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Bivariate probit analysis of differences between male and female formal employment in urban China☆

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ABSTRACT

Using the 2004 and 2006 pooling data from the China Health and Nutrition Survey (CHNS) questionnaire, this paper studies the differences between male and female employment in urban China, taking into account the interdependence between the decision of women to participate in the workforce and the formal hiring decisions of organizations. We take into account this interdependence issue using a bivariate probit model.

When certain unobserved factors are ignored that may otherwise influence both the decision of women to participate in the workforce and the formal recruitment decisions of organizations, the results denote that the estimated coefficients of the equation corresponding to the formal hiring of female employees are inconsistent. On the other hand, the results indicate that the conditional formal employment probability of women, which can be obtained through a censored bivariate probit from an all-female sample, was about 3% lower than the unconditional probability obtained through a univariate probit from a sample of only labor market participants. Moreover, the results show that the formal employment probability differential (between males and females), owing to discrimination, will be overestimated in the case of a univariate probit model.

1. Introduction

Results based on the methodology for estimating informal employment (Cai & Wang, 2004)[1] show that the number of individuals informally employed in China was approximately 23 million in 1990; this number remained somewhat constant until 1996. However, informal employment increased rapidly from 1997 onward, reaching 174 million in 2005; the share of informal employment, as a portion of all employment, also increased, exceeding 30% from 1999 onward.[2] In China, male workers have significantly higher average formal employment probabilities than female workers. As shown in Table 1, according to the 2004 and 2006 pooling data on the China Health and Nutrition Survey (CHNS)[3] questionnaire, the average formal employment probability for men in urban China in 2005 was 69%, while that of females was 55%; therefore, the former was higher than the latter by about 14%.

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[1] Cai and Wang (2004) estimate informal employment, based on differences between household labor surveys and employment information obtained from enterprises (the former being larger than the latter), both from a particular China statistics system. Informal employment therefore refers to unrecorded employment, because certain enterprises refrain from reporting, for a variety of reasons.

[2] Source: China Labor Statistical Yearbook (2006).

[3] Source: http://www.cpc.unc.edu/projects/china.

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Lower formal employment probabilities for females can be attributed to factors such as individual characteristics, area of settlement, macroeconomic situation, and discrimination.[4] To what extent are the differences between formal employment probabilities attributable to these aforementioned factors? In particular, to what extent does labor market discrimination impact female formal employment probabilities? This paper seeks to answer these questions.

Johnson (1983), Abowd and Killingsworth (1984), and Mohanty (1998, 2000, 2002) studied employment discrimination in the US. Chen and Hamori (2008) used the results of the CHNS questionnaire (1997 data, 2004 and 2006 pooling data) to investigate, for two sample years (1996 and 2005), whether Chinese employers discriminate against females when recruiting employees.

However, regardless of a worker's decision to participate in the labor market, using a univariate probit or a univariate logit to estimate a worker's employment probabilities may lead to inconsistent estimates. For this reason, Abowd and Farber (1982), Farber (1983), Heywood and Mohanty (1995), and Mohanty (2002) used bivariate probits to estimate a worker's employment probability, because that probability may depend not only on the hiring decision but also the worker's decision to participate in the labor market.

Consequently, when we estimate the formal employment probabilities of males and females, using either a univariate probit or a univariate logit, we obtain biased estimates if unobserved characteristics determine both the worker's decision to participate and the employer's decision to hire. This article is the first study of differences between male and female rates of formal employment in urban China, using bivariate probit modeling.

In Section 2, we present the framework by which we estimate the formal employment probabilities of male and female workers in China. Section 3 presents information on the dataset used as well as definitions of the variables, while Section 4 reports results concerning the determinants of formal employment of male and female workers and examines the various components of such differences. Finally, Section 5 summarizes the findings.

2. Empirical techniques

In this section, we present the framework for estimating the formal employment probabilities of men and women, according to Meng and Schmidt (1985), Mohanty (2002), and Greene (2003). We let y_{1i} be a latent variable that denotes the probability that an individual will enter the labor market, which is dependent on personal and family characteristics and the area of settlement (x_{1i}). Moreover, we let y_{2i} be a latent variable that denotes the probability that a worker is formally employed, which depends on personal characteristics, the area of settlement, and the macroeconomic situation (x_{2i}).

Therefore, our model is represented as follows:

$$y_{1i} = X_{1i}\beta_1 + \mu_{1i} \tag{1}$$

$$y_{2i} = X_{2i}\beta_2 + \mu_{2i}, \tag{2}$$

where the values for y_i are unobservable and related to the following binary dependent variables, on the basis of the following conditions:

$$Parti_i = 1, \text{ if } y_{1i} > 0; \qquad Parti_i = 0, \text{ if } y_{1i} \le 0 \tag{3}$$

and

$$Sel_i = 1, \text{ if } y_{2i} > 0; \qquad Sel_i = 0, \text{ if } y_{2i} \le 0, \tag{4}$$

where $Parti_i = 1$ denotes that the worker is seeking work; $Sel_i = 1$, that the worker would have the opportunity to be formally employed. The errors $(\mu_{1i},\mu_{2i})'$ are assumed to have the standard bivariate normal distribution, with $E(\mu_{1i}) = 0 = E(\mu_{2i})$, $V(\mu_{1i}) = V(\mu_{2i}) = 1$, and $Cov = (\mu_{1i},\mu_{2i}) = \rho$. Thus, the worker's formal employment probability can be written as

$$\begin{aligned} &P(Formal) \\ &= P(Parti_i = 1, Sel_i = 1) \\ &= P(X_{1i} < x_{1i}, X_{2i} < x_{2i}) \\ &= \int_{-\infty}^{x_{2i}} \int_{-\infty}^{x_{1i}} \phi_2(z_{1i}, z_{2i}; \rho) dz_{1i}\, dz_{2i} \\ &= F(X_{1i}\beta_1, X_{2i}\beta_2; \rho), \end{aligned} \tag{5}$$

where F denotes the bivariate standard normal distribution function with correlation coefficient ρ.[5] If $Parti_i$ and Sel_i are both observed—that is, in terms of the four possible combinations, "$Parti_i = 1$, $Sel_i = 1$," "$Parti_i = 1$, $Sel_i = 0$," "$Parti_i = 0$, $Sel_i = 1$" and "$Parti_i = 0$, $Sel_i = 0$"—this case is a bivariate probit model with full observability; it has the most complete observability and

[4] According to discussions of employment discrimination (Abowd & Killingsworth, 1984; Mohanty, 1998, 2000, 2002), we define formal employment discrimination as follows: a situation wherein identical workers have unequal formal employment probabilities (e.g., if male workers receive more favorable treatment and consequently a higher average formal employment probability than female workers). Differences in formal employment probabilities between male and female workers that cannot be explained by observed characteristics may indicate the presence of formal employment discrimination between male and female workers in the labor market.

[5] Density function is given as follows: $\phi_2 = e^{-(1/2)(x_{1i}^2 + x_{2i}^2 - 2\rho x_{1i}x_{2i})/(1-\rho^2)} / 2\pi(1-\rho^2)^{1/2}$ (Greene, 2003).