行政院國家科學委員會補助專題研究計畫成果報告

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計畫類別：☑個別型計畫　　□整合型計畫

計畫編號：NSC 89－2416－H－004－011－

執行期間：　88 年 8 月 1 日至 89 年 7 月 31 日

計畫主持人：莊奕琦

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執行單位：政治大學經濟系

中　華　民　國　八十九年　八月　二十二日

Educational Choice, Wage Determination, and Rates of Return to Education in Taiwan

Yih-chyi Chuang
Department of Economics
National Chengchi University

Chen-yeng Chao
Department of Finance
Jin Wen Institute of Technology

(Revise version: July 12, 2000)

Abstract

This paper estimates educational choice, wage determination, and the rate of return to education in Taiwan using Taiwan' s Manpower Utilization Survey data of 1996. As education investment is a self-selection process, this paper adopts a two-stage estimation method. First, a ploychotomous ordered probit model is used to estimate the education decision. Second, the wage equations of different educational attainments are estimated by incorporating the possible selection bias obtained in the probit model. Finally, rates of return on each education level are calculated from the estimation results.

The main findings of the paper are as follows. (a) Family factors significantly affect a person' s selection of education level, for example, the larger the number of children in the family, the lower the educational attainment of the children; the higher the parents' education and work position, the higher their children' s education; and children from single parent families tend to attain a lower level education. (b) Significant negative selection bias is found in the male group for university; and in the female group for vocational school, junior college, and university. On the other hand, significant positive bias is only found in the female group for senior high school. (c) The estimated annual rates of return to schooling are 2.30% for high school, 3.98% for vocational school, 4.58% for junior college, and 12.20% for university. In general, consistent with the literature, we find that the female has a higher return rate to education than the male for most educational levels.

Key words: Returns to education; Selection bias
JEL Classification: J24

Correspondence to: Yih-chyi Chuang, Department of Economics, National Chengchi University, Taipei, Taiwan, R.O.C. Phone: 886-2-29387630; Fax: 886-2-29390344; E-

mail: ycchuang@nccu.edu.tw.

Educational Choice, Wage Determination, and Rates of Return to Education in Taiwan

1. Introduction

For the past forty years after the Second World War, the proportion of educated people in Taiwan has been increasing tremendously. The number of students increases from 1.19 million in 1953 (18.6% of population aged over 6) to 5.18 million in 1997 (26.2% of population aged over 6). The enrollment rates of all educational levels also surge over time, from 56.96% in 1953 to 90.7% in 1997 for senior higher school, and from 26.27% in 1953 to 56.88% in 1997 for college and university.[1] The average years of education increased from 5.5 in 1976 to 8.55 in 1993. According to the human capital theory (Becker, 1975), people forgo their possible earnings (including all costs of schooling), accumulate skill and knowledge in school and expect in return to receive higher lifetime earnings. If education is a kind of investment, what are the rates of returns for different educational levels? Moreover, schooling is not only an individual' s decision but also a family' s decision.[2] That is, people self-select into appropriate educational attainment according to their talent and family resources constraints. In this regard, the observed market wages for different educational attainment are the result of self-selection. Therefore, any direct calculation of rates of educational returns, even after considering individual and job attributes may still be subject to bias. In this paper, a two-stage

[1] A nine-year compulsory education policy was implemented in 1968.

[2] Education may also be a content of intergenerational transfer, see, e.g., Kotlijioff and Summers (1986), Cox and Jappelli (1993), Altig and Davis (1993), and Chu and Koo (1995), among others.

selection corrected method was adopted using the Taiwanese Manpower Utilization Survey data of 1996.[3] We first estimate individuals' educational decision by a ploychotomous ordered probit model. The wage equations of different educational attainments were then estimated by incorporating the possible selection bias term obtained in the ordered probit estimation. Finally, returns on each educational level are calculated from the estimation results.

The rest of the paper is organized as follows. Section 2 provides the theoretical background for the optimal education decision and self-selection process; Section 3 discusses the data and estimation method employed; Section 4 summarizes the estimation results and calculates the rates of returns for each educational level. Concluding remarks are finally made in Section 5.

2. The Theoretical Model

This section provides a theoretical model that emphasizes the self-selection process of educational choice and the need to correct the selection bias for the estimation of wage equations of different educational levels. Suppose that each individual maximizes the present value of his lifetime earnings defined as

$$V(s) = \int_s^N y(s)e^{g(t-s)}e^{-rt}dt\,, \tag{2.1}$$

where y(s) is the income for s years of education, N is the year of retirement, g is the growth rate of income, and r is the discount rate. Integrating (2.1) yields

[3] The use of probit model and selection-corrected wage equations for estimating returns of education can be found in Willis and Rosen (1979).

$$V(s) = \frac{y(s)}{r-g}[e^{-rs} - e^{(N-s)g}e^{-rN}]. \tag{2.2}$$

Let N approach infinity, (2.2) will reduce to $V(s) = \frac{y(s)}{r-g}e^{-rs}$. Thus, the first-order condition for optimal education is

$$\frac{\partial V(s)}{\partial s} = \frac{y'(r-g)+g'y}{(r-g)^2}e^{-rs} - \frac{y}{r-g}re^{-rs} = 0, \tag{2.3}$$

where $y' = \frac{\partial y}{\partial s} > 0$, $g' = \frac{\partial g}{\partial s} \geq 0$, and $V_{ss} = \frac{\partial^2 y}{\partial s^2} \leq 0$. The growth rate of income has the property that $g: \Re_+ \to \Re_+$ is a strictly quasi-concave function, which satisfies $\lim_{s\to\infty} g(s) < r$. From (2.3) optimal education can thus be expressed as

$$S = S(y', r, g, g'). \tag{2.4}$$

Let the income at time t with s years of education be

$$y(t) = ye^{g(t-s)}e^{\theta}. \tag{2.5}$$

As claimed in Garen (1984), the income distribution for different educational levels may likely be heterogeneous. Hence, error term θ in (2.5) can be specified as $\varepsilon + \phi \cdot s$, which satisfies $E(\varepsilon_i + \phi_i \cdot s_j) = 0$ and $\text{cov}(\varepsilon_i + \phi_i \cdot s_j, R_i) = 0$, where R represents all observable factors that affect income and income growth rates. Furthermore, $E(\varepsilon_i + \phi_i \cdot s_i)(\varepsilon_k + \phi_k \cdot s_k) = 0$ if $i \neq k$, and $E(\varepsilon_i + \phi_i \cdot s_i)(\varepsilon_k + \phi_k \cdot s_k) = \sigma^2$ if $i = k$.

Assumed that income and income growth rates are influenced by educational attainments and other factors (x_1), they can thus be expressed as

$$y = \exp[\alpha_0 + \alpha_1 \cdot s + \alpha_2 \cdot x_1 + \alpha_3 \cdot x_1 \cdot s], \tag{2.6}$$

$$g = b_0 + b_1 \cdot s + b_2 \cdot x_1 + b_3 \cdot x_1 \cdot s, \tag{2.7}$$

where α_0 to α_3 and b_0 to b_3 are parameters to be estimated. Substituting (2.6) and (2.7) into (2.5) and taking log form on both sides yields

$$\ln y(t) = \alpha_0 + \alpha_1 s + \alpha_2 x_1 + \alpha_3 x_1 s + b_0 T + b_1 sT + b_2 x_1 T + b_3 x_1 sT + \varepsilon + \phi \cdot s \ , \tag{2.8}$$

where T is the working experience defined as t-s. Note that in the complete model of equations (2.8) and (2.4), where $E(\varepsilon + \phi \cdot s | s, x_1, T) \neq 0$ which renders bias under OLS estimation. Therefore, in the next subsection, we provide an intergenerational utility maximization model to show that education is not a random process, but one that is strongly influenced by an individual' s ability and family background. Therefore, in order to obtain unbiased estimators for wage equations of different educational levels, an educational choice equation need to be estimated first and then use it to correct for the selection bias in the wage equations.

Educational Choice

This section analyzes what factors determining a person' s educational decision. Considering an intergenerational utility function suggests that each generation cares about his own consumption and human capital accumulation of his children. The utility maximization problem can be expressed as

$$\text{Max} \quad U = U(C_p, H_c) \tag{2.9}$$

$$\text{s.t.} \quad P_H H_c + C_p = \alpha H_p t \ , \tag{2.10}$$

where C_p is parents' consumption level and H_c is the stock of children' s human capital,

P_H is the price of children' s human capital (the price of consumption goods is taken as the rumeraire), t is the total time available, α is the parents' working ability, H_p is the parents' human capital. Utility function has the usual properties of U'>0, U"<0. (2.10) is the resource constraint.[4] The Lagrange equation for the utility maximization is

$$L = U(C_p, H_c) + \lambda[\alpha H_p t - P_H H_c - C_p]. \tag{2.11}$$

The first-order conditions for C_p and H_c are

$$\frac{\partial U}{\partial C_p} = U_{C_p} - \lambda = 0, \tag{2.12}$$

and

$$\frac{\partial U}{\partial H_c} = U_{H_c} - \lambda P_H = 0 \tag{2.13}$$

Dividing (2.12) by (2.13) yields

$$\frac{U_{C_p}}{U_{H_c}} = \frac{1}{P_H}. \tag{2.14}$$

(2.14) shows that the trade-off between the parents' own consumption and children' s human capital accumulation depends on the price of the children' s human capital. In other words, in the intergeneration model, a parent must allocate his time between working and educating his children. Let the parent' s time constraint be defined as

$$t_h + t_w = t, \tag{2.15}$$

where t_h is the time engaged in children' s human capital accumulation and t_w is the time spent in working activities. Furthermore, assume that the children' s human capital

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[4] The right hand side of the equation is actually the parents' full income.

accumulation function and parents' consumption constraint have the following functional forms

$$H_c = At_k H_p^{\beta}, \tag{2.16}$$

$$C_p = \alpha H_p t_w . \tag{2.17}$$

(2.16) implies that the children' s human capital formation is influenced by their own ability (A), the time that parents spent with them, and parents' own human capital.[5] (2.17) shows that the parents' consumption availability depends on the parents' working income, which in turn depends on parents' ability, their stock of human capital, and the time they work. Substituting (2.15) and (2.17) into (2.9) and differentiating with respect to t_w yields

$$\frac{U_{C_p}}{U_{H_c}} = \frac{A}{\alpha} H_p^{\beta-1} . \tag{2.18}$$

From (2.14) and (2.18) we have[6]

$$\frac{U_{C_p}}{U_{H_c}} = \frac{1}{P_H} = \frac{A}{\alpha} H_p^{\beta-1} . \tag{2.19}$$

From (2.19) it is apparent that under intergenerational utility maximization, children' s human capital depends on their individual factor as well as their family background such as their ability, their parents' ability, and their parents' human capital. Therefore, we may

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[5] Note that $\beta=1$ implies positive income effect and no substitution effect; $\beta<1$ implies a positive income effect and a negative substitution effect; and $\beta>1$ implies both income and substitution effects are positive. Therefore, $\beta \geq 1$ implies that the higher the parents' human capital, the larger the effect on children' s human capital accumulation is.

define the individual education choice function (E) as

$$E = f(\underset{+}{A}, \alpha, \underset{+}{Hp}, \underset{?}{\beta}) \tag{2.20}$$

In short, an individual' s attributes as well as family background influence an individual' s educational choice.

3. Estimation Method and Data Description

The empirical study is conducted in three steps. First, an ordered probit model is used to estimate the educational choice decision according to equation (2.20). Second, the wage equations of different educational attainments are estimated by incorporating the possible selection bias obtained in the ordered probit model. Finally, the returns on each educational level are calculated from the estimation results.

Let the wage equations for each educational level be

$$W_{ij} = r_{oj} + r_{ij}' X_{ij} + v_{ij}, \qquad i=1,2,3,..,n, \text{ and } j=1,2,3,..m \tag{3.1}$$

where i and j are indices for the ith individual and jth educational level, respectively, W is the wage rate, X represents all observable factors that affect wage, and v represents all unobservable variables. Observable factors include individual attributes such as work experiences and its square term, tenure and its square term, professional field, and marital status, as well as exogenous variables such as occupation and firm size.

If education is a self-selection process under utility maximization, then the data we observed will be a truncated non– random sample. In this case, direct OLS estimation of

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[6] This can also be obtained by substituting (2.15) and (2.17) into (2.10), i.e.,

$$P_H = \frac{\alpha H_p t - \alpha H_p t_w}{A t_h H_p^{\beta}} = \frac{\alpha H_p t_h}{A t_h H_p^{\beta}} = \frac{\alpha}{A} H_p^{1-\beta}.$$

(3.1) will be biased. To cope with this problem, Heckman' s (1979) two-stage method is used.

3.1 Two– stage Estimation Method

First, an ordered probit model is adopted to estimate the educational choice equation. Assuming n workers and m types of educational level, the choice function of the optimal level of education for each individual is expressed as

$$E_i = \beta' H_i + u_i, \qquad i=1,2,3,\cdots,n \tag{3.2}$$

where E_i is the educational preference of the ith worker, H represents factors affecting educational choice, and $u_i \sim N(0,1)$ is an error term. From Section 2, H includes individual and family attributes. In the literature, family background includes parents' education, mother' s working hours, number of children in the family, religion, race, and living amenity (Willis and Rosen, 1979; Garen, 1984; Falaris, 1995; Joseph and Thomas, 1996; Glewwe, 1996; Arjun and Gaston, 1997). Individual attributes include intelligence, health condition, and test scores. In fact, E_i is a latent and unobservable variable. In reality, the observed educational choice is represented by a dummy variable Z_{ij}, and $\alpha_1 \cdots \alpha_m$ are cut– off points for the different educational levels, where $\alpha_1 < \alpha_2 < \cdots < \alpha_m$, $\alpha_0 = -\infty$, and $\alpha_m = \infty$ for i=1, 2,$\cdots$, n and j=1, 2,$\cdots$, m. If $\alpha_{j-1} \le S_i < \alpha_j$, then Z_{ij}=1 and ith worker chooses jth level of education; else $Z_{ij} = 0$. The probability of having education j becomes

$$\Pr ob(Z_{ij} = 1) = \Phi(\alpha_j - \beta' H_i) - \Phi(\alpha_{j-1} - \beta' H_i), \tag{3.3}$$

where Φ is a standard normal cumulative density function. Since under self-selection the samples we observed would be a truncated normal distribution, estimation of r_{oj} and r_{ij} in (3.1) by OLS will be biased and inconsistent.

Let $\psi_{ij} = \sigma_{uv} / \sigma_u$ be the covariance matrix of error terms between educational choice and wage equations, and $\lambda_{ij} = E\left(\frac{u}{\sigma_u} \middle| \frac{\alpha_{j-1} - \beta' H_i}{\sigma_u} < \frac{u_i}{\sigma_u} < \frac{\alpha_j - \beta' H_i}{\sigma_u}\right)$ is the expected value of the correction term, and then (3.1) can be rewritten as:[7]

$$W_{ij} = r_{oj} + r_{ij}' X_{ij} + \psi_{ij}\lambda + e_{ij} \tag{3.4}$$

Empirically, we can use the Maximum Likelihood Estimation (MLE) method to estimate (3.3) and then use $\hat{\alpha}$ and $\hat{\beta}$ to calculate the standard normal cumulative density function (Φ) and probability density function (ϕ) among j=1, j=1 to m, and j=m, respectively. Except for the cases j=1 and j=m which are single truncated, all other cases are double truncated. According to Maddala (1983), the expected values of truncated correction terms can thus be expressed as

$$\lambda_{ij} = E\left(\frac{u}{\sigma_u} \middle| \frac{\alpha_0 - \beta' H_i}{\sigma_u} < \frac{u_i}{\sigma_u} < \frac{\alpha_1 - \beta' H_i}{\sigma_u}\right) = \frac{-\phi\left(\frac{\alpha_1 - \beta' H_i}{\sigma_u}\right)}{\Phi\left(\frac{\alpha_1 - \beta' H_i}{\sigma_u}\right)}, \quad j=1 \tag{3.5}$$

$$\lambda_{ij} = E\left(\frac{u}{\sigma_u} \middle| \frac{\alpha_{j-1} - \beta' H_i}{\sigma_u} < \frac{u_i}{\sigma_u} < \frac{\alpha_j - \beta' H_i}{\sigma_u}\right) = \frac{\phi\left(\frac{\alpha_{j-1} - \beta' H_i}{\sigma_u}\right) - \phi\left(\frac{\alpha_j - \beta' H_i}{\sigma_u}\right)}{\Phi\left(\frac{\alpha_j - \beta' H_i}{\sigma_u}\right) - \Phi\left(\frac{\alpha_{j-1} - \beta' H_i}{\sigma_u}\right)}, \quad 1<j<m \tag{3.6}$$

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[7] $$\begin{aligned} E(W_{ij} | X_{ij}, Z_{ij} = 1) &= \gamma_{0j} + \gamma_{ij}' X_{ij} + E(v_i | X_{ij}, Z_{ij} = 1) \\ &= \gamma_{0j} + \gamma_{ij}' X_{ij} + E(v_i | \alpha_{j-1} - \beta' H_i < u_i < \alpha_j - \beta' H_i) \\ &= \gamma_{0j} + \gamma_{ij}' X_{ij} + E\left[E(v_i | \alpha_{j-1} - \beta' H_i < u_i < \alpha_j - \beta' H_i, u_i) \middle| \alpha_{j-1} - \beta' H_i < u_i < \alpha_j - \beta' H_i\right] \\ &= \gamma_{0j} + \gamma_{ij}' X_{ij} + \frac{\sigma_{uv}}{\sigma_u^2} E(u | \alpha_{j-1} - \beta' H_i < u_i < \alpha_j - \beta' H_i) \\ &= \gamma_{0j} + \gamma_{ij} X_{ij} + \frac{\sigma_{uv}}{\sigma_u} E\left(\frac{u}{\sigma_u} \middle| \frac{\alpha_{j-1} - \beta' H_i}{\sigma_u} < \frac{u_i}{\sigma_u} < \frac{\alpha_j - \beta' H_i}{\sigma_u}\right) \end{aligned}$$

$$\lambda_{im} = E(\frac{u}{\sigma_u} \Big| \frac{\alpha_{m-1} - \beta' H_i}{\sigma_u} < \frac{u_i}{\sigma_u} < \frac{\alpha_m - \beta' H_i}{\sigma_u}) = \frac{\phi(\frac{\alpha_m - \beta' H_i}{\sigma_u})}{1 - \Phi(\frac{\alpha_m - \beta' H_i}{\sigma_u})}, j=m \quad (3.7)$$

In the second stage, substituting the sample selection– corrected terms λ into (3.4) and then using OLS estimation method will solve the problem of sample selection bias, in this case $E(e_{ij} | X_{ij}, Z_{ij} = 1) = 0$.

3.2 Returns to Education

We then use the estimation results obtained from the selection-corrected wage equations to calculate the rates of return for each educational level. The annual rate of return for each educational level is defined as

$$R \equiv \frac{[\frac{E(W(ij)) - E(W(jj))}{E(W(jj))} + \frac{E(W(ji)) - E(W(ii))}{E(W(ii))}] \div 2}{S(j) - S(i)} \quad (3.8)$$

where E(W(ij)) is the expected wage of jth educational level for workers with ith educational attainment, E(W(jj)) is the average wage of workers with jth educational attainment, E(W(ji)) is the expected wage of ith educational level for workers with jth educational attainment, E(W(ii)) is the average wage of workers with ith educational attainment. The calculation of returns to education requires the estimation of the expected wage received if the workers choose not to have the current educational attainment. For example, for a college graduate worker, we need to estimate the expected wage with high school education if he chooses to receive only high school education instead of going further for college; or for a high school graduate, we need to

calculate his expected wage with college education provided he chooses to go further for college. As the expected wage computation involves these two types of workers, we thus use the average of the two as the rates of return as shown in (3.8). In addition, although we perform only one type of calculation, the results are quite similar.

3.3 Data Description

This study utilizes Taiwan' s Manpower Utilization Survey data of 1996 obtained from the Directorate-General of Budget, Accounting and Statistics, Executive Yuan, Republic of China. We employ data with complete information on intergenerational properties, including parents' education, occupation, and marital status. There are 19,455 samples with 61.9% of male and 38.1% of female for the first-stage selection equation and 8,485 samples with 55% of male and 45% of female for the second-stage wage equations. As seen in Table 1 the average years of schooling for parents and children are 6.79 and 11.89 years, respectively, and the correlation coefficient of the two variables is 0.23. On average, the worker' s age is 26 years; the tenure is 2.63 years in which the male' s tenure (3.05), in general, is greater than the female' s (1.96); and the years of other experience is 5.8 years in which the male' s (7.07) is about twice the female' s (3.53). Appendix A shows the basic properties of the wage equation sample. In this study, due to limited data, information on an individual' s ability is not available. However, we can obtain some family background data which include parents' education, occupation, and marital status, as well as number of siblings. Factors that affect wage rate include tenure, work experience, industries, occupations, firm size, skill level, gender,

and marital status. The definitions of all the variables that are used in the paper are summarized in Appendix B.

[Insert Table 1 about here]

4. Estimation Results

Table 2 presents the MLE results of ordered probit educational choice equation. For all the full, male-only, and female-only samples, the Pearson χ^2 tests for models' goodness of fit are all significant at the 1% level. For the full sample, all the coefficients are significant at the 5% level. The negative sign of parents' education implies the higher the parents' education levels, the larger the probability of education for their children. The parents' occupations with probability of receiving more education are in the following order: government administrators and business managers, technicians and associate professionals, services or sales workers, clerks, machine operators and assemblers, production laborers, and agriculture-related workers. For parents working in the public sector, their children tend to have higher education attainment. This is mainly because parents working in the public sector receive an educational subsidy for their kids from the government, and therefore reduce their children' s cost of education. Children whose parents are living together also tend to receive more education.[8] However, the larger the number of siblings, the smaller the chance to receive education is. This is

[8] Mincer (1996) points out that the rise in income increases the devotion rate which, in turn, results in many single-parent families that destroy household division of labor and generate family' s instability which in turn decrease the possibility of their children to receive more education.

consistent with Becker' s (1973) argument that altruistic parents trade off between quantity and quality of their children. When separated into male and female subgroups, except for the variable PPUB, EXE&GOV_P, and TEC&PRO_P, the coefficients of all the variables show that the male tends to have higher probability of receiving more education than the female. These results suggest that family background factors are essential in determining the children' s education level. Moreover, in Taiwan, as in any society deeply rooted in traditional Chinese culture, family preference is significantly biased toward the male and so is the education.

[Insert Table 2 about here]

Tables 3 to 5 show the estimation results of the second-stage selection-corrected wage equations of each educational level for the full, male, and female samples. The main findings are as follows. (a) Occupations have a positive effect on wage. Government administrators, business executives and managers, and professionals receive the highest wage. For the male they are significant across different educational levels except for primary school level, but for the female it is most significant at the junior college and university level. (b) A positive firm-size or public sector effect is only present at higher educational levels. (c) The industries that pay higher wages are transportation, storage, and communication and public utilities, which are especially significant for senior high, vocational school, and junior college. Agriculture sector, in general, pays lower wages especially at the junior high level for female and at the vocational school and university

levels for male. (d) As for the subject studied, for vocational school graduates, the Medicine major receives the highest wage for male while lowest wage for female. For junior college graduates, the Science, Human, and Agriculture majors pay lower wages. For university graduates, the Medicine major receives the highest wage for both male and female. However, Science major receives significant lower wage for the female. (e) Tenure and work experiences have significant and positive effect on wages. Tenure has a positive and significant effect on wages for all educational levels except the primary school. Work experience has a positive and significant effect for junior high, vocational school, and junior college. The negative effects of their square terms imply that the effects of tenure and work experience diminish over time. Moreover, we find that the effect of tenure is more important than work experience for both male and female groups. This result may imply the relative importance of specific training over general training in determining workers' wages. (f) Workers married and living with spouse receive higher wages. (g) Male receives higher wages than female especially at the vocational school level, however, the wage gap shrinks as educational level increases.

[Insert Tables 3-5 about here]

As for the coefficients of selection bias term, significant coefficients are found for education attainment at the university level for the male and at all educational levels above junior high for the female. These results strongly suggest that sample selection bias is presented in our data and this also justifies the need for the two-stage estimation method.

Table 6 shows the values of selection bias by multiplying the correction terms with the estimated coefficients. For example, for the female, positive selection bias exists for senior high school (0.146) and negative selection bias is present for vocational school (-0.007), junior college (-0.065) and university (-0.149). These results imply that the observed wages of workers with junior high school attainment are biased upward, while those of workers with educational attainment above vocational school are biased downward.

[Insert Table 6 about here]

Finally, we compute the rates of return on education for different educational levels according to (3.8). The results are shown in Table 7. The estimated annual rate of return is – 3.57% for junior high school, -2.32% for male and -11.3% for female[9]; 2.30% for senior high school, 1.83% for male and 3.28% for female; 3.98% for vocational school, 3.40% for male and 4.40% for female[10]; 4.58% for junior college, 4.20% for male and 6.09% for female; 8.20-12.41% for university, 7.23-10.57% for male and 8.82-18.77% for female.

[9] The negative rates of return for junior high school education may be due to the small sample size. However, the reasons may be that the jobs available for primary school and junior high school graduates are similar and the knowledge of primary school education is quite enough for the jobs, i.e. junior high school graduates are overqualified, resulting in negative returns for junior high school. This may also justify the nine-year compulsory education policy introduced by the Taiwanese government in 1968 for the reason of upgrading labor quality from the social viewpoint.

[10] As it shows that the rates of return for senior high and vocational schools are also relatively low, the reason why people are willing to receive these education levels may be partly due to the high return rates for the university provided that they may enter the university in future.

[Insert Table 7 about here]

In summary, the annual rate of return for secondary school education is 3%, 2.8% for male and 4.1% for female, while that for higher education is 12.2%[11], 10.3% for male and 18.1% for female. Therefore, in Taiwan the return rate of education is higher for higher education than for secondary education. Moreover, the rates for the female are also greater than that for the male at all educational levels except for the junior high school level. The findings of this paper are consistent with those of most studies conducted in developing countries.[12]

5 Concluding Remarks

This paper estimates educational choice, wage determination and the rate of return to education in Taiwan using Taiwan' s Manpower Utilization Survey data of 1996. As education investment is a self-selection process, this paper adopts a two-stage estimation method. First, a polychotomous ordered probit model is used to estimate the education decision. Second, the wage equations of different educational attainments are estimated

[11]The rates of return for higher education is a weighted average of returns for entering the university from senior high, vocational school, and junior college.

[12] Cross-country studies by Psacharopoulos (1981, 1985) find that private rates of return on education are greater in developing than in developed countries. In the developing countries, the rate is higher for the higher education than for the secondary school. Country-specific studies also shows that rates of educational return increase with educational level: for example, Garen (1984), Ganderton and Griffin (1993) for the U.S.; Bedi and Born (1995) for Honduras; Ryoo, Nam, Cranoy (1993) for Korea. Return rates are higher for female than for male are: Alba-Ramirez and San-Segundo (1995) for Spain; Duraisamy (1993) for India; Deolalikar (1995) for Indonesia; Vijverberg (1995) for Cote d' Ivoire; Johnson and Chow (1997) for China.

by incorporating the possible selection bias that obtained in the ordered probit model. Finally, the rates of return on each education level are calculated from the estimation results.

The main findings of the paper are as follows. (a) Family factors significantly affect a person' s selection of education level, for example, the larger the number of children in the family, the lower the educational attainment of the children; the higher the parents' education and work position, the higher their children' s education; and children from single parent families tend to attain a lower level education. (b) Significant negative selection bias is found in the male group for the university level; in the female group for vocational school, junior college, and university. On the other hand, in the female group significant positive bias is only found for senior high school. (c) The estimated annual rate of return to schooling is 2.30% for senior high school, 3.98% for vocational school, 4.58% for junior college, and 12.20% for university. In general, consistent with the literature, we find that the female has a higher return rate to education than the male for most educational levels.

Due to limited data on the measurement of individual' s talent, the results of our educational choice estimation may likely understate the extent of the selection biases that we identified. Nevertheless, the findings of the paper clearly support that people in Taiwan are in favor of a higher education study and this is conducive to human capital accumulation.

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APPENDIX A. SUMMARY PROPERTIES OF SAMPLE

Full Sample							
Age	15-25	26-35	36-45	46-55	56-65	65+	
	[14.7%]	[30.1%]	[28.8%]	[16.2%]	[9.0%]	[0.2%]	
Marital Status	Never married	Married & cohabited	Separated or divorced	Widowed			
	[26.9%]	[67.8%]	[3.0%]	[2.3%]			
Educational attainment	Primary school	Junior high	Senior high	Vocational	Junior college	University	
	[2.2%]	[20.5%]	[20.2%]	[32.5%]	[16.1%]	[7.47%]	
Occupation	Managers & Professionals	Technicians	Clerks	Service workers	Agricultural workers	Skilled workers	production laborer
	[7.4%]	[16.1%]	[13.5%]	[16.3%]	[6.1%]	[36.4%]	[4.2%]
Firm size	1-49	50-99	100-499	500+	Public		
	[74.9%]	[5.0%]	[5.1%]	[6.3%]	[8.6%]		
Female-only							
Age	15-25	26-35	36-45	46-55	56-65	65+	
	[20.3%]	[29.6%]	[28.3%]	[14.3%]	[6.7%]	[0.8%]	
Marital Status	Never married	Married & cohabited	Separated or divorced	Widowed			
	[29.8%]	[62.8%]	[3.3%]	[4.1%]			
Educational attainment	Primary school	Junior high	Senior high	Vocational	Junior college	University	
	[0.1%]	[8.9%]	[7.6%]	[30.3%]	[16.4%]	[8.5%]	
Occupation	Managers & Professionals	Technicians	Clerks	Service workers	Agricultural workers	Skilled workers	production laborer
	[10.4%]	[18.7%]	[29.8%]	[23.3%]	[1.3%]	[13.8%]	[2.7%]
Firm size	1-49	50-99	100-499	500+	Public		
	[69.5%]	[6.2%]	[6.7%]	[7.6%]	[10.0%]		
Male-only							
Age	15-25	26-35	36-45	46-55	56-65	65+	
	[11.3%]	[30.4%]	[29.0%]	[16.8%]	[10.4%]	[2.1%]	
Marital Status	Never married	Married & cohabited	Separated or divorced	Widowed			
	[25.1%]	[70.9%]	[2.8%]	[1.2%]			
Educational attainment	Primary school	Junior high	Senior high	Vocational	Junior College	University	
	[3.2%]	[30.0%]	[9.0%]	[34.3%]	[15.8%]	[6.7%]	
Occupation	Managers & Professionals	Technicians	Clerks	Service workers	Agricultural workers	Skilled workers	production laborer
	[5.7%]	[14.5%]	[3.9%]	[12.2%]	[8.9%]	[49.7%]	[5.1%]
Firm size	1-49	50-99	100-499	500+	Public		
	[78.1%]	[4.4%]	[4.1%]	[5.6%]	[7.9%]		

Figures in the parentheses are ratio of composition.

APPENDIX B. THE DEFINITIONS OF VARIABLES

Variable	Description
LNWAGE	Log of yearly wage rate.
Worker' s Attributes	
EDUC	Years of formal education; there are six educational categories: primary school (6 years), junior high school (3 years), senior high school (3 years), vocational school (3 years), junior college (5 years), and university (4 years).
TENURE	Years of employment with current employer.
TENUSQ	Square term of TENURE.
WEXPER	Years of other work experience (defined as age-TENURE-EDUC-6).
WEXPSQ	Square term of WEXPER.
SEX	Dummy = 1 if male.
MARR	Dummy = 1 if married with spouse present.
Field-of-Major	(Business is the reference group)
HUM	Field-of-major dummies = 1 if Humanities.
LAW	Field-of-major dummies = 1 if Law.
SCI	Field-of-major dummies = 1 if Science.
TEC	Field-of-major dummies = 1 if Technology.
AGR	Field-of-major dummies = 1 if Agriculture.
MED	Field-of-major dummies = 1 if Medicine.
EDU	Field-of-major dummies = 1 if Education.
OTH	Field-of-major dummies = 1 if Others.
Family Background	
CHILD	Number of siblings.
PEDUC	Parents' education; same definition as in EDUC.
PMARR	Dummy = 1 if respondent' s parents are married with spouse present.
PPUB	Dummy=1 if respondent' s parent works in public sector.
Parent' s Occupation	(Production Laborers is the reference group)
EXE&GOV_P	Parent' s occupation dummies = 1, if working as Legislators, Government Administrators, Business Executives and Mangers, and Professionals.
TEC&PRO_P	Parent' s occupation dummies = 1, if working as Technicians and Associate Professionals.
CLERK_P	Parent' s occupation dummies = 1, if working as Clerks.
SER&SALE_P	Parent' s occupation dummies = 1, if working as Service Workers and Shop and Market Sales Assistants.
AGR&FISH_P	Parent' s occupation dummies = 1, if working as Agriculture, Animal Husbandry, Forestry and Fishing Workers.
OPR&ASSE_P	Parent' s occupation dummies = 1, if working as Plant and Machine Operators and Assemblers

APPENDIX B. (Continued)

Industry	(Commerce is the reference group)
AGR	Industry dummies = 1, if Agriculture, Forestry, Fishing, Animal Husbandry, and Mining.
MFG	Industry dummies = 1, if Manufacturing.
ELE	Industry dummies = 1, if Electricity, Gas and Water.
CON	Industry dummies = 1, if Construction.
TRA	Industry dummies = 1, if Transportation, Storage and Communication.
FIN	Industry dummies = 1, if Finance, Insurance, and Real Estate.
SER	Industry dummies = 1, if Services.
Occupation	(Production Laborers is the reference group)
EXE&GOV	Occupation dummies = 1, if working as Legislators, Government Administrators, Business Executives and Mangers, and Professionals.
TEC&PRO	Occupation dummies = 1, if working as Technicians and Associate Professionals.
CLERK	Parent' s occupation dummies = 1, if working as Clerks.
SER&SALE	Occupation dummies = 1, if working as Service Workers and Shop and Market Sales assistants.
AGR&FISH	Occupation dummies = 1, if working as Agriculture, Animal Husbandry, Forestry and Fishing Workers.
OPR&ASSE	Occupation dummies = 1, if working as Plant and Machine Operators and Assemblers
FS2-FS4	Firm-size dummies=1, if working in 50-99, 100-499, and 500 or more size plant, respectively (1-49 persons is the reference group).
PUB	Dummy=1 if respondent works in public sector.

TABLE 1. BASIC STATISTICS OF VARIABLES IN WAGE EQUATIONS

Variable	Full Sample		Male sample		Female sample	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Age	25.88	(5.57)	27.23	(5.76)	23.58	(4.36)
Years of education	11.89	(2.31)	11.49	(2.34)	12.56	(2.10)
Tenure	2.63	(3.11)	3.05	(3.44)	1.96	(2.26)
Other work experiences	5.80	(4.73)	7.07	(4.86)	3.53	(3.46)
Parents' education	6.79	(2.89)	6.47	(2.70)	7.33	(3.12)
Number of siblings	1.67	(2.01)	1.82	(2.05)	1.42	(2.10)
Number of observation	8485		4676		3809	

Note: Figures in the parentheses are standard deviation.

TABLE 2. ORDERED PROBIT MODEL OF EDUCATIONAL CHOICE

Variable	Full-sample	Male	Female
Constant	-1.914	-1.639	-2.140
	(283.9)***	(159.73)***	(75.23)***
Family background			
PEDU	-0.07	-0.09	-0.04
	(92.3)***	(84.61)***	(14.91)***
PPUB	-0.175	-0.159	-0.196
	(38.70)***	(17.96)***	(20.54)***
PMARR	-0.239	-0.302	-0.05
	(4.77)***	(5.81)***	(0.04)**
CHILD	0.011	0.018	0.003
	(5.45)***	(7.73)***	(16.23)***
Parents' occupation			
EXE&GOV_P	-0.375	-0.354	-0.396
	(92.32)***	(37.95)***	(35.66)***
TEC&PRO_P	-0.223	-0.217	-0.224
	(26.65)***	(14.20)***	(11.21)***
CLERK_P	-0.175	-0.214	-0.117
	(13.97)***	(11.67)***	(2.59)*
SER&SALE_P	-0.201	-0.228	-0.179
	(41.24)***	(28.46)***	(11.93)***
AGR&FISH_P	0.18	0.212	0.089
	(32.53)***	(27.01)***	(2.89)*
OPR&ASSE_P	-0.04	-0.09	0.027
	(2.07)***	(4.965)***	(0.33)
Personal Characteristics			
SEX	(5.45)***		
	(144.9)***		
$\alpha 2$	1.364	1.412	1.272
$\alpha 3$	1.829	1.849	1.799
$\alpha 4$	2.819	2.796	2.856
$\alpha 5$	3.425	3.385	3.484
Log likelihood	-30040.58	-18323.85	-11642.8
Pearson χ^2	73067.8***	40019.64***	27922.4***
Observations	19470	11800	7670

Notes: Figures in the parentheses are x^2 statistics.

*, **, *** indicate statistically significant at the 10%, 5%, and 1% levels, respectively.

Reference group for occupation is production laborers.

Negative coefficients imply higher probability for receiving education.

TABLE 3. WAGE REGRESSION BY EDUCATIONAL ATTAINMENT

Full sample

Variable	Primary school	Junior high	Senior high	Vocational school	Junior college	University
Constant	12.39(19.9)***	12.11(87.1)***	12.18(152.)***	12.18(355.)***	12.32(293.)***	12.63(138.)***
Occupation						
EXE&GOV	0.68(2.04)***	0.43(4.06)***	0.21(2.75)***	0.26(7.04)***	0.22(7.62)***	0.23(5.12)***
TEC&PRO	–	0.06(0.76)	0.09(2.40)***	0.05(2.78)***	0.07(3.79)***	0.07(2.01)**
CLERK	0.40(1.60)	0.11(1.58)	0.07(2.05)**	0.04(2.21)***	0.12(3.69)***	0.23(2.89)***
SER&SALE	0.22(0.67)	-0.13(1.48)	-0.25(1.83)*	-0.21(3.37)***	0.11(0.45)	0.49(1.57)*
AGR&FISH	0.50(1.86)*	0.09(1.26)	-0.02(0.73)	-0.02(1.09)	0.02(0.87)	0.11(1.22)
OPR&ASSE	0.17(0.63)	0.04(0.63)	-0.05(0.95)	-0.12(3.73)***	-0.15(2.27)**	0.16(0.53)
Firm-size						
FS2	0.24(1.16)	0.04(0.99)	-0.10(2.21)**	0.01(0.71)	0.02(1.04)	0.09(1.81)*
FS3	-0.09(0.44)	0.12(2.70)***	-0.01(0.28)	0.02(0.86)	0.08(3.01)***	0.20(4.99)***
FS4	-0.29(1.22)	0.05(0.93)	-0.05(1.11)	0.05(2.22)**	0.04(1.85)*	0.17(3.65)***
PUB	-0.05(0.12)	-0.00(0.10)	0.10(1.95)*	-0.01(0.46)	0.06(2.36)**	0.20(5.10)***
Industry						
AGR	-0.05(0.42)	-0.18(1.98)*	0.05(0.78)	-0.11(2.99)***	0.01(0.32)	-0.22(2.78)***
MFG	–	-0.09(1.11)	0.08(1.24)	-0.04(1.12)	-0.00(0.21)	-0.12(1.90)*
ELE	0.08(1.02)	0.00(0.11)	0.13(1.74)*	0.07(1.90)*	0.05(1.34)	0.09(1.02)
CON	0.09(0.63)	-0.11(1.29)	0.05(0.80)	-0.01(0.57)	-0.00(0.25)	-0.03(0.50)
TRA	0.21(1.02)	0.01(0.17)	0.17(2.40)**	0.06(1.68)*	0.08(2.46)**	0.03(0.62)
FIN	0.17(1.20)	-0.04(0.55)	0.10(1.56)	-.07(2.29)***	0.00(0.07)	-0.14(2.26)**
SER	-0.04(0.08)	-0.28(1.05)	0.06(0.68)	0.09(1.68)*	0.06(1.22)	-0.05(0.66)
Academic specialty						
HUM	–	–	–	0.08(0.38)	-0.11(1.62)*	-0.00(0.15)
LAW	–	–	–	–	–	0.01(0.26)
SCI	–	–	–	—	-0.17(1.90)*	-0.03(0.55)
TEC	–	–	–	-0.01(0.75)	-0.03(1.55)	-0.01(0.44)
AGR	–	–	–	-0.03(1.32)	-0.10(2.15)**	0.05(0.84)
MED	–	–	–	0.18(3.79)***	0.01(0.39)	0.42(7.13)***
EDU	–	–	–	0.01(0.10)	0.04(0.73)	0.03(0.72)
OTH	–	–	–	-0.01(0.60)	0.06(1.75)*	0.11(1.57)
TENURE	0.01(0.87)	0.07(11.2)***	0.06(7.34)***	0.06(12.8)***	0.05(8.89)***	0.05(5.40)***
TENUSQ	-0.00(0.68)	-0.00(7.52)***	-0.00(4.88)***	-.00(5.67)***	-0.00(4.41)***	-0.00(2.08)**
WEXPER	-0.02(1.41)	0.05(1.62)*	0.00(1.00)	0.03(8.32)***	0.04(6.53)***	0.01(1.02)
WEXPSQ	0.00(1.51)	-0.00(8.92)***	-0.00(1.13)	-.00(5.57)***	-0.00(4.10)***	0.00(1.15)
MARR	0.19(2.42)***	0.06(3.25)***	0.19(6.03)***	0.07(4.30)***	0.05(2.42)***	0.02(0.65)
SEX	0.25(2.56)***	0.17(7.02)***	0.18(6.13)***	0.28(14.4)***	0.18(9.16)***	0.11(3.63)***
λ	0.20(0.80)	0.07(1.00)	-0.03(0.56)	-.10(2.72)***	-0.04(1.50)	-0.10(2.16)**
R^2	0.18	0.35	0.38	0.42	0.38	0.43
SSE	35.06	299.34	94.12	416.78	146.42	98.69
Observations	185	1741	1711	2761	1367	634

Notes: Figures in the parentheses are x^2 statistics.

*, **, *** indicate statistically significant at the 10%, 5%, and 1% levels, respectively.

Reference groups: Production laborers for occupation; 1-99 persons for firm size; business for academic specialty; commerce for industry.

TABLE 4. WAGE REGRESSION BY EDUCATIONAL ATTAINMENT

Male sample

Variable	Primary school	Junior high	Senior high	Vocational school	Junior college	University
Constant	13.23(17.4)***	12.12(58.9)***	12.32(71.5)***	12.47(163.)***	12.49(142.)***	12.83(80.8)***
Occupation						
EXE&GOV	-0.10(0.22)	0.59(3.71)***	0.18(1.87)*	0.53(7.95)***	0.21(4.48)***	0.18(2.26)**
TEC&PRO	–	0.10(0.73)	0.04(0.60)	0.07(1.62)*	0.10(2.70)***	0.05(0.77)
CLERK	-0.46(1.08)	0.16(1.19)	0.02(0.36)	0.14(3.06)***	0.26(4.73)***	0.32(2.19)**
SER&SALE	-0.49(1.07)	-0.08(0.58)	-0.09(0.57)	-0.21(2.74)***	0.05(0.18)	0.53(1.54)
AGR&FISH	-0.26(0.62)	0.15(1.13)	-0.05(0.92)	0.01(0.32)	0.03(0.81)	0.12(0.98)
OPR&ASSE	-0.74(1.72)	0.09(0.69)	-0.09(1.07)	-0.12(2.36)**	-0.12(1.45)	0.12(0.37)
Firm-size						
FS2	–	0.06(1.10)	-0.10(1.47)	-0.00(0.24)	0.01(0.37)	0.04(0.59)
FS3	-0.10(0.50)	0.13(1.99)*	-0.03(0.36)	-0.01(0.36)	0.06(1.69)*	0.18(3.05)***
FS4	-0.16(0.56)	0.07(0.93)	-0.06(0.82)	0.01(0.30)	0.02(0.87)	0.21(3.04)***
PUB	-0.17(0.37)	-0.00(0.10)	0.10(1.62)*	-0.06(1.45)	0.09(2.07)**	0.15(2.40)**
Industry						
AGR	-0.10(0.72)	-0.14(1.31)	0.21(1.34)	-0.19(3.07)***	-0.01(0.25)	-0.24(2.02)**
MFG	–	-0.09(0.84)	0.21(1.38)	-0.11(1.83)*	-0.02(0.39)	-0.07(0.74)
ELE	0.06(0.74)	0.02(0.23)	0.25(1.63)*	-0.00(0.01)	0.04(0.58)	0.11(0.78)
CON	0.06(0.40)	-0.08(0.76)	0.17(1.13)	-0.12(2.13)**	-0.03(0.52)	0.01(0.16)
TRA	0.22(1.06)	0.02(0.23)	0.31(2.01)*	-0.00(0.09)	0.00(0.10)	0.08(0.81)
FIN	0.08(0.52)	-0.02(0.19)	0.20(1.30)	-0.12(2.09)*	0.02(0.31)	-0.06(0.65)
SER	0.03(0.05)	-0.27(0.98)	0.23(1.30)	0.07(0.87)	-0.07(0.87)	-0.05(0.44)
Academic specialty						
HUM	–	–	–	–	-0.13(1.23)	-0.03(0.56)
LAW	–	–	–	–	–	0.14(1.18)
SCI	–	–	–	–	-0.28(1.83)*	0.01(0.16)
TEC	–	–	–	-0.00(0.28)	-0.04(1.39)	-0.00(0.08)
AGR	–	–	–	-0.01(0.35)	-0.04(0.63)	0.05(0.56)
MED	–	–	–	-0.29(1.69)*	-0.07(1.18)	0.47(5.47)***
EDU	–	–	–	–	-0.00(0.01)	-0.01(0.18)
OTH	–	–	–	0.00(0.09)	0.05(0.88)	0.24(1.81)*
TENURE	0.00(0.18)	0.07(9.16)***	0.06(6.59)***	0.06(9.87)***	0.05(6.12)***	0.04(3.08)***
TENUSQ	0.00(0.01)	-0.00(6.16)***	-0.00(4.89)***	-0.00(4.87)***	-0.00(3.01)***	-0.00(0.94)
WEXPER	-0.01(0.45)	0.06(11.5)***	0.01(1.38)	0.04(6.80)***	0.03(3.91)****	-0.00(0.39)
WEXPSQ	0.00(0.66)	-0.00(9.10)***	-0.00(1.45)	-0.00(5.00)***	-0.00(2.70)***	0.00(1.58)*
MARR	0.14(1.72)*	0.06(2.83)	0.17(5.04)***	0.06(3.28)***	0.04(1.76)*	0.03(0.70)
λ	0.13(0.51)	0.02(0.34)	0.08(0.93)	-0.01(0.29)	0.01(0.35)	-0.12(1.70)*
R^2	0.16	0.29	0.30	0.29	0.26	0.44
SSE	26.32	232.76	52.18	205.21	69.85	49.22
Observations	149	1402	423	1605	741	311

Note: See notes in Table 3.

TABLE 5. WAGE REGRESSION BY EDUCATIONAL ATTAINMENT

Female sample

Variable	Primary school	Junior high	Senior high	Vocational school	Junior college	University
Constant	13.82(5.27)***	12.22(48.4)***	12.13(126.)***	12.13(310.)***	12.32(231.)***	12.63(106.)***
Occupation						
EXE&GOV	–	-0.51(2.22)**	0.13(0.80)	0.05(1.04)	0.25(5.88)***	0.24(4.13)***
TEC&PRO	—	-0.03(0.36)	0.15(2.97)***	0.09(3.68)***	0.08(3.52)***	0.06(1.59)*
CLERK	1.04(4.33)***	0.00(0.10)	0.10(2.06)***	-0.00(0.21)	0.01(0.32)	0.02(0.25)
SER&SALE	–	–	-1.19(3.62)***	0.16(0.84)	–	–
AGR&FISH	1.28(2.09)**	0.14(1.23)	-0.04(0.74)	-0.05(1.55)	0.09(1.54)	–
OPR&ASSE	1.50(2.85)***	0.01(0.16)	-0.09(0.90)	0.01(0.28)	-0.26(1.91)*	–
Firm-size						
FS2	0.17(0.83)	0.01(0.21)	-0.08(1.40)	0.04(1.46)	0.05(1.40)	0.21(2.76)***
FS3	–	0.11(2.16)**	-0.00(0.07)	0.06(1.92)*	0.12(3.01)***	0.23(3.92)***
FS4	-1.39(1.24)	-0.00(0.03)	-0.05(0.92)	0.11(3.42)***	0.05(1.59)	0.14(1.99)*
PUB	–	-0.02(0.11)	0.10(0.89)	0.12(2.02)**	0.06(1.58)	0.27(5.31)***
Industry						
AGR	0.36(2.04)	-0.27(1.68)*	0.00(0.10)	-0.04(0.99)	0.03(0.68)	0.02(0.20)
MFG	–	-0.15(0.94)	0.06(0.74)	0.00(0.09)	-0.01(0.33)	-0.25(2.66)***
ELE	-2.76(1.21)	0.29(1.67)*	0.01(0.08)	0.07(1.11)	0.02(0.49)	0.04(0.41)
CON	0.97(2.16)**	-0.06(0.45)	0.04(0.53)	0.07(1.73)*	0.00(0.01)	-0.10(1.38)
TRA	–	0.51(1.30)	0.11(1.26)	0.12(2.43)**	0.16(3.83)***	-0.00(0.00)
FIN	0.61(1.02)	0.00(0.04)	0.08(1.02)	-0.01(0.47)	-0.03(0.76)	-0.21(2.71)***
SER	–	–	-0.03(0.22)	-0.08(1.01)	0.07(1.16)	-0.15(1.48)
Academic specialty						
HUM	–	–	–	0.29(1.46)	-0.06(0.72)	0.01(0.46)
LAW	–	–	–	–	–	-0.12(1.55)
SCI	–	–	–		-0.09(0.84)	-0.23(1.62)*
TEC	–	–	–	-0.01(0.45)	-0.01(0.41)	-0.01(0.18)
AGR	–	–	–	-0.03(0.89)	-0.13(1.85)*	0.08(0.87)
MED	–	–	–	0.31(6.04)***	0.05(1.30)	0.22(2.30)**
EDU	–	–	–	0.03(0.33)	0.07(1.00)	0.03(0.53)
OTH	–	–	–	-0.00(0.25)	0.04(0.99)	-0.01(0.11)
TENURE	-0.00(0.10)	0.09(7.07)***	0.04(2.00)**	0.06(7.99)***	0.05(6.72)***	0.10(5.23)***
TENUSQ	-0.00(0.04)	-0.00(4.47)***	-0.00(0.11)	-0.00(2.84)***	-0.00(3.71)***	-0.00(3.75)***
WEXPER	-0.15(2.02)*	0.03(3.38)***	-0.00(0.01)	0.03(5.13)***	0.04(5.26)***	0.02(1.47)
WEXPSQ	0.00(1.53)	-0.00(2.70)**	-0.00(0.10)	-0.00(3.32)***	-0.00(2.77)***	-0.00(0.03)
MARR	0.49(1.50)	-0.14(0.96)	0.27(1.94)*	0.19(1.95)*	0.24(2.71)***	0.09(0.74)
λ	1.04(0.92)	0.08(0.55)	-0.20(2.31)**	-0.19(3.88)***	-0.09(1.89)*	-0.10(1.68)*
R^2	0.56	0.23	0.16	0.25	0.34	0.35
SSE	6.01	36.97	24.61	116.71	54.77	37.07
Observations	36	339	289	1156	626	323

Note: See notes in Table 3.

TABLE 6. ESTIMATION OF SELECTION BIAS ($\lambda * \psi$)
BY EDUCATIONAL ATTAINMENT

Education	Full-sample	Male	Female
Primary school	-0.451	-0.307	-2.334
Junior high	-0.095	-0.037	-0.114
Senior high	0.026	-0.062	0.146**
Vocational school	-0.004***	-0.001	-0.007***
Junior college	-0.040	0.012	-0.065**
University	-0.145**	-0.182*	-0.149*

Note: Positive (negative) selection implies observed values are overestimated (underestimated).

TABLE 7. ESTIMATED RETURNS ON EDUCATION
BY EDUCATIONAL ATTAINMENT

Average annual rate of return	Full-sample	Male	Female
Junior high school	-3.57	-2.32	-11.03
Senior high school	2.30	1.83	3.28
Vocational school	3.98	3.40	4.40
Junior college	4.58	4.20	6.09
From senior high school to university	12.41	10.57	18.77
From vocational school to university	12.33	8.96	14.74
From junior college to university	8.20	7.23	8.82