta + \nu_\mathrm{i} \\ \mathrm{S_i} &= \mathrm{E_i}\theta + \mathrm{X_i}\alpha + \mathrm{Z_i}\gamma + \xi_\mathrm{i} \end{aligned} \tag{3}$$

where, S indicates body size variable. Z is a vector of instrumental variables that are correlated with S, but not with ξ and ν. In such a case, we may use the 2SLS approach to identify the causal effect of body size on individual employment.

4.2. Identification

We use a set of community level body size prevalence as our instrumental variables to explain individual body size but not employment status. As a result of human behavior, body size could be affected by peer group effects, which means the propensity of an individual to behave in a particular way is affected by how people behave in a reference group which comprises the individual. Using the terminology of Manski (1993), these peer effects could be divided into two categories. The first is the "exogenous effect", wherein the pattern of an individual behavior varies with the exogenous characteristics of the reference group. This means that the preference of the local population towards food intake or physical exercises can have an impact on the individual preference (James, 1995). Thus the community level body size prevalence will be directly related to the individual body size as a result of similarity in such preference. The second is the endogenous effects, wherein the pattern of an individual's behavior reflects the "endogenous" influence of social norm (Burke & Heiland, 2006, 2007). The social norm of body size in a community may influence the individual's perception of being normal, thus community level body size prevalence might influence the individual body size. In fact, area based measures have been used as instrumental variables for individual level variables in many studies (Bhattacharya, Goldman, & Sood, 2003; Card, 1995; Currie & Cole, 1993; Goldman et al., 2001; Grabowski & Hirth, 2003; Lo Sasso & Buchmueller, 2004; Morris, 2007; Sloan, Picone, Taylor, & Chou, 2001). For example, Goldman et al. (2001) and Bhattacharya et al. (2003) use the state Medicaid policies as instrumental variables to explain individual insurance status. Moreover, Morris (2007) uses the area prevalence of obesity to instrument individual obesity. Previous literature has demonstrated the body size peer effects from qualitative discussion, and it is noteworthy that three studies (Christakis & Fowler, 2007; Henao-Mejia et al., 2012) recently have also provided strong quantitative evidences on the clustering

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of obese people. Christakis and Fowler (2007) study a densely interconnected social network of 12,067 people evaluated repeatedly for 23 years (from 1971 to 2003), and find significant BMI correlation between the individual herself and the people in her social network. They consider three possible reasons for the phenomena: first, individuals might choose to associate with people alike (Barabási & Albert, 1999; McPherson, Smith-Lovin, & Cook, 2001; Sackett, Anderson, Milner, Feinleib, & Kannel, 1975); second, individuals and her social context might be subject to unobserved factors (e.g. contemporaneous events) that cause their weight to vary at the same time; third, social contacts may exert influence or peer pressure on the individual, thus cause her body size to converge to the average level. Christakis and Fowler (2007) also provide evidence of the clustering of BMI from the sociological perspective. Furthermore, Henao-Mejia et al. (2012) study the BMI clustering from the point of biology. Henao-Mejia et al. (2012) run experiment with mice, and find that obesity is infectious through changing microbe populations in the stomach, suggesting that obesity and non-alcoholic fatty liver disease (NAFLD) may be infectious (at least in the case of mice). Additionally, Ling (2009) uses China's data, and finds that BMI and waist circumference are clustered at province level. All of the above evidence shows strong correlation between individual BMI and area prevalence BMI. Therefore, following the convention in the literature, we employ the community level BMI prevalence as instrumental variables for the individual level body size measures in our study.

The community, gender and year specific body size prevalence variables are constructed as follows:

$$\text{Body size prevalence}_{jgt} = \frac{1}{n}\sum_{i=1}^{n} \text{Body size}_{jgit}$$

where, i denotes an individual, g denotes the gender (female or male), j denotes a community, n denotes the total amount of residents in community j, and t denotes the year. Body size prevalence_{jgt} denotes the indicators of community body size prevalence for community j and gender g in year t. Body size_{jgit} denotes the body size measures for individual i and gender g in community j and year t. Therefore, we instrument individual body size measures (BMI, BMI square, underweight, overweight and obesity) using the community based prevalence of BMI, prevalence of BMI square, prevalence of underweight, prevalence of overweight and prevalence of obesity, respectively. The first two instruments (BMI and BMI squared) are used in the regressions with continuous body size variables, while the other three instruments are used in the regressions with categorical endogenous variables (underweight, overweight and obesity).

There are two requirements for these area based measures to be valid. The first requirement is the existence of a high correlation between body size and the community measure. The hypothesis of peer group effects is supported by the regression results in Appendix Table 1, where the community based BMI measures have a positive and significant effect on individual body size. The first stage F-statistics are 350.99 and 401.34 for female and male, respectively, which exceeds the threshold value under 10% relative bias toleration (see Stock and Yogo, 2005), suggesting that the instrumental variables are unlikely to be weak.

The second requirement is whether or not the exclusion restriction is satisfied, namely whether $\text{Cov}(v, Z) = 0$ holds in Eq. (3). In our application, this means that the area based BMI measures should not directly correlate with the employment outcome through channels other than the individual's body size. The only circumstance under which such correlation occurs is that some community-level unobservable factors determine both the local body mass and employment profiles. For example, the new fast food restaurant in the community might have some influences on the BMI prevalence, and it also might affect local employment opportunity. To test whether the exclusion restriction is satisfied, we apply a community level OLS model to estimate the correlation between the body mass prevalence and the employment percentage. Appendix Table 2 reports the regression results for both genders, respectively.[7] Neither of the coefficient estimates associated with the employment prevalence is statistically significant at 10% level, suggesting such direct correlation is not significant in our sample.

In summary, we find strong correlation between the individual body mass and community based BMI prevalence, but we do not find evidence on the direct effect of the BMI prevalence on individual employment, indicating that the Instrumental variables are valid. In the analysis that follows, we will thus use the gender specific average BMI, prevalence rate of obesity, overweight and underweight in the individual's residential community during each year as the instrumental variables for personal BMI and body size categories, respectively.

5. Empirical results

5.1. Sample description

Fig. 1 is the Lowess curves of the mean probability of being employed against BMI for female and male. Four body size categories are separated by three vertical dotted lines (BMI = 18.5, 24, and 28). The curves illustrate a nonlinear relationship between BMI and the mean probability of being employed. For both male and female, the curves first go up and then decline at different rates after reaching their peaks, thus we may describe them as an inverted-U shaped relationship. Compared to male, female curve is steeper with the turning point closer to the lower end of BMI spectrum. The highest employment rate occurs among the under and normal weight females and the normal and overweight males.

Table 1 summarizes the sample means and frequency percentage of each body size category for female and male. Overall, the overweight and obese females perform poorer in employment, education and self-reported health. They are also more likely to

[7] Because the community BMI prevalence variables are constructed by genders, we run separate regressions.

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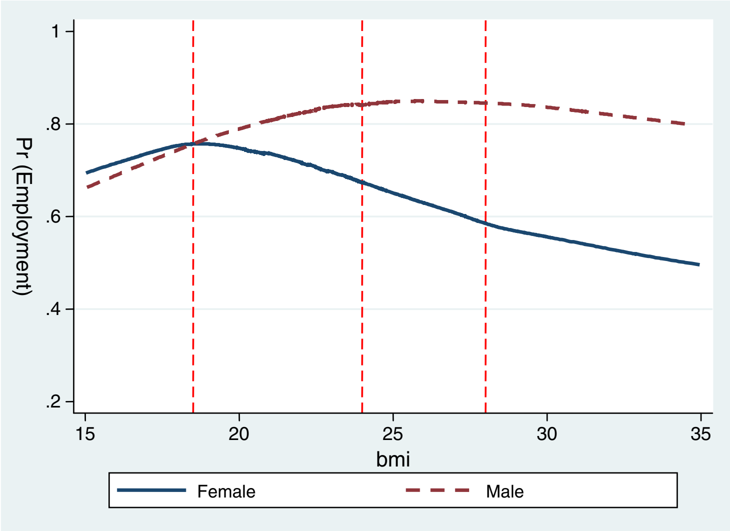

Fig. 1. Lowess curves of the probability of being employed against BMI.

suffer from chronic diseases and be stricken with sickness in the past two weeks. On the other hand, the overweight and obese males also have worse health conditions, but generally perform better than the underweight male in terms of self-reported health, education and employment rate. Additionally, for both female and male, those who are married are more likely to be overweight. In the labor economic literature (Becker, 1991; Dougherty, 2006; Korenman & Neumark, 1991), there might be a marriage premium in wage, which means that those who are married receive higher wages. If the premium hypothesis holds, then failing to control for the individual's marital status will cause a biased estimation of the true effects of BMI on employment, which is one of the reasons for including the marital status in our model.

5.2. Basic results

Table 2 shows the estimated effects of the body size on employment. Columns 1, 2, 5, and 6 represent the results from the simple OLS estimation, and Columns 3, 4, 7, and 8 represent the results of 2SLS estimation for both genders, respectively.[8] The reference groups in regressions with clinical weight classification are persons in the normal BMI range.

Based on the discussion in previous sections, body size variables are likely to be endogenous in the regressions, and the OLS estimates tend to be biased. The results basing on Wooldridge's robust regression-based test (1995) which are reported at the bottom of Table 2, also provide evidences that the body size measures are endogenous in our regressions for both genders, thus we focus on the instrumental variable results.[9] From Column (3), the estimated effects of BMI are positive while that of BMI squared is negative, and both are statistically significant at 5% level, indicating an inverted U-shaped effect of BMI on the mean probability of being employed among female. This suggests that being too fat or too slim will both negatively affect female's performance in job market. The coefficients of education are significantly positive, indicating a positive return to education in Chinese labor market. Age and its squared term are also statistically significant in the regression, indicating a nonlinear effect of age on employment probability. The effect of hukou is insignificant, showing that females from rural area (holding an agriculture hukou) and from urban area (with non-agriculture hukou) do not differ significantly on employment prospects in the city. There is also no significant difference between the married and the non-married female groups, but being divorced or widowed seems to have a negative influence. On the other hand, having children under 6 in family shows a significant impact, and will decrease the employment probability by 8.2% on average. In Column (4) of Table 2 we explore alternative body size measures, i.e. the clinical weight classification. The reference groups are persons in the normal BMI range as mentioned. The effects of all the non-normal body size categories are negative, and statistically significant at the 1% level. The effects turn out to be economically important: underweight, overweight and obese lead to an average 22.9%, 15.2% and 45.1% decrease in the mean probability of being employed for female, respectively. The estimates of body size categories are consistent with the continuously measured BMI. In addition, the estimates of control variables in Column (3) do not differ significantly from Column (1).

Columns (7) and (8) of Table 2 present the results for males. Column (7) uses the continuous BMI measures. The BMI variables are statistically significant at the 5% level, and an inverted U-shaped marginal effect of BMI is also observed. This shows that the

[8] While we use the linear probability model (OLS and 2SLS model) to estimate the marginal effects of body size on employment, the probit (probit with instrumental variables) model using Newey's twostep method (1987) is tried and the results are nearly the same. Additionally, because the 2SLS method is basing on the linear regression models, we also avoid the substantial problem caused by the two-stage instrumental variable approach in nonlinear models, such as IV-Probit, which is proposed by Terza, Basu, and Rathouz (2008).

[9] Compared to OLS results, the 2SLS results are more sensitive to body mass indicators. The estimations for OLS model seem to underestimate for both genders.

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Table 1
Sample means and frequency percentage of select variables.

Female	All	Body size category			
		Underweight BMI<18.5	Normal 18.5≤BMI<24	Overweight 24≤BMI<28	Obese BMI≥28
Employed	71.3%	74.7%	73.2%	63.9%	57.3%
Age	38.05	32.51	37.63	42.28	43.16
Education					
Primary	9.5%	7.1%	8.4%	14.2%	16.3%
Junior	29.9%	22.8%	28.8%	37.0%	39.2%
Senior	35.2%	31.2%	36.3%	33.6%	33.4%
College	25.4%	38.9%	26.5%	15.2%	11.0%
Self-reported health					
Excellent (=5)	22.2%	20.7%	22.8%	21.3%	19.2%
Good (=4)	43.6%	45.5%	44.8%	38.8%	35.3%
Fair (=3)	28.8%	29.4%	27.6%	32.1%	35.7%
Poor (=2)	4.7%	3.6%	4.2%	7.0%	8.7%
Very poor (=1)	0.6%	0.8%	0.5%	0.8%	1.2%
Any chronic diseases	12.0%	7.7%	9.9%	19.6%	32.3%
Fell sick in past two weeks	11.5%	10.0%	10.2%	16.1%	22.0%
Urban Hukou status	90.7%	90.5%	91.1%	89.3%	89.5%
Marriage status					
Single	11.9%	29.8%	11.5%	3.9%	2.9%
Married	83.3%	66.6%	83.7%	90.8%	92.5%
Divorce or widow (Yes=1)	4.7%	3.6%	4.8%	5.3%	4.6%
Any children under 6	18.8%	22.3%	19.3%	15.2%	15.9%
Sample size	28,686	3107	19,754	4963	851
Sample share	100%	10.8%	68.9%	17.3%	3.0%

Male	All	Body size category			
		Underweight BMI<18.5	Normal 18.5≤BMI<24	Overweight 24≤BMI<28	Obese BMI≥28
Employed	82.8%	72.6%	82.2%	85.1%	83.6%
Age	40.77	36.39	40.14	42.36	41.44
Education					
Primary	7.3%	8.0%	7.6%	7.0%	6.6%
Junior	30.5%	32.9%	31.1%	29.4%	29.7%
Senior	34.8%	34.7%	34.9%	34.5%	35.7%
College	27.3%	24.4%	26.5%	29.1%	28.0%
Self-reported health					
Excellent (=5)	23.3%	16.7%	22.5%	25.2%	25.4%
Good (=4)	44.0%	42.9%	45.1%	42.9%	40.6%
Fair (=3)	28.2%	32.3%	28.1%	27.8%	28.0%
Poor (=2)	3.9%	6.5%	3.7%	3.6%	5.4%
Very poor (=1)	0.6%	1.6%	0.5%	0.5%	0.7%
Any chronic diseases	15.0%	13.0%	12.1%	18.5%	24.8%
Fell sick in past two weeks	10.4%	10.6%	9.2%	11.4%	15.1%
Urban Hukou status	91.9%	91.0%	91.6%	92.4%	92.4%
Marriage status					
Single	14.0%	32.6%	16.3%	8.4%	8.7%
Married	83.1%	64.1%	80.5%	89.1%	89.3%
Divorce or widow (Yes=1)	2.9%	3.3%	3.2%	2.5%	2.0%
Any children under 6	17.9%	17.8%	18.1%	17.3%	19.5%
Sample size	31,331	1328	18,014	9836	2149
Sample share	100%	4.2%	57.5%	31.4%	6.9%

discrimination against body size does exist for male too. The effects of education status and age are similar to that for females. Hukou is statistically significant and negatively affects male's employment, which suggests that being a rural Hukou holder is positively associated with the employment prospect in city. The reasons are two-folded: first, the urban Hukou holder might have higher individual reservation wage when controlling for other factors, which makes them less likely to accept a job offer compared to rural migrants; second, rural males who do not have a job would probably migrate back to the rural area, giving a higher observed employment rate for the people who stay in the city. The marriage status plays a significant role, and being married increases a male adult's probability of having a job by 13%, indicating a positive marriage premium. Similar to females' results, having children under 6 also reduces males' employment possibility, with the marginal effect of about quarter of females'. Column (8) shows the results with clinical weight classification. In contrast with female, being overweight loses its statistical significance, while being underweight and obese reduces employment probability by 34.3% and 14.7%. The estimates of the control variables are similar to those in Column (5).

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Table 2
Effects of body size on the probability of being employed.

Pr (employed)	Female				Male			
	OLS		IV		OLS		IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BMI	0.034***		0.934**		0.057***		0.388**	
	(0.012)		(0.374)		(0.009)		(0.170)	
BMI∗BMI	−0.001***		−0.021**		−0.001***		−0.008**	
	(0.000)		(0.008)		(0.000)		(0.004)	
Underweight		−0.012		−0.200***		−0.061***		−0.332***
		(0.009)		(0.076)		(0.013)		(0.090)
Overweight		−0.031***		−0.142**		0.015***		0.035
		(0.008)		(0.057)		(0.005)		(0.033)
Obese		−0.070***		−0.444***		−0.002		−0.133**
		(0.020)		(0.129)		(0.009)		(0.067)
Junior high school	0.118***	0.118***	0.105***	0.114***	0.088***	0.089***	0.087***	0.089***
	(0.013)	(0.013)	(0.016)	(0.013)	(0.012)	(0.012)	(0.013)	(0.012)
Senior high school	0.209***	0.209***	0.183***	0.197***	0.150***	0.151***	0.143***	0.149***
	(0.013)	(0.013)	(0.018)	(0.014)	(0.012)	(0.012)	(0.013)	(0.012)
College degree of above	0.355***	0.356***	0.340***	0.345***	0.231***	0.233***	0.217***	0.228***
	(0.013)	(0.013)	(0.017)	(0.014)	(0.012)	(0.012)	(0.014)	(0.013)
Age	0.033***	0.033***	0.012	0.027***	0.016***	0.016***	0.011***	0.013***
	(0.003)	(0.003)	(0.010)	(0.004)	(0.002)	(0.002)	(0.004)	(0.003)
Age∗Age	−0.000***	−0.000***	−0.000**	−0.000***	−0.000***	−0.000***	−0.000***	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban Hukou status	−0.014	−0.014	−0.011	−0.014	−0.047***	−0.046***	−0.049***	−0.046***
	(0.011)	(0.011)	(0.013)	(0.011)	(0.008)	(0.008)	(0.008)	(0.008)
Minority (Yes=1)	−0.069***	−0.070***	−0.046**	−0.060***	−0.040***	−0.039***	−0.037***	−0.036***
	(0.014)	(0.014)	(0.019)	(0.014)	(0.012)	(0.012)	(0.013)	(0.012)
Married (Yes=1)	−0.003	−0.004	−0.042*	−0.014	0.134***	0.136***	0.121***	0.131***
	(0.011)	(0.011)	(0.022)	(0.012)	(0.011)	(0.011)	(0.013)	(0.012)
Divorce or widow (Yes=1)	−0.027	−0.027	−0.066**	−0.043**	0.013	0.014	0.003	0.010
	(0.018)	(0.018)	(0.026)	(0.019)	(0.020)	(0.020)	(0.021)	(0.020)
Any children under 6 (Yes=1)	−0.082***	−0.082***	−0.077***	−0.081***	−0.024***	−0.024***	−0.022***	−0.024***
	(0.009)	(0.009)	(0.010)	(0.009)	(0.007)	(0.007)	(0.007)	(0.007)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	28,686	28,686	28,686	28,686	31,331	31,331	31,331	31,331
Wooldridge's robust regression-based test	–	–	4.89***	5.79***	–	–	2.52*	4.98***

Notes: The standard errors are adjusted for individual level clustering.
*** $p<0.01$.
** $p<0.05$.
* $p<0.10$.

In summary, the results in Section 5.2 suggest that body size has an inverted U-shaped effect on employment for both genders in China. Urban residents with unfit body size are at disadvantage in the workplace, with the exception of the overweight men. The discrimination is most pronounced for the obese female and for the underweight male.[10] Further calculation based on the inverted U-shaped effect shows that the "Golden Employment BMI"[11] (the optimal BMI for being employed in the Chinese urban labor market) is 22.7 for female, and 24.3 for male. Thus, the optimal body size is slimmer for females than males in China's employment market. Moreover, calculation of marginal effect based on the coefficient estimates indicates that if an individual increases or decreases 1 unit of BMI from the Golden Employment BMI level, her/his probability of employment will reduce by 1.94% and 0.08%, for female and male respectively.

5.3. Health, "body size environment" and the mechanism of discrimination

As mentioned in Section 2, the effects of body size on employment can work through the "health channel" and the "esthetic channel". In this section we will explore the two mechanisms.

We first examine the hypothesis that body size affects employment status through the "health channel". Three health indicators (self-reported health status, any sickness in the past two weeks and presence of chronic diseases) are employed. We

[10] The Wald test shows that the coefficient estimates of being underweight and obese based on the female sample is significantly different with male's estimates (−0.332 and −0.133) at 10% (p=0.0804) and 5% (p=0.0159) level, respectively. Thus the gender difference in the magnitude of the body size effect on employment is statistically significant.

[11] The formula: Golden Employment BMI = −[coefficient of BMI/(2•coefficient of BMI^2)], that is, the BMI at the peak of the inverted U-shaped curve of BMI and employment. The used coefficients are accurate to the 7th decimal point. Therefore, the values differ slightly from using the estimates reported in Table 2 directly.

Table 3
2SLS results including health indicators.

Pr (employed)	Female				Male			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BMI	0.934**		0.894**		0.388**		0.319*	
	(0.374)		(0.373)		(0.170)		(0.174)	
BM∗BMI	−0.021**		−0.020**		−0.008**		−0.007*	
	(0.008)		(0.008)		(0.004)		(0.004)	
Underweight		−0.200***		−0.181**		−0.332***		−0.261***
		(0.076)		(0.075)		(0.090)		(0.090)
Overweight		−0.142**		−0.102*		0.035		0.043
		(0.057)		(0.057)		(0.033)		(0.034)
Obese		−0.444***		−0.364***		−0.133**		−0.132**
		(0.129)		(0.130)		(0.067)		(0.067)
Self-reported health			0.034***	0.039***			0.031***	0.033***
			(0.005)	(0.004)			(0.004)	(0.003)
Any chronic diseases (Yes = 1)			−0.002	−0.031**			−0.017*	−0.019**
			(0.022)	(0.013)			(0.010)	(0.009)
Fell sick in past two weeks (Yes = 1)			−0.032***	−0.032***			−0.028***	−0.029***
			(0.011)	(0.010)			(0.009)	(0.009)
N	28,686	28,686	28,686	28,686	31,331	31,331	31,331	31,331

Notes: Control variables are included in all models for education, age, age squared, urban hukou status, married, any children under 6, year dummies and city dummies. The standard errors are adjusted for individual level clustering.
*** $p<0.01$.
** $p<0.05$.
* $p<0.10$.

add them into the basic models. Thus, the difference in the estimate of d between the two sets of models indicates to what extent the body size affects the individual employment through the "health channel".

Table 3 represents the 2SLS results.[12] For comparison, odd-numbered columns (Columns 1, 3, 5, and 7) list the results excluding the health indicators, which are the same to Table 2, and the models in the even numbered columns (Columns 2, 4, 6, and 8) contain the full set of covariates including the health indicators. As expected, for both genders, better health status contributes to higher likelihood of being employed. The inclusion of health indicators reduces the estimates of BMI (and its square term) from 0.910 (−0.020) to 0.869 (−0.019) for female, and from 0.395 (−0.008) to 0.327 (−0.007) for male. After including the health indicators, the effects of non-normal body size still negatively affect female's employment, but the magnitude of effects is reduced by about 10%, 25%, and 20% for underweight, overweight and obesity, respectively. For male, the effects of underweight and obesity also decrease by about 20% and 2%, respectively.

In summary, the inclusion of the health covariates attenuates the effects of all the body size indicators for both genders, by about 20% reduction in magnitude. This implies that a significant part of the body size discrimination on employment which we identified in the previous section is due to the "health channel".[13]

On the other hand, the negative influence of body size still remains for both genders even after health condition is controlled. To test whether the alternative "esthetic channel" is at work, we introduce the "body size environment" indicators in the regressions. By definition, the esthetic based discrimination on body size comes from the employer's subjective judgment on the potential workers' physical appearance that is unrelated to their productivity. This prejudice is usually formed from people's cognitive view based on everyday observation rather than objective criteria: an overweight person could be deemed as "normal" in an environment where fat people are abundant, while a normal sized person might be seen as too slim in such an environment. We will thus use the city level BMI indicators by age group to measure this relative sense of body size in a particular social setting. If the "esthetic channel" hypothesis is true, then the discrimination against obesity would be smaller in a "plump" environment, and the discrimination against underweight will also be reduced in a "slim" environment.

The "body size environment" is calculated as the gender and age specific BMI average[14] in the city that an individual lives in for each survey wave. We then added the "body size environment" indicator and its interaction term with the individual BMI to our

[12] Given the potential endogeneity of such control variables as marital status, child status and self-reported health status, we use the Wu–Hausman test to test the exogeneity of these variables with their community level prevalence rates as instruments. The results show that endogeneity is not significant in our data. In a robust test, we also run the 2SLS regressions with added IV's to explicitly address the endogeneity of these control variables, and the results are consistent with Table 3.

[13] As suggested by other studies (Bhattacharya & Bundorf, 2009; Garcia & Quintana-Domeque, 2006), the health channel may also work through the health insurance mechanism, i.e. employers can turn away obese individual because they might increase the insurance premium. However, this is not likely to be the case in China, where most employees are covered by the government provided mandatory insurance — Urban Employee Basic Medical Insurance (UEBMI). The insurance premium of UEBMI is proportional to the wage of the employee, and is not related to employees' individual health status or body size.

[14] The categorization of age groups is as follows: ages 18–30, 30–40, 40–50, 50–55 for female and 50–60 for male in addition.

Table 4
2SLS results including "body size environment" indicator.

Pr(Employed)	Female	Male
	(1)	(2)
BMI*"body size environment"	0.030**	0.012**
	(0.014)	(0.006)
"Body size environment"	−0.679**	−0.265**
	(0.303)	(0.127)
BMI	0.992**	0.315*
	(0.486)	(0.186)
BMI∗BMI	−0.036**	−0.012**
	(0.017)	(0.006)
Health indicators	Yes	Yes
N	28,686	31,331

Notes: Control variables are included in all models for education, age, age squared, self-reported health, any chronic diseases, fell sick in past two weeks, urban hukou status, married, any children under 6, and city dummies. The standard errors are adjusted for individual level clustering.
*** $p<0.01$.
** $p<0.05$.
* $p<0.10$.

regression model. The interaction term captures the influence of the environment on the body size based discrimination, thus is the key variable under consideration. If the term has a positive coefficient, then the body size discrimination is shown to be attenuated by the environment, and the esthetic channel should be at work.

As exhibited by the 2SLS regression results in Table 4,[15] the interaction term is significantly positive at 5% level for both genders, after health status is controlled. Moreover, the size of the effect for female is about 2.5 times larger than male. This in turn reflects two findings: (1) for both genders, the body size discrimination against overweight is partially due to the "esthetic channel"; and (2) women suffer more from the esthetic based discrimination than men.[16]

In fact, if esthetic judgement is made by employers, then we would expect that the parameter of the interaction term should be insignificant when we restrict our sample to the self-employed. The regression results using this sample show that the interaction terms are insignificant for both female and male, as expected.[17] The results indirectly prove our hypothesis that people's employment status is affected by the employers' judgment on body size through the esthetic channel.

5.4. The impact of body size on employment rank

This section further explores whether the "rank" of employment is also affected by body size in addition to whether the person is employed. The previous literature suggests that body size may also have an impact on people's hierarchical rank in the workplace as well as their social economic status. In China, urban employment can usually be divided into two types: formal employment and informal employment. Employment in the formal sector usually comes with a long term contract and many fringe benefits such as health insurance and housing allowance which are rare for informal employment. As a result, formal employment is commonly considered as superior to the informal employment. Since our data contains information on such employment types, we will use it to estimate the impact of body size on the employment rank.

For regression purpose, we assume that the employment rank (the dependant variable) can take three values: unemployment, informal employment and formal employment. One question in the URBMI survey is "What is your employment status now?" Nine options are given: "1, formal; 2, temporary; 3, part-time; 4, self-employed or free lance; 5, retired; 6, students; 7, preschool child; 8, unemployed; and 9, others". Following Wan (2008), we define "formal employment" as option 1 and "informal employment" for answers that choose options 2, 3, 4, and 9. Obviously, "unemployment" is defined as option 8.[18]

In the literature (Barrett & Doiron, 2001; Connelly & Kimmel, 2003; Ermisch & Wright, 1993), the employment rank is often modeled as an ordered response. However, other literature (e.g. Carbonell & Frijters, 2004) also suggests that linear treatment of the dependant variable gives similar results compared to the nonlinear model. For simpler estimation algorithm taking the Instrumental variables into account, we use the regular 2SLS approach and treat the employment rank as a linear continuous variable. The

[15] The corresponding instrumental variables for these interaction terms are also generated by interacting the prevalence of BMI variable with the body size environment proxies. Thus, we use three variables – the community based prevalence of BMI, its squared term, and its interaction term with the body size environment – to instrument the associated individual level variables (BMI, BMI square, and BMI∗body size environment) in each regression in Table 4, respectively.
[16] When comparing the magnitude of the esthetic effects between two genders, the Wald test shows that the estimate of male's interaction term (0.012) is significantly different with female's estimate (0.030) at 1% ($p=0.0012$) level.
[17] Due to space limitation, the regression results for the self-employed sample are not reported but available upon request.
[18] In fact, the results are similar when the self-employed individuals are classified as formal employment.

Table 5
2SLS results of body size on employment rank.

Pr (employed)	Female		Male	
	(1)	(2)	(3)	(4)
BMI	1.526**		0.885**	
	(0.660)		(0.382)	
BMI∗BMI	−0.034**		−0.019**	
	(0.014)		(0.008)	
Underweight		−0.386***		−0.600***
		(0.131)		(0.176)
Overweight		−0.352***		−0.019
		(0.104)		(0.072)
Obese		−1.241***		−0.534***
		(0.233)		(0.139)
N	28,686	28,686	31,331	31,331

Notes: Control variables are included in all models for education, age, age squared, self-reported health, any chronic diseases, fell sick in past two weeks, urban hukou status, married, any children under 6, and city dummies. The standard errors are adjusted for individual level clustering.
*** $p<0.01$.
** $p<0.05$.
* $p<0.10$.

estimation results indicating the effect of body size on employment rank are presented in Table 5, where the dependent variable ranges from 1 to 3, referring to unemployment, informal employment and formal employment, respectively.[19]

The effects of BMI are all significant at the 5% level, affecting the individual employment "Rank" for both genders. The impact of BMI being placed on a higher employment rank exhibits the similar inverted U-shaped pattern as previously seen for the mean probability of being employed. This indicates that being too fat or too slim would increase the probability of an individual to be placed into a lower hierarchical rank such as unemployment or informal employment. The results of body size categories show that compared to normal, being unfit decreases the urban adults' employment "Rank", except for overweight men. For females, underweight, overweight and obesity on average increases the tendency of moving down the rank by 0.414, 0.362, and 1.250 unit, respectively. And for males, underweight and obesity raise such tendency by 0.624 and 0.568 unit, respectively. To confirm our previous findings, these results again show that body size discrimination influences people's employment prospects in urban China, and only overweight males are not subject to such prejudices.

6. Conclusions

Does body size affect the employment status in the Chinese urban labor market? The answer is "yes" based on our findings. In this paper, we use the nationally representative URBMIS data to explore the effect of body size on the probability and rank of employment. After explicitly addressing the endogeneity problem with the use of Instrumental variables, we find that the BMI has an inverted U-shaped effect on people's likelihood of being employed when human capital and other environmental factors are controlled. From the regression results, we derived the optimal BMI for employment for both genders, which is 22.7 for female and 24.3 for male. We further explored the mechanism of such discrimination using a set of health status indicators and the "body size environment" variables, and find that while the "health channel" plays an important role in forming the body size discrimination among both male and female, women suffer more from the esthetic based discrimination than men. This result in turn reflects that the body size discrimination is partially based on employers' subjective prejudice in addition to their concerns about the negative impact on productivity exerted by the workers' body size. In addition, the impact of body size on employment rank is also examined, and the results suggest that adults with unfit body sizes, except for overweight men, are disadvantaged in their workplace and more likely to work in the informal sector.

Our paper provides new evidence on how body size influences the employment status in China, which accounts for about one fifth of the overweight population around the world. Our findings contribute to the growing literature on the mechanism of appearance based discrimination in the labor market. Our studies can be extended by further exploring the effects of body size on other labor market outcomes, for example wage and occupational choices, as such studies will further clarify the role of body size in the country's labor market.

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[19] We also defined "Formal" as a dummy variable, 1 for formal, and 0 for informal employment. The estimation results are nearly the same as the "Rank" results, so we do not present the results here.

Appendix A

Appendix Table 1
First stage results for females.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	BMI	BMI	BMI	BMI	BMI*BMI	BMI*BMI	Underweight	Underweight	Overweight	Overweight	Obesity	Obesity
BMI prevalence	0.862***	0.843***	−0.027	−0.008	−35.265	−33.750						
	(0.045)	(0.045)	(1.492)	(1.488)	(69.810)	(69.590)						
BMI prevalence∗BMI prevalence			0.020	0.019	1.709	1.653						
			(0.034)	(0.034)	(1.600)	(1.595)						
Underweight prevalence							0.928***	0.926***	0.040	0.036	0.001	−0.002
							(0.050)	(0.050)	(0.056)	(0.056)	(0.025)	(0.025)
Overweight prevalence							0.021	0.018	0.944***	0.933***	−0.016	−0.026
							(0.034)	(0.034)	(0.047)	(0.047)	(0.021)	(0.021)
Obesity prevalence							0.039	0.032	−0.115	−0.138	0.968***	0.948***
							(0.075)	(0.075)	(0.108)	(0.108)	(0.067)	(0.067)
Junior high school	0.017	0.023	0.016	0.023	0.075	0.409	−0.011	−0.011	−0.005	−0.005	−0.002	−0.001
	(0.088)	(0.087)	(0.088)	(0.087)	(4.139)	(4.102)	(0.007)	(0.007)	(0.012)	(0.012)	(0.006)	(0.006)
Senior high school	−0.225**	−0.211**	−0.225**	−0.211**	−11.556***	−10.794***	−0.008	−0.007	−0.039***	−0.037***	−0.009	−0.008
	(0.090)	(0.089)	(0.090)	(0.089)	(4.229)	(4.186)	(0.007)	(0.007)	(0.012)	(0.012)	(0.006)	(0.006)
College degree of above	−0.463***	−0.458***	−0.463***	−0.458***	−21.823***	−21.481***	0.015*	0.016*	−0.048***	−0.047***	−0.013**	−0.012**
	(0.094)	(0.094)	(0.094)	(0.094)	(4.401)	(4.360)	(0.009)	(0.009)	(0.012)	(0.012)	(0.006)	(0.006)
Age	0.095***	0.107***	0.095***	0.107***	3.292***	3.893***	−0.023***	−0.023***	−0.001	0.000	−0.004***	−0.003**
	(0.022)	(0.022)	(0.022)	(0.022)	(0.980)	(0.981)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)
Age∗Age	0.000	−0.000	0.000	−0.000	0.016	0.004	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.013)	(0.013)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban Hukou status	−0.033	−0.048	−0.032	−0.047	−1.260	−2.032	−0.004	−0.004	−0.007	−0.008	0.003	0.001
	(0.071)	(0.070)	(0.071)	(0.070)	(3.296)	(3.273)	(0.007)	(0.007)	(0.009)	(0.009)	(0.005)	(0.005)
Minority (Yes=1)	0.184**	0.165*	0.185**	0.166*	9.686**	8.746**	0.002	0.002	0.015	0.014	0.012**	0.011*
	(0.091)	(0.091)	(0.091)	(0.091)	(4.230)	(4.194)	(0.009)	(0.009)	(0.011)	(0.011)	(0.006)	(0.006)
Married (Yes=1)	0.411***	0.408***	0.412***	0.409***	16.856***	16.725***	−0.064***	−0.064***	0.004	0.004	0.004	0.004
	(0.078)	(0.078)	(0.078)	(0.078)	(3.417)	(3.410)	(0.011)	(0.011)	(0.008)	(0.008)	(0.003)	(0.003)
Divorce or widow (Yes=1)	0.079	0.051	0.080	0.052	1.666	0.255	−0.052***	−0.052***	−0.027*	−0.029**	−0.007	−0.009
	(0.119)	(0.119)	(0.119)	(0.119)	(5.370)	(5.355)	(0.014)	(0.014)	(0.015)	(0.015)	(0.006)	(0.006)
Any children under 6 (Yes=1)	0.022	0.026	0.023	0.026	1.267	1.467	−0.003	−0.003	0.005	0.005	0.002	0.003
	(0.057)	(0.056)	(0.057)	(0.056)	(2.599)	(2.588)	(0.006)	(0.006)	(0.007)	(0.007)	(0.003)	(0.003)
Self-reported health		0.050**		0.050**		1.925*		−0.008***		0.000		0.001
		(0.023)		(0.023)		(1.046)		(0.002)		(0.003)		(0.002)
Any chronic diseases (Yes=1)		0.639***		0.639***		31.461***		−0.012*		0.042***		0.041***
		(0.077)		(0.077)		(3.659)		(0.006)		(0.010)		(0.006)
Fell sick in past two weeks (Yes=1)		0.017		0.017		0.876		0.010		0.008		0.001
		(0.063)		(0.063)		(2.947)		(0.006)		(0.009)		(0.005)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	28,686	28,686	28,686	28,686	28,686	28,686	28,686	28,686	28,686	28,686	28,686	28,686
R-squared	0.189	0.194	0.189	0.194	0.181	0.186	0.084	0.084	0.089	0.091	0.038	0.044
Joint F-statistics of the IVs	364.21	351.91	186.55	180.4	187.14	180.5	114.49	114.17	139.65	136.47	69.16	67.34

Notes: The standard errors are adjusted for individual level clustering. *** $p<0.01$; ** $p<0.05$, * $p<0.10$.

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Appendix Table 2
First stage results for males.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	BMI	BMI	BMI	BMI	BMI*BMI	BMI*BMI	Underweight	Underweight	Overweight	Overweight	Obesity	Obesity
BMI prevalence	0.911***	0.889***	0.464	0.106	−17.419	−33.160						
	(0.045)	(0.045)	(1.251)	(1.248)	(61.757)	(61.614)						
BMI prevalence * BMI prevalence			0.010	0.017	1.308	1.623						
			(0.027)	(0.027)	(1.336)	(1.333)						
Underweight prevalence							0.969***	0.953***	0.081	0.103	0.007	−0.002
							(0.061)	(0.060)	(0.103)	(0.102)	(0.051)	(0.051)
Overweight prevalence							0.016	0.016	0.962***	0.955***	−0.009	−0.017
							(0.018)	(0.018)	(0.043)	(0.043)	(0.025)	(0.025)
Obesity prevalence							0.030	0.032	−0.068	−0.078	0.979***	0.971***
							(0.033)	(0.033)	(0.089)	(0.089)	(0.060)	(0.060)
Junior high school	0.000	−0.016	0.001	−0.015	−0.210	−0.934	0.000	0.001	−0.001	−0.003	−0.000	−0.001
	(0.092)	(0.091)	(0.092)	(0.091)	(4.426)	(4.408)	(0.005)	(0.005)	(0.013)	(0.013)	(0.007)	(0.007)
Senior high school	0.132	0.101	0.133	0.102	5.450	4.100	−0.006	−0.005	0.014	0.011	0.001	0.001
	(0.095)	(0.094)	(0.095)	(0.094)	(4.563)	(4.543)	(0.005)	(0.005)	(0.014)	(0.014)	(0.007)	(0.007)
College degree of above	0.352***	0.295***	0.352***	0.295***	15.113***	12.576***	−0.013**	−0.011*	0.046***	0.040***	0.002	0.001
	(0.098)	(0.098)	(0.098)	(0.098)	(4.759)	(4.733)	(0.006)	(0.006)	(0.014)	(0.014)	(0.008)	(0.008)
Age	0.173***	0.180***	0.173***	0.180***	7.627***	7.971***	−0.012***	−0.012***	0.016***	0.017***	0.002	0.003*
	(0.021)	(0.021)	(0.021)	(0.021)	(1.003)	(0.999)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Age * Age	−0.002***	−0.002***	−0.002***	−0.002***	−0.076***	−0.083***	0.000***	0.000***	−0.000***	−0.000***	−0.000	−0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.012)	(0.012)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Urban Hukou status	0.010	0.010	0.012	0.014	0.492	0.484	−0.002	−0.003	−0.004	−0.004	0.008	0.007
	(0.078)	(0.077)	(0.078)	(0.078)	(3.826)	(3.803)	(0.005)	(0.005)	(0.011)	(0.011)	(0.007)	(0.007)
Minority (Yes = 1)	0.347***	0.332***	0.347***	0.331***	17.034***	16.253***	−0.009	−0.009	0.016	0.015	0.029***	0.028***
	(0.105)	(0.104)	(0.105)	(0.104)	(5.102)	(5.045)	(0.006)	(0.006)	(0.014)	(0.015)	(0.010)	(0.010)
Married (Yes = 1)	0.701***	0.683***	0.701***	0.683***	31.820***	30.992***	−0.024***	−0.023***	0.060***	0.058***	0.019***	0.019***
	(0.094)	(0.093)	(0.094)	(0.093)	(4.425)	(4.401)	(0.007)	(0.007)	(0.012)	(0.012)	(0.007)	(0.007)
Divorce or widow (Yes = 1)	0.204	0.194	0.204	0.193	8.308	7.741	−0.015	−0.015	0.003	0.002	−0.003	−0.005
	(0.153)	(0.151)	(0.153)	(0.151)	(7.187)	(7.115)	(0.011)	(0.011)	(0.022)	(0.022)	(0.011)	(0.011)
Any children under 6 (Yes = 1)	−0.045	−0.043	−0.045	−0.042	−1.834	−1.692	−0.001	−0.001	−0.009	−0.009	0.002	0.002
	(0.063)	(0.062)	(0.063)	(0.062)	(3.022)	(3.005)	(0.004)	(0.004)	(0.009)	(0.009)	(0.005)	(0.005)
Self-reported health		0.218***		0.219***		9.750***		−0.010***		0.022***		0.003*
		(0.023)		(0.023)		(1.118)		(0.002)		(0.004)		(0.002)
Any chronic diseases (Yes = 1)		0.736***		0.737***		36.388***		−0.006		0.070***		0.050***
		(0.064)		(0.064)		(3.134)		(0.004)		(0.010)		(0.006)
Fell sick in past two weeks (Yes = 1)		−0.016		−0.015		−0.294		0.001		−0.013		0.003
		(0.065)		(0.065)		(3.170)		(0.004)		(0.010)		(0.006)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	31,331	31,331	31,331	31,331	31,331	31,331	31,331	31,331	31,331	31,331	31,331	31,331
R-squared	0.115	0.123	0.115	0.123	0.110	0.118	0.042	0.044	0.057	0.060	0.042	0.046
Joint F-statistics of the IVs	415.47	397.41	214.95	204.65	212.51	202.38	85.19	83.65	168.96	166.86	89.1	87.88

Notes: The standard errors are adjusted for individual level clustering. ***$p<0.01$; **$p<0.05$, *$p<0.10$.

Appendix Table 3
Community level BMI prevalence.

Employed	Female	Male
	(1)	(2)
Community based BMI prevalence	−0.259	−0.316
	(0.262)	(0.367)
Fraction of education junior	0.359	−0.468
	(0.571)	(0.603)
Fraction of education senior	−0.090	0.403
	(0.513)	(0.540)
Fraction of education college or above	−0.940**	0.843
	(0.446)	(0.524)
Average age	0.037*	0.025
	(0.022)	(0.023)
Fraction of urban hukou	0.103	−0.203
	(0.259)	(0.318)
Fraction of minority	−0.126	0.196
	(0.283)	(0.295)
Fraction of married	1.036*	1.055
	(0.565)	(0.656)
Fraction of divorce or widow	0.804	−1.024
	(1.065)	(1.214)
Fraction of family has any children under age 6	0.451	0.509
	(0.387)	(0.436)
Year dummies	Yes	Yes
City dummies	Yes	Yes
N	487	487
R-squared	0.676	0.737

Notes: The standard errors are adjusted for community level clustering. ***$p<0.01$; **$p<0.05$, *$p<0.10$.

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