A selection analysis of returns to education in China

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This paper estimates the economic returns to education in China from 1989 to 2009, using the China Health and Nutrition Survey (CHNS) dataset. We find that education returns for one additional year generally increase from 2.6% in 1989 to 7.9% in 2009. Education returns, however, may reflect signals of innate ability, or the accumulation of human capital. Moreover, traditional Ordinary Least Square estimates may be biased by selection problems and mix-ups of age group heterogeneity. Hence, we estimate the marginal effects of schooling with the increasing labour markets experience, using the Heckman Selection Model. We find that the education returns for one additional year decline with labour markets experience, which support human capital hypothesis for all age groups except the group educated during the "Cultural Revolution". Different dynamics of education returns in the four age groups are identified with large influence of institutional reforms in the labour markets, supporting the transition explanation of the evolution of education returns in China.

JEL classification: J24, J31, P23, C52

Keywords: Education returns, China, Selection

Introduction

There is a well-established literature on the economic returns to education, since Schultz (1961) and Mincer (1974). According to human capital theory, following Becker (1962), education is an investment that produces knowledge acquisition and increases productivity, which in turn leads to higher income. Human capital theory bears a strong resemblance to vintage capital theory. The individual's capital stock (his or her level of education) can be treated as a factor of production in its own right and may gradually depreciate with time (Byron and Manaloto 1990). Thus, the distribution of labour incomes can be regarded as a function of education and experience, as in the benchmark Mincerian model which involves regression of the natural logarithm of earnings against educational attainment and working experience.

A large amount of empirical research, based on the Mincerian model, has been carried out for many countries and time periods and confirms that better-educated individuals earn higher wages, experience less unemployment, and work in more prestigious occupations than their less-educated counterparts (Card 1999, O'Mahony and Stevens 2009). Psacharopoulos and Patrinos (2004) finds that the education returns for one additional year are 9.7% for world average, 9.9% for Asian average as well as the 10.7-10.9% range for low and middle incomes. However, literature on economic returns to education in China is still sparse and shows much lower rates of returns compared with those from other countries, especially developing ones. An early study on this topic for China was made by Byron and Manaloto (1990). Using a sample of eight hundred adult workers from the city of Nanjing in 1986, they estimate a low rate of returns between 1.2% and 3.7% for one additional year of schooling. Meng and Kidd (1997) also find a low rate of returns to education of 2.7% in 1987. Liu (1998) uses the

China Household Income Project (CHIP) 1988 data and finds a slightly larger but still low rate of returns to education of 3.6% . Therefore, Fleisher *et al.* (2005) conclude that China is an outlier, in that its rapid economic growth is associated with returns to education remaining below the world average for comparable countries.

Low returns to education do not necessarily imply that education has no value in China. It may be because the value of education has not been properly reflected as private economic returns in labour markets. Fleisher and Wang (2004) find that the wages of educated workers are well below their marginal product in China, and the social returns to education will exceed the estimated private returns. Hence, the most widely accepted explanation of lower Chinese education returns may be the explanation of labour markets transition. Before 1978, wages of all workers were determined and controlled through a rigid system in China, designed to reduce labour costs during the rapid industrialization. Low wages were made possible by state-subsidized food prices and state provision of non-wage benefits to workers and their families. Throughout the economic reforms in China into the early 1990s, the wage differentials by levels of skill and schooling still remained narrow. After the "socialist market economy" was authorized in the early 1990s, the rigid wage system was gradually replaced by the flexible wage system. [1] Thus, the wage reform in China freed up the compressed wage differentials and thereafter had similar implications for the economic returns to education.

The explanation of labour markets transition is supported by the literature dealing with evidence of increasing returns to education over time, following the progress of economic reforms. Recent research suggests that reform and marketization are finally contributing to an increase in the relative wages of educated workers (Fleisher and

Wang 2005). Zhang *et al.* (2005) find a dramatic increase in education returns, from only 4.0% in 1988 to 10.2% in 2001 for one additional year of schooling. Most of the rise occurs after 1992 and supports the explanation of labour markets transition.

This paper provides alternative points of view on returns to education in China, using recent available China Health and Nutrition Survey (CHNS) datasets from 1989 to 2009. We have three objectives. First, education has an important effect on wages but it is not clear whether this is because education raises productivity or because education is simply a signal of innate ability (Chevalier *et al.* 2004). We need to test whether the returns to education in China reflect accumulation of human capital or are just signals of innate ability. Following Qiu and Hudson (2010), we put the interaction of education and experience into regressions for all employees and for four age groups. We calculate the marginal effects of schooling at different percentiles of experience (Friedrich 1982, Dreher and Gassebner 2007, Potrafke 2009) and then graph their trends with ranges of standard errors. We find that Chinese data appear to strongly support the human capital explanation.

Second, most studies on education returns in China only apply the traditional OLS Mincerian model, which ignores the probable selection biases of employment. If the job assignments in the labour markets are not random, OLS estimation of education returns might be biased. The direction of biases is dependent on how jobs are assigned and how people make self-selections in the labour markets (Roy 1951, Heckman 1974, Heckman and Honoré 1990). Appleton *et al.* (2005) observe a continued influence of political forces of loyalty, power, and patronage on the rewards for labour in the Chinese labour markets. Considering the selection bias of employment, we compare the estimates of education returns in a Heckman selection model with results from traditional OLS.

Last, but not least, the aggregated estimates of repeated cross-section regressions may be mix-ups of many heterogeneous cohorts and hence may suffer serious composition biases (Solon *et al.* 1994). Li (2003) uses the 1988 CHIP data to classify workers into three cohorts depending on when they started working: prior to economic reform, up to 1979; in the early stage of urban reforms (1980 to 1987); or during the advanced stage of urban reform (1988 to 1995). The average annual rates of returns to college education were 7.7% for the pre-1979 cohort, 14.1% for the 1980–1987 cohort, and 14.8% for the 1988–1995 cohort. Maurer-Fazio (1999) finds higher annual rates of education returns for the young (under age 30, 6.6%) than for their elders (above age 50, 3.4%) in 1989. Fleisher and Wang (2005) estimate education returns in the first and subsequent jobs, with workers grouped by the year of the first job, in order to observe the impact of the "Cultural Revolution". Their OLS estimators find that annual rates of education returns to the younger cohorts (whose first jobs were in 1984, 1987 and 1990) have received smaller returns to education than did the older cohorts (whose first jobs occurred prior to 1970 and 1975, and were affected by the Cultural Revolution). These cohort analyses reveal different views of education returns, compared to traditional aggregated analysis. Hence, we estimate wage equations for four age groups which can provide insights into the nature of labour markets changes and the fluctuations in returns to schooling over time.

The rest of this paper is organized as follows: In section 2 we outline the empirical specifications for our three objectives. In section 3 we describe our data and present descriptive statistics. Estimates of the returns to schooling are presented in section 4. Section 5 forms our conclusions.

Empirical specifications

Most previous literature relies on the theoretical foundations for returns to education, laid down by Schultz (1961), Becker (1962) and Mincer (1974). We also estimate a semi-logarithmic specification for the wages based on the Mincerian equation, given as:

$$\ln w_i = \beta_0 + \beta_1 S_i + \beta_2 Exp_i + \beta_3 Exp_i^2 + \beta_4 Urban_i + \beta_5 Gender_i + \beta_6 \mathrm{Pr}_i + \theta_1 \qquad (1)$$

where the dependent variable $\ln w_i$ is the log form of real hourly wage rate of employee *i*. Wages consist of basic wages, subsidies and bonuses. We use the urban/rural consumer price indices, classified by year and province from the China Statistics Yearbooks, to deflate employees' labour incomes. In the independent variables S_i is years of schooling; Exp_i is an employee's potential labour markets experience, measured as age minus years of schooling minus six (Katz and Murph 1992); $Urban_i$ is a dummy variable for the urban areas; $Gender_i$ is a dummy variable capturing the wage differential between men and women; and Pr_i is a set of province dummy variables.

Signal and human capital effects

There is debate whether the impact of education on earnings isolates the effects that are caused by education from the consequences of innate ability. Economists have relied on natural experiments, twins data, regression discontinuity, and field experiments to control for innate ability and estimate the causal impact of education (human capital) on earnings (see a review in Card (1999)). The CHNS cannot provide data for a direct control on innate ability as do these classic models. However, we can develop Qiu and Hudson's (2010) model to test whether education is the signal of innate ability, or the

accumulation of human capital. It is assumed that schooling (S_i) that an individual acquires is a function of innate ability (A_i):

$$S_i = m(A_i) \qquad (2)$$

Hence, more able individuals can grasp knowledge more rapidly and transform schooling into human capital more efficiently, that is, $\partial S_i / \partial A_i > 0$. We can argue that the basic theory underlying the earnings' equation is that wages (w_i) are a function of human capital (H_i):

$$w_i = f(H_i) \qquad (3)$$

In efficient labour markets, jobs with higher wages will be assigned to individuals with higher productivity. Hence, individuals with higher human capital would have higher wages, that is, $\partial f / \partial H_i > 0$. Human capital of an individual itself is a function of innate ability (A_i), education-augmented human capital (S_i) and experience-augmented human capital (from on-the-job training or "learning by doing" processes, Exp_i) as follows:

$$H_i = A_i + h(S_i) + g(Exp_i) \qquad (4)$$

Human capital augmented by experience is also possibly influenced by innate ability. More able individuals can grasp knowledge from on-the-job training or "learning by doing" processes more rapidly and transform it into human capital more efficiently, that is $\frac{\partial g(Exp_i, A_i)}{\partial A_i} > 0$. However, an inverted U curve of experience in earnings equations with quadratic experience is widely observed in the literature (for China, see Appleton *et al*. (2005) and Qiu and Hudson (2010)). The individual's capital stock from experience can be treated as a factor of production in its own right and gradually depreciates with time. Hence, we can firstly assume (for simplicity) that the experience-augmented human capital is derived only from experience, and we also assume linearity and that it is possible to separate the three types of human capital, in equation (4). We cannot observe innate ability directly, hence we estimate wages as a function of education and experience as:

$$w_i = f(m^{-1}(S_i) + h(S_i) + g(Exp_i)) \qquad (5)$$

The total derivative of the wage function with respect to experience is as follows:

$$dw_i = \frac{\partial f}{\partial Exp_i} dExp_i + \frac{\partial f}{\partial S_i} dS_i \qquad (6)$$

We calculate the partial derivative of wage function with respect to schooling, and allow the correlation between schooling and experience-augmented human capital. The equation (6) has the form:

$$dw = \frac{\partial f}{\partial Exp} dExp + \frac{\partial f}{\partial H}\left(\frac{\partial m^{-1}(S)}{\partial S} + \frac{\partial h(S)}{\partial S}\right) dS + \frac{\partial f}{\partial H} \frac{\partial g(Exp)}{\partial h(S)} \frac{\partial h(S)}{\partial S} dS \qquad (7)$$

For simplicity, we drop the individual subscript *i*. The first item is the quadratic experience items in equation (1) to proxy the isolated experience effect on the wage. The second item is the combination of signal and human capital effects of schooling on the wage. The final item is the interaction of schooling and experience. If the only impact of schooling is to proxy innate ability, schooling cannot enhance human capital, that is, $\frac{\partial h(S)}{\partial S} = 0$. Then, the above equation becomes:

$$dw = \frac{\partial f}{\partial Exp} dExp + \frac{\partial f}{\partial H} \frac{\partial m^{-1}(S)}{\partial S} dS = \frac{\partial f}{\partial Exp} dExp + \frac{\partial f}{\partial H} dA \qquad (8)$$

The coefficients of schooling are only capturing the effects of variations of innate ability among individuals on wages. The impact of education on wages should be constant over time, as the coefficients of experience and education interaction are zero. Riley (1979) and Farber and Gibbons (1996) also argue that a basic condition for a signalling equilibrium is that employers' predictions based on education signals are correct on average. If not, then education and experience could enhance productivity, supporting the human capital theory.

Do the returns to schooling decline with rising experience since the individual left formal education? Normally, with rising experience, education will depreciate. Hence, the interaction between schooling and experience-augmented human capital should

show a negative correlation (substitution relationship) $\frac{\partial g(Exp)}{\partial h(S)} < 0$ and make the coefficients of interaction items also negative because $\frac{\partial f}{\partial H} > 0$ and $\frac{\partial h(S)}{\partial S} > 0$. But, in a reforming society such as China, education chances may be very selective for innate ability (for example, very strict college entrance examinations) or political virtue (Broaded 1990). Individual human capital, enhanced by education and experience, could be complementary if we consider the possibility that the innate ability or political virtue also enhances human capital from experience. Education-augmented human capital could be positively correlated with experience-augmented human capital. The marginal effects of schooling may increase with experience in this simultaneous system. We use pooled data to test the trend of education returns with rising experience over time. Therefore, an interaction item is very important in our wage equation. After we add the interaction variable of schooling and experience, and allow year dummies *Y* for macro time dynamics, the empirical specification for our pooled data is as follows:

$$\ln w = \delta_0 + \delta_1 S + \delta_2 Exp + \delta_3 Exp^2 + \delta_4 (S * Exp) + \delta_5 Urban + \delta_6 Gender + \delta_7 \Pr + \delta_8 Y + \mu_1 \quad (9)$$

Heckman selection bias

One important issue to consider is the fact that wages are only observed for individuals actually working. Some individuals become inactive because they do not find a job, or their reservation wages are higher than offer wages. There would be a potential selection bias when estimating earnings equations. The Heckman selection model provides a solution through an additional selection equation (Heckman 1976). People with more education might have higher participation rates, because they are more

attractive to employers and their opportunity cost of unemployment are higher. Education increases expected wages over time, through higher wages when working (the effect captured through the Mincerian equation above) and through a higher probability of being employed (this effect will be captured through the Heckman selection model below).

As derived from equation (9), the hourly wage rate is a function of schooling, experience, urban, gender, province and year dummies, whereas the likelihood of employment is a function of marital status and (implicitly) the wage (via the inclusion of all above variables which determine the wage). The identifying variable for employment selection is the marital status of a respondent, that is, a dummy variable (0= single; 1=once married) which is widely used in literature (see an example for Italy, in Brown and Sessions (1999)). Therefore, we assume that wage is observed if

$$\gamma_0 + \gamma_1 Married + \gamma_2 S + \gamma_3 Exp + \gamma_4 Exp^2 + \gamma_5 (S * Exp) + \gamma_6 Urban + \gamma_7 Gender + \gamma_8 \Pr + \gamma_9 Y + \mu_2 > 0 \quad (10)$$

The inverse Mills ratio (lambda) defined as in (Heckman 1979) is designed to correct for selectivity bias in the samples. A significant coefficient on the lambda term indicates non-random selection into employment in the relevant sample.

Age groups

To gain more understanding of patterns of returns to schooling in China, we estimate the regressions with separated age group samples. The four age groups are people born before 1950, during 1950-1961, during 1962-1980 and in 1981 or after. The cut-off time

choice of groups is based on the widely accepted structural break points in Chinese modern history to allow heterogeneity of groups in our study. The first structural break point is the foundation of the People's Republic of China in 1949 and then two structural break points based on the two baby boom periods (1950-1961 and 1962-1980). Finally, the full enforcement of the "One Child Policy" in 1981 defines the last group.

These structural break points can be clearly observed in a birth rate graph over the period of 1949-2009 (see Figure 1). The birth rate was above 30 per thousand in the 1950s. The economic crisis from the "Great Leap Forward" and famine during the period 1958-1961 resulted in 30 million extra deaths (Lin 1990), and the lowest birth rate at 18.02 per thousand in 1961. Afterwards, with the economic recovery, China experienced the largest baby boom, with the birth rate peaking at 43.37 per thousand in 1963. From 1961 to 1980, the newborns were about 310 million and comprised 23.5% of the total population in 2009. [2] The large number of children born caused China's leaders to be very concerned about the growth potential of this extraordinarily large age group. The "One Child Campaign" was launched in December 1979. In Feb 1980, Guangdong province was the first province to make regulations for implementation, followed by other provinces. The full enforcement of "One-Child policy" across country started from 1981. There were two small peaks of the birth rate; between 1980 and 1982, due to the implementation of China's new Marriage Law in 1981; and the consequent baby boom during 1984 and 1987. After that, the birth rate continued to decline to be as low as 12.13 per thousand in 2009.

The special age group born 1950-1961 mainly received their education during the "Cultural Revolution" period (1966-1976), when the leftist ideological goals of an egalitarian educational agenda reached a peak and the normal education process was

interrupted and replaced by continuous political movements (Qian and Smyth 2008). They find this group has considerably lower returns to education than younger people who received standardised education and entered the labour market during the urban economic reform era.

(Figure 1 around here)

Data description

The data used in this paper are eight waves (1989, 1991, 1993, 1997, 2000, 2004, 2006 and 2009) of the CHNS dataset, which has been collected by the Carolina Population Centre and the National Institute of Nutrition and Food Safety. The CHNS data cover two decades of Chinese economic reform since 1989, and contain accurate information on wages, education, and other demographic information which provides a basis for an estimate of the returns to education. Eight provinces are covered by data in the period of 1989-1997 and nine provinces thereafter. [3] We exclude individuals working as farmers, fishermen and hunters in the primary sector (mainly agriculture). Employees with a salary (wage earners) between 16 and 65 years old are our basic sample. [4] The full sample composed of employees, unemployed persons and self-employees is also analyzed for the Heckman correction.

Table 1 represents the data description for the employee and full samples. For the employee sample, the real hourly wage rate (based on 1995 RMB) is below 2 Yuan and grows comparatively slowly before 1993. However, the hourly wage rate dramatically doubles in the 4 years from 1993 to 1997, and then doubles again in the 9 years from 1997 to 2006. In the last 3 years of our sample period, 2006-2009, the hourly wage rate

still grows by about 30%. The rapidly rising wage rate, especially after 1993, is also observed by other authors, such as Yang *et al.* (2010).

The average schooling increases with rising wages by about 40% over the last two decades (from 7.49 years in 1989 to 10.54 years in 2009). The working experience decreases in the 1990s and increases in the 2000s, but still seems quite stable, ranging between 20.15 years in 2000 to 24.33 years in 2009. About 60% of employees are males and less than half the employees are in an urban area. About 80% of the employees are married once, in our employee sample. The largest baby boom group, born in 1962-1980, occupies 37% of total employment in 1989, increasing to around 55% after 1993. Hence, this group can benefit much more than others from the dramatic rising wages after 1993. Actually, we find the special wage premium (or "rent") in returns to schooling of this group in the later analysis. The oldest group (born before 1950) keeps on decreasing due to retirement. The youngest group (born in 1981 or after) has no observation before 1997, and is still small in 1997, so we involve this group only after 1997. The share of the group born just after the foundation of China is stable at around 30% in the past two decades. Compared with the employee sample, the main difference in the full sample is that the average years of schooling is lower (8.48 years in 1989 to 9.06 years in 2009). That is consistent with the findings that higher educated individuals have higher probability to be employed (O'Mahony and Stevens 2009).

Table 2 shows descriptive statistics for the four groups in the pooled dataset of all eight waves. For employees, the younger groups have higher real hourly wage rates and years of schooling, but shorter potential labour markets experience. For example, the youngest group (born in 1981 or after) has the highest hourly wage rate at 6.35 Yuan (double the oldest), and years of schooling (at 10.89 years, this is 4.35 years longer than

the oldest), and lowest experience at 5.11 years (35.6 years less than the oldest). In addition, the younger group has a higher female participation rate, higher participation rates in rural regions and lower marriage rates.

Compared with employees, the full sample in the bottom panel has fewer years of schooling than employees for all four groups, as we find in Table 1. Each group still has distinguishable features as employees. These distinctive characteristics among groups reflect volatile changes of Chinese society in recent decades, which imply heterogeneous human capital accumulation of different groups from their education and experience. If we only consider aggregated results, our estimate may be biased by the composition shifts of groups.

(Table 1 around here)

(Table 2 around here)

Empirical results

Table 3 presents results of repeated cross-section OLS, as in equation (1). We find, in common with others that education returns for one additional year generally increase from 2.6% in 1989 to 7.9% in 2009. Results by groups are very similar to the aggregated results in 1989, and this is consistent with the highly regulated wage setting in the 1980s. With the ownership reform in the 1980s, the role of state-owned enterprises has been weakened in the Chinese economy and has triggered the transformation from a planned labour allocation system into a well-functioning labour markets (Appleton *et al.* 2005). China authorized the "socialist market economy" to accelerate reforms, including to the labour markets, the effect of which led to a major

reduction in rates of returns for the aggregated sample or groups in the early 1990s. Camposa and Jolliffe's (2003) study of Hungary, as well as that of Flabbi *et al.* (2008) in examining eight transition economies (Bulgaria, Czech Republic, Hungary, Latvia, Poland, Russia, Slovak Republic and Slovenia) argue that the skills acquired cannot be easily transferred to a changed economic situation. Thus one would expect to see a temporary decline to returns during any period of transition.

Between the trough of 1.4% in 1993 and peak of 9.4% in 2004, there is a continuous rising trend of education returns for one additional year, which is also noted in the most recent literature (for example, Liu *et al.* (2010)). After 1997, the four groups experience different, but still increasing paths of education returns. Groups born before 1950 (8% for one additional year) and 1962-1980 (10% for one additional year) have a peak in 2004 as for the employee sample, while the other two groups experience peaks in 2006 (both around 10% for one additional year). The decline of education returns after 2004 is caused mainly by the structural break of education returns of the group born before 1950. Their dramatic fall of education returns (from the peak value to insignificance) may reflect the human capital loss of compulsory retirement (especially for women), and the rapidly depreciated human capital from education by the new skill-biased technology (Liu *et al.* 2010). This loss can only be partly offset by the rising employment proportions of the younger groups with still significant and high education returns.

Table 4 shows the estimates from OLS regressions using the pooled dataset for all eight waves. In order to test whether schooling only reflects the signal effects of innate ability the interaction of schooling and experience has been regarded as an explanatory variable, as in equation (9). For all employees, the coefficient of schooling is 6% for

one additional year. The highest coefficients are for groups born before 1950 and in 1981 or after (around 10%), but they are below 5% for the other two middle-aged groups, suggesting lower rates of returns to schooling acquired during the Mao era. The difference between Table 4 and Table 3 is derived from the interaction item of schooling and experience. The coefficients of schooling in Table 4 are actually the education returns when the labour market experience is equal to zero (Friedrich 1982). Thus, the above results only show that the new entrants of the oldest and youngest groups have higher education returns than new entrants in the other two groups. We need to investigate the interaction item for the marginal effects of schooling with experience.

The interaction variable of schooling and experience (divided by 100) is only significantly negative for the full employee sample and the group born before 1950, which casts doubt on the human capital explanation of education. In order to show the dynamics of changing schooling returns by groups, we follow Dreher and Gassebner (2007) and Potrafke (2009) to evaluate the marginal effects of schooling at various points of the distribution of experience; namely at the 5^{th}, 25^{th}, median, 75^{th} and 95^{th} percentiles of the interacted variable. [5] Using this method we can distinguish between the impact of schooling on wage rates when the levels of experience are low and high. All marginal effects are presented in the bottom panel of Table 4.

(Table 3 around here)

(Table 4 around here)

At the fifth percentile of potential labour markets experience (3.41 years), the groups born before 1950 and in 1981 or after have the marginal effects of about 8.5% , higher than the other two middle-aged groups (each around 4.5%), and similar to the coefficients of schooling as experience equals 0. With increase in experience, the groups born before 1950 and in 1981 or after have declining marginal effects of schooling. However, the group born 1962-1980 has significant and increasing marginal effects, which are also significant and stable over experience for the group born 1950-1961.

Figure 2 illustrates the trends of marginal effects of schooling with increasing experience, with the lower and upper limits of one standard deviation for all the employees and the four groups. Equation (7) shows that the coefficients of schooling only reflect the signal of innate ability, because the coefficients of interaction are insignificantly different from zero. Hence, the signal model fits the group born 1950-1961 in Table 4 and Figure 2 very well. If the interactions have negative coefficients, the longer an individual has been out of school, the lower are his/her education returns for one additional year of schooling, which fits the groups born before 1950 and in 1981 or after in Table 4 and Figure 2. Possible explanations for this difference include a vintage effect, the rising quality of education, and greater mobility among younger workers because they have made fewer employer-specific investments. People with longer experience also are likely to be more constrained by wage compression and other restrictions of past employment arrangements. Coefficients of schooling in this case may include both signal and human capital effects of schooling, which would be a traditional endogeneity problem. [6]

Moreover, if the innate ability or education enhanced human capital can also enhance human capital from on-the-job training and "learning by doing" processes,

education enhanced human capital is positively correlated (hence complementary) with experience enhanced human capital in equation (7). The longer an individual has been out of school, the higher are his/her returns to education. Therefore, the group born 1962-1980 (if they are employed) can benefit from the "rent" from interaction between education and experience. In this case, coefficients of schooling also include both signal and human capital effects of schooling and show a rising trend in Figure 2.

(Figure 2 around here)

Next, we will use the Heckman selection model to correct selection biases. We apply the Heckman selection model to provide consistent, asymptotically efficient estimates for schooling. Table 5 presents the results of the Heckman selection model using equation (9) and (10). The selectivity effect (lambda) is significant for the full sample and the four groups. LR/Wald tests of independent equations (rho = 0) are easily rejected for all ML specifications. These tests clearly justify the Heckman selection model with data. By correcting the selection bias, the education returns for the full sample decrease from 6% to 5.2% for one addition year, and decrease from 9.1% to 7.4% for the group born before 1950. Returns do not change very much for the group born 1950-1961, while the two younger groups have higher rates (from 4.1% to 11.8% for the group 1962-1980; and from 9.3% to 22.1% for the group born in 1981 or after) than in the OLS specification. Although these results are only point estimates, as experience is equal to 0, we still find that they are closer to the results in other transition countries (Psacharopoulos and Patrinos 2004, Flabbi *et al.* 2008).

The Heckman correction also has a significant effect on coefficients of interaction of schooling and experience. Figure 3 illustrates all negative correlations (substitution relationship) between marginal effects of schooling and experience. Compared with the OLS estimates, the interactive variable of schooling and experience becomes significantly negative for the largest baby-boom group (1962-1980) and the one-child-policy group (in 1981 or after). Selection biases seem very serious for the group 1962-1980. The positive coefficients of interaction variable in OLS regressions just fit the "rents", as above-equilibrium wages in this group and could give rise to a "hitting the jackpot" effect when a job is won (Peng and Siebert 2008). After we correct the selection biases, the significantly positive trend of the group 1962-1980 in Figure 2 is replaced by a significantly negative trend in Figure 3.

The only insignificant coefficient remains that to be found in the group born 1950-1961, the schooling years of which may only reflect the innate ability as we find in the OLS regressions. This is not very surprising, because the group born 1950-1961 mainly received their education during the "Cultural Revolution" period (1966-1976), when education chances were only allocated for selected students based on political virtue. Those from families of workers, peasants or soldiers were deemed the most "virtuous" and were among the first admitted. This has generated the label of worker-peasant-soldier student (*gong-nong-bing xueyuan*) for those students entering college during the early 1970s. Identification as a Cultural Revolution-era university student continues to carry a negative loading and, in general, depressed opportunities for advancement (Broaded 1990, Fleisher and Wang 2005).

For the only-child-policy group, even though the starting education for one additional year are as high as about 20% , the most rapidly depreciation of education

offsets the high coefficients of schooling as a new entrant. However, since we have only a few hundred observations in the youngest group, any formal interpretation should be concerned with caveats and needs further research. Therefore, the human capital explanation of education is supported by our study, except for the group educated during the "Cultural Revolution".

(Table 5 around here)

(Figure 3 around here)

Conclusions

Schooling itself can be identified as an augmenting factor of human capital, or merely as signals reflecting innate ability. Moreover, traditional aggregated Ordinary Least Squares (OLS) estimates are biased by selection problem and mix-ups of group heterogeneity. Hence, in this paper, we use the eight waves of the CHNS dataset to estimate the rates of private returns to schooling in China over the last two decades. We categorize data into four age groups according to the structural breaks of the birth rates and estimate the marginal effects of schooling with increasing experience, using OLS and the Heckman selection model.

The OLS estimates of education returns for all employees are 2.6% for one addition year in 1989, then declining to around 1.5% in 1991 and 1993, possibly due to the political campaigns and delayed reaction for labour market reforms. And then, education returns increase to 9.4% for one addition year in 2004 before finally dropping to 7.9% for one addition year in 2009 with the dramatic loss of human capital of the retired group (born before 1950). Groups have similar education returns in the early

years of the 1990s, but they experience heterogeneous dynamics later. This suggests a substantial influence of institutional reforms in the labour markets. Our age group analyses support the labour market transition explanation of the evolution of returns to schooling over time.

The interactive variable of schooling and experience is used in the Heckman model to test whether years of schooling only reflect the signal effects of innate ability. We find that the education returns for one additional year decline with labour markets experience, which supports the human capital hypothesis for all groups except the group born 1950-1961, the schooling years of which may only reflect the innate ability or political virtue as we find in the OLS regressions. This conclusion is not very surprising because the group born 1950-1961 mainly received their education during the "Cultural Revolution" period (1966-1976) when education chances were only allocated for selected students based on political virtue. This group also has the lowest education returns after we correct selection biases, just as found by Fleisher and Wang (2005).

Selection biases are very serious for the group born in the period 1962-1980. The positive coefficients of interaction variable in OLS regressions just fit the "rents" argument in this group with a "hitting the jackpot" effect when a job is won. After we correct the selection biases, the significantly positive marginal effects of the group 1962-1980 in OLS are replaced by significantly negative marginal effects, as expected by the human capital hypothesis. For the only-child-policy group, even though the starting returns to schooling are as high as about 20%, the most rapid depreciation of education offsets the high coefficients of schooling as a new entrant. However, since the youngest group has many fewer observations than other groups in our sample, any formal interpretation should be concerned with caveats and demands further research.

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Notes

1. The flexible wage system allows a variable component in the usual fixed wages. The fixed wage includes the basic wages, seniority wage, insurance (medical, unemployment and pensions) and a housing fund. The variable wage includes bonuses, based on both individual productivity and enterprise profitability. The system of allocated housing was largely abolished around 1998 and replaced with a housing fund.
2. Data are from the Chinese Statistics Yearbook 2010.
3. 8 provinces (Liaoning, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi and Guizhou) for years 1989-1993; 8 provinces in 1997 (replacing Liaoning with Heilongjiang); 9 provinces for years 2000-2009 (with both Liaoning and Heilongjiang, and other provinces as well).

4. The current retirement age in China is usually 60 for men and 50-55 for women. But civil servants or professionals can postpone their retirement. Hence, we put the upper limit as 65 for our sample.
5. We use the 5^{th} percentile and 95^{th} percentile to replace the minimum and maximum experience years, which are extreme values and hence not representative.
6. We acknowledge the possible endogeneity of schooling in the sense of unobserved innate ability in the OLS regressions and the bias it can cause. However, we would not correct the endogeneity biases in this paper because we have argued that schooling may only reflect the signals of innate ability.

References

Appleton, S., Song, L. and Xia, Q., 2005. Has china crossed the river? The evolution of wage structure in urban china during reform and retrenchment. *Journal of Comparative Economics,* 33 (4), 644-663.

Becker, G.S., 1962. Investment in human capital: A theoretical analysis. *The Journal of Political Economy,* 70 (5, Part 2: Investment in Human Beings), 9-49.

Broaded, M., 1990. The lost and found generation: Cohort succession in chinese higher education. *The Australian Journal of Chinese Affairs,* 23, 77-95.

Brown, S. and Sessions, J.G., 1999. Education and employment status: A test of the strong screening hypothesis in italy. *Economics of Education Review,* 18, 397-404.

Byron, R.P. and Manaloto, E.Q., 1990. Returns to education in china. *Economic Development and Cultural Change,* 38 (4), 783-796.

Camposa, N.F. and Jolliffe, D., 2003. After, before and during: Returns to education in hungary. *Economic Systems,* 27, 377-390.

Card, D., 1999. The causal effect of education on earnings. *Handbook of Labor Economics,* Vol. 3A, Elsevier Science North-Holland, Amsterdam, New York and Oxford, 1801-1863.

Chevalier, A., Harmon, C., Walker, I. and Zhu, Y., 2004. Does education raise productivity, or just reflect it? *The Economic Journal,* 114 (499), F499-F517.

Dreher, A. and Gassebner, M., 2007. Greasing the wheels of entrepreneurship? The impact of regulations and corruption on firm entry. *CESifo Working Paper No 2013*.

Farber, H. and Gibbons, R., 1996. Learning and wage dynamics. *The Quarterly Journal of Economics,* 111, 1007-47.

Flabbi, L., Paternostro, S. and Tiongson, E., 2008. Returns to education in the economic transition: A systematic assessment using comparable data. *Economics of Education Review,* 27 (6), 724-740.

Fleisher, B., Sabirianova, K. and Wang, X., 2005. Returns to skills and the speed of reforms: Evidence from central and eastern europe, china, and russia. *Journal of Comparative Economics,* 33 (2), 351-370.

Fleisher, B. and Wang, X., 2005. Returns to schooling in china under planning and reform. *Journal of Comparative Economics,* 33 (2), 265-277.

Fleisher, B.M. and Wang, X., 2004. Skill differentials, return to schooling, and market segmentation in a transition economy: The case of mainland china. *Journal of Development Economics,* 73 (1), 315-328.

Friedrich, R.J., 1982. In defense of multiplicative terms in multiple regression equations. *American Journal of Political Science,* 26 (4), 797-833.

Heckman, J.J., 1974. Shadow prices, market wages, and labor supply. *Econometrica,* 42 (4), 679-694.

Heckman, J.J., 1976. The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. *Annals of Economic and Social Measurement,* 5, 475-492.

Heckman, J.J., 1979. Sample selection bias as a specification error. *Econometrica,* 47 (1), 153-161.

Heckman, J.J. and Honoré, B.E., 1990. The empirical content of the roy model. *Econometrica,* 58 (5), 1121-1149.

Katz, L.F. and Murph, K.M., 1992. Changes in relative wages, 1963-1987: Supply and demand factors. *The Quarterly Journal of Economics,* 107 (1), 35-78.

Li, H., 2003. Economic transition and returns to education in china. *Economics of Education Review,* 22 (3), 317-328.

Lin, J.Y., 1990. Collectivization and china's agricultural crisis in 1959-1961. *The Journal of Political Economy,* 98 (6), 1228-1252.

Liu, X., Park, A. and Zhao, Y., 2010. Explaining rising returns to education in urban china in the 1990s. *IZA DP No. 4872*.

Liu, Z., 1998. Earnings, education, and economic reforms in urban china. *Economic Development and Cultural Change,* 46 (4), 697-725.

Maurer-Fazio, M., 1999. Earnings and education in china's transition to a market economy survey evidence from 1989 and 1992. *China Economic Review,* 10 (1), 17-40.

Meng, X. and Kidd, M.P., 1997. Labor market reform and the changing structure of wage determination in china's state sector during the 1980s. *Journal of Comparative Economics,* 25, 403-421.

Mincer, J., 1974. Schooling, experience and earnings. *National Bureau of Economic Research, New York*.

National Bureau of Statistics, D.O.C.S., 1999. Comprehensive statistical data and materials on 50 years of new china. *Beijing: China Statistics Press*.

O'mahony, M. and Stevens, P., 2009. Output and productivity growth in the education sector: Comparisons for the us and uk. *Journal of Productivity Analysis,* 31 (3), 177-194.

Peng, F. and Siebert, W.S., 2008. Real wage cyclicality in italy. *LABOUR,* 22 (4).

Potrafke, N., 2009. Did globalization restrict partisan politics? An empirical evaluation of social expenditures in a panel of) oecd countries. *Public Choice,* 140, 105-124.

Psacharopoulos, G. and Patrinos, H.A., 2004. Returns to investment in education: A further update. *Education Economics,* 12 (2).

Qian, X. and Smyth, R., 2008. Private returns to investment in education: An empirical study of urban china. *Post-Communist Economies,* 20 (4), 483-501.

Qiu, T. and Hudson, J., 2010. Private returns to education in urban china. *Economic Change and Restructuring,* 43 (2), 131-150.

Riley, J., 1979. Testing the educational screening hypothesis. *Journal of Political Economy,* 87, s227-52.

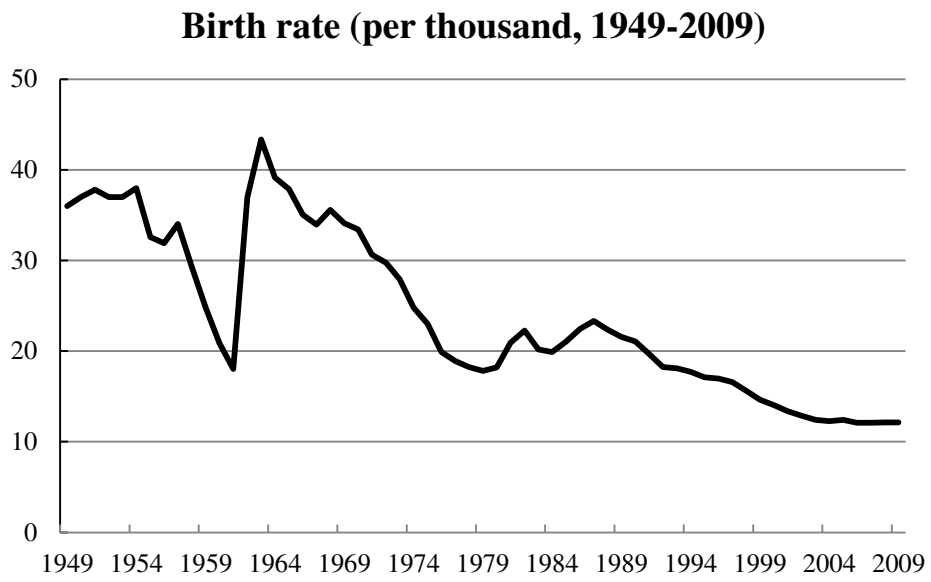
Roy, A.D., 1951. Some thoughts on the distribution of earnings. *Oxford Economic Papers, New Series,* 3 (2), 135-146.

Schultz, T.W., 1961. Investment in human capital. *American Economic Review,* 51 (1), 1-17.

Solon, G., Barsky, R. and Parker, J.A., 1994. Measuring the cyclicality of real wages: How important is composition bias? *NBER working paper*.

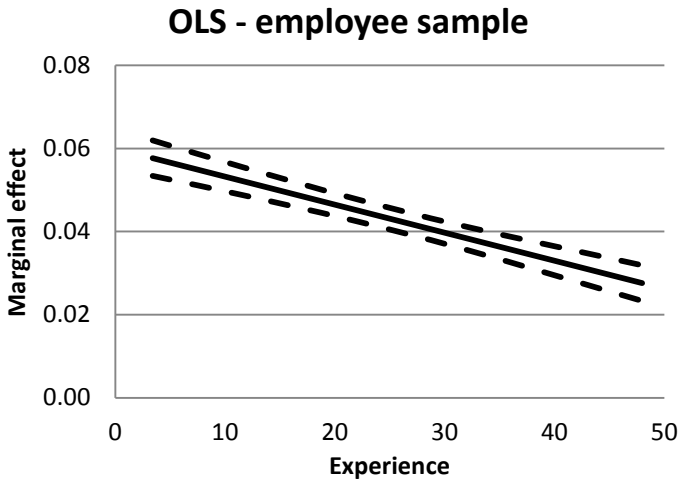
Yang, D.T., Chen, V.W. and Monarch, R., 2010. Rising wages: Has china lost its global labor advantage? *IZA DP No. 5008*.

Zhang, J., Zhao, Y., Park, A. and Song, X., 2005. Economic returns to schooling in urban china, 1988 to 2001. *Journal of Comparative Economics,* 33 (4), 730-752.



Source: National Bureau of Statistics (1999) ; China Statistics Yearbook 2010

Figure 1: Birth rate (per thousand, 1949-2009)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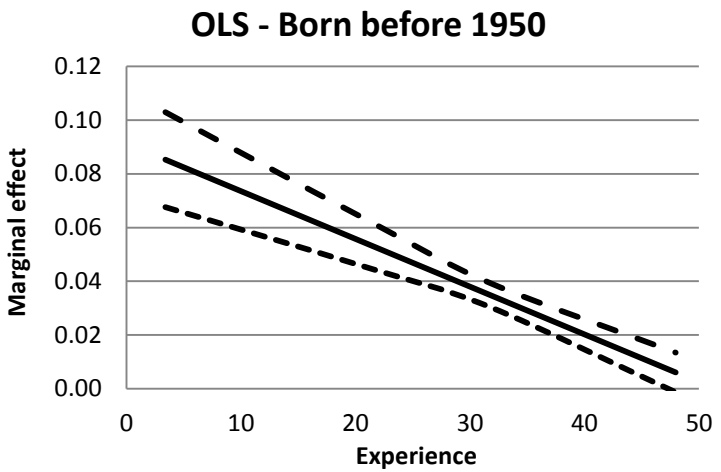
30
40
50
Experience


OLS - Born before 1950
Marginal effect
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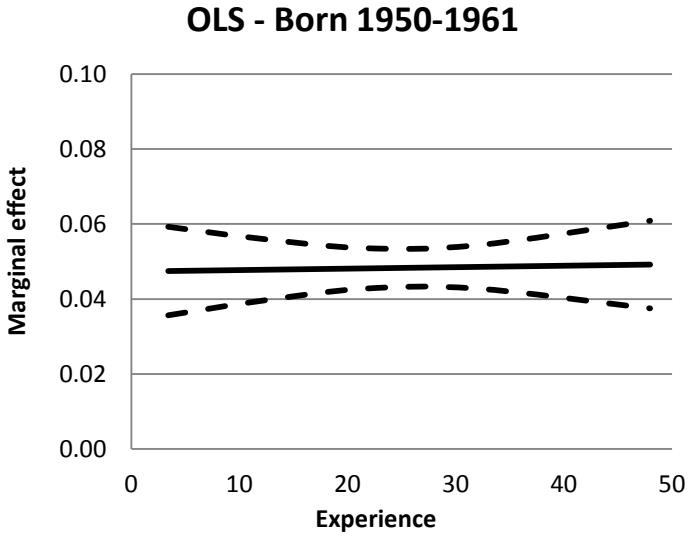
Experience


OLS - Born 1950-1961
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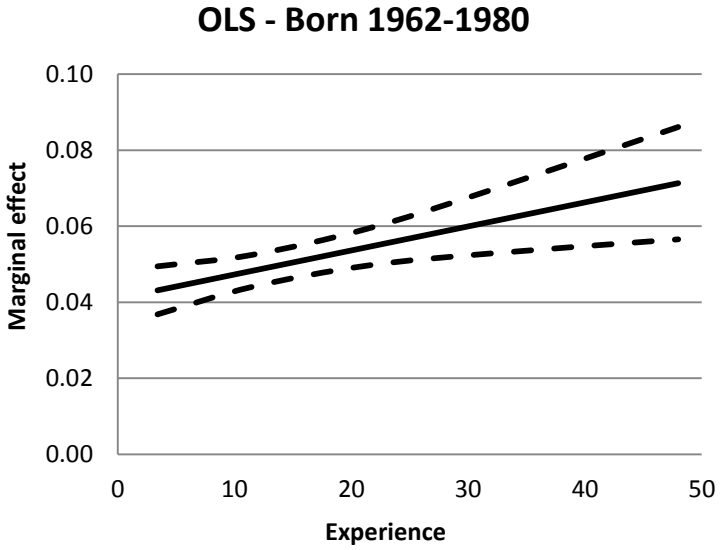
OLS - Born 1962-1980
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Experience

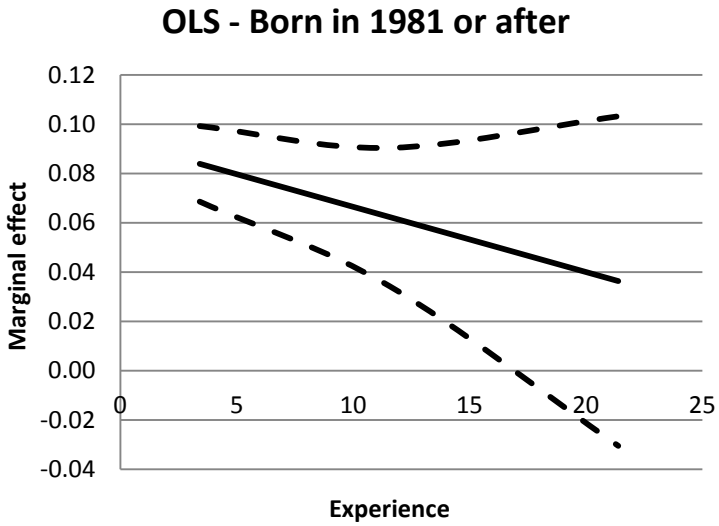
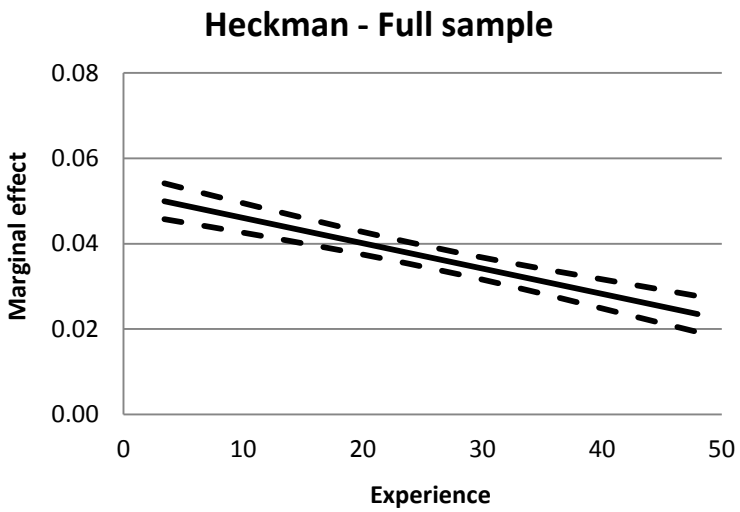


Figure 2: Ordinary Least Square Model (OLS) - marginal effects and low/upper limits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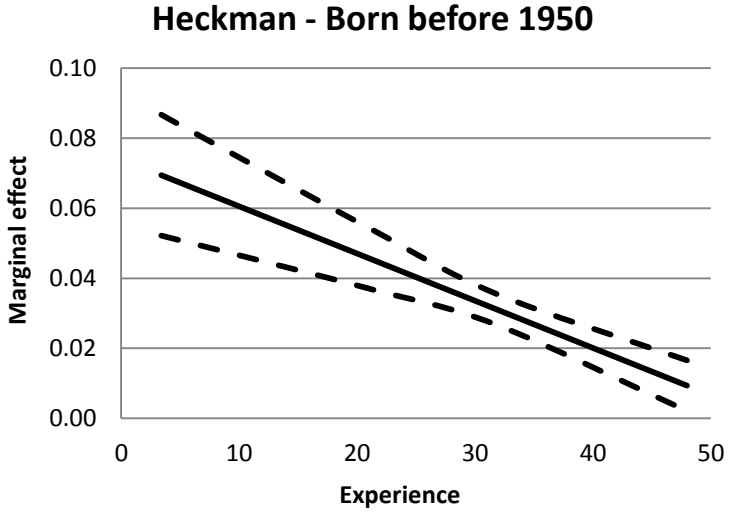
Experience


Heckman - Born before 1950
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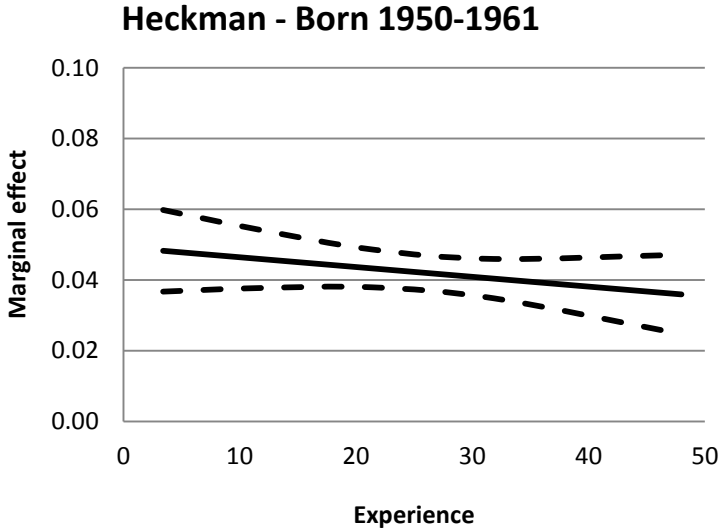
Experience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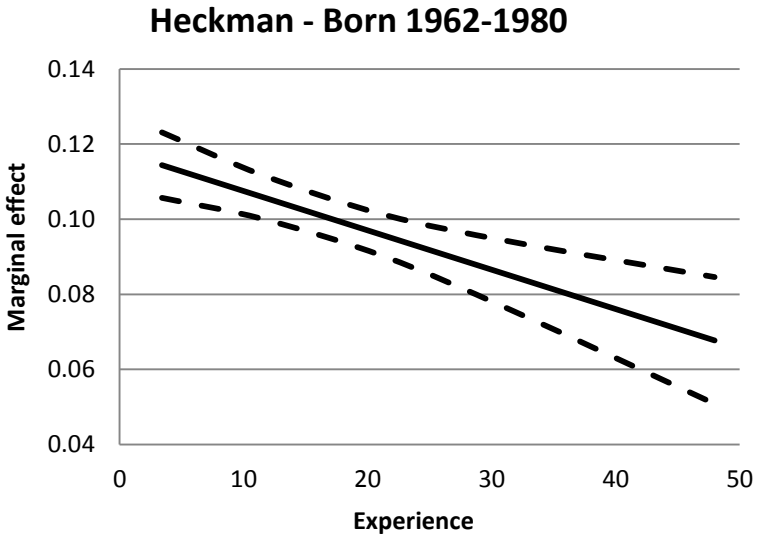
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Experience

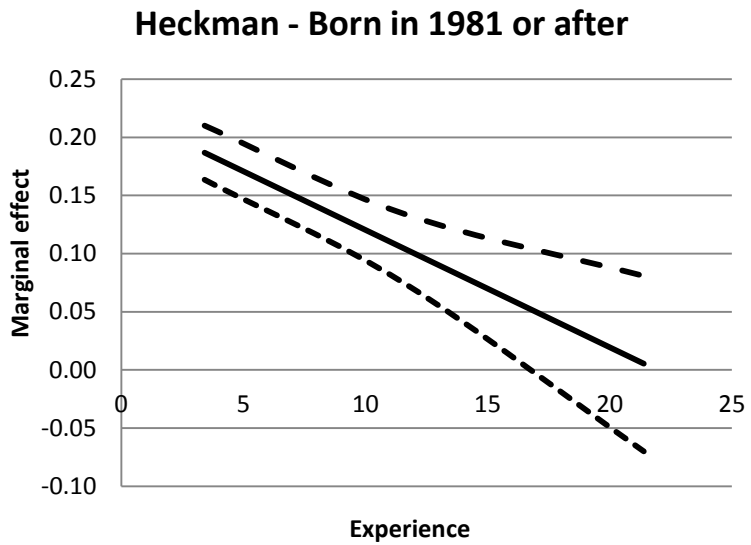

Figure 3: Heckman Selection Model - marginal effects and low/upper limits

Table 1: Data description for cross-sectional data

Employee sample (Ordinary Least Square model)									
Variable	**All**	**1989**	**1991**	**1993**	**1997**	**2000**	**2004**	**2006**	**2009**
Real hourly wage rate (Yuan)	3.93	1.22	1.46	1.73	3.49	5.13	6.07	6.93	9.05
Years of schooling (Years)	9.17	7.49	8.29	8.59	9.36	9.85	10.46	10.64	10.54
Experience (Years)	22.63	23.21	23.40	22.99	20.50	20.15	22.53	23.54	24.33
Male (%)	0.57	0.52	0.56	0.57	0.58	0.59	0.59	0.59	0.59
Urban (%)	0.48	0.49	0.51	0.48	0.48	0.44	0.50	0.47	0.47
Married (%)	0.79	0.75	0.80	0.77	0.74	0.74	0.87	0.88	0.88
Born before 1950 (%)	0.20	0.35	0.34	0.30	0.15	0.11	0.07	0.05	0.03
Born 1950-1961 (%)	0.29	0.28	0.31	0.30	0.29	0.29	0.30	0.30	0.25
Born 1962-1980 (%)	0.47	0.37	0.35	0.41	0.55	0.55	0.54	0.55	0.57
Born in 1981 or after (%)	0.04				0.00	0.06	0.09	0.10	0.16
Full sample (Heckman selection model)									
Variable	**All**	**1989**	**1991**	**1993**	**1997**	**2000**	**2004**	**2006**	**2009**
Years of schooling (Years)	8.48	7.16	7.90	8.12	8.37	8.95	8.79	9.04	9.06
Experience (Years)	24.77	23.45	22.28	22.42	22.36	22.14	26.82	27.87	28.80
Male (%)	0.51	0.51	0.53	0.54	0.52	0.52	0.49	0.49	0.48
Urban (%)	0.43	0.45	0.46	0.43	0.43	0.41	0.42	0.42	0.43
Married (%)	0.78	0.74	0.73	0.71	0.71	0.71	0.88	0.89	0.90
Born before 1950 (%)	0.23	0.35	0.32	0.29	0.24	0.19	0.18	0.16	0.11
Born 1950-1961 (%)	0.27	0.27	0.27	0.26	0.24	0.24	0.29	0.30	0.31
Born 1962-1980 (%)	0.43	0.38	0.41	0.45	0.50	0.45	0.41	0.41	0.43
Born in 1981 or after (%)	0.07				0.03	0.12	0.12	0.13	0.16

Source: CHNS 1989-2009

Table 2: Data description for pooled data (four age groups)

Employee sample (Ordinary Least Square model)				
Variable	**Born before 1950**	**Born 1950-1961**	**Born 1962-1980**	**Born in 1981 or after**
Real hourly wage rate (Yuan)	2.99	3.88	4.11	6.35
Years of schooling (Years)	6.53	9.41	10.06	10.89
Experience (Years)	40.71	26.31	13.57	5.11
Male (%)	0.63	0.6	0.53	0.5
Urban (%)	0.53	0.53	0.44	0.4
Married (%)	0.99	0.98	0.63	0.23
Full sample (Heckman selection model)				
Variable	**Born before 1950**	**Born 1950-1961**	**Born 1962-1980**	**Born in 1981 or after**
Years of schooling (Years)	5.88	8.43	9.6	10.36
Experience (Years)	44.09	30.21	14.39	3.83
Male (%)	0.5	0.51	0.51	0.52
Urban (%)	0.48	0.47	0.39	0.39
Married (%)	0.98	0.98	0.64	0.19

Source: CHNS 1989-2009

Table 3: Ordinary Least Square regressions

Employee sample	**All years**	**1989**	**1991**	**1993**	**1997**	**2000**	**2004**	**2006**	**2009**
Years of schooling	0.043***	0.026***	0.015***	0.014**	0.028***	0.051***	0.094***	0.090***	0.079***
	0.003	*0.004*	*0.004*	*0.006*	*0.007*	*0.008*	*0.009*	*0.007*	*0.007*
R-squared	0.597	0.138	0.12	0.102	0.1	0.09	0.222	0.238	0.197
N	17,212	2,712	2,759	2,307	2,080	1,879	1,695	1,787	1,993
Born before 1950	**All years**	**1989**	**1991**	**1993**	**1997**	**2000**	**2004**	**2006**	**2009**
Years of schooling	0.026***	0.028***	0.009	0.014	0.02	0.070***	0.080**	0.026	-0.106
	0.004	*0.006*	*0.006*	*0.009*	*0.019*	*0.016*	*0.033*	*0.043*	*0.068*
R-squared	0.482	0.211	0.097	0.117	0.055	0.236	0.25	0.441	0.304
N	2,962	877	736	551	339	210	116	80	53
Born 1950-1961	**All years**	**1989**	**1991**	**1993**	**1997**	**2000**	**2004**	**2006**	**2009**
Years of schooling	0.048***	0.026***	0.020*	0.017	0.047***	0.065***	0.086***	0.107***	0.095***
	0.005	*0.009*	*0.011*	*0.012*	*0.013*	*0.016*	*0.017*	*0.015*	*0.018*
R-squared	0.614	0.084	0.087	0.077	0.134	0.101	0.19	0.253	0.192
N	5,706	978	1,006	849	704	590	531	544	504
Born 1962-1980	**All years**	**1989**	**1991**	**1993**	**1997**	**2000**	**2004**	**2006**	**2009**
Years of schooling	0.051***	0.026***	0.014	0.014	0.022**	0.034***	0.100***	0.093***	0.087***
	0.004	*0.009*	*0.009*	*0.012*	*0.009*	*0.01*	*0.012*	*0.01*	*0.008*
R-squared	0.605	0.063	0.05	0.063	0.09	0.047	0.222	0.209	0.226
N	7,891	857	1,017	907	1,034	1,000	936	997	1,143
Born in 1981 or after	**Years in 2000s**	**1989**	**1991**	**1993**	**1997**	**2000**	**2004**	**2006**	**2009**
Years of schooling	0.080***					0.022	0.025	0.102***	0.087***
	0.013					*0.154*	*0.038*	*0.023*	*0.016*
R-squared	0.306					0.04	0.354	0.243	0.204
N	650					79	112	166	293

Note: The standard errors are in italics and adjusted by clusters. *** Significant at 1%, **significant at 5%, *significant at 10%. Province dummies are included for all regressions. Year dummies are included in the 'all years' regression. Constants and controlled variables are not reported.

Table 4: Ordinary Least Square regressions

	Employee sample	**Born before 1950**	**Born 1950-1961**	**Born 1962-1980**	**Born in 1981 or after**
Years of schooling	0.060***	0.091***	0.047***	0.041***	0.093***
	0.005	*0.019*	*0.013*	*0.008*	*0.026*
School*experience/100	-0.067***	-0.178***	0.004	0.063	-0.265
	0.015	*0.053*	*0.048*	*0.043*	*0.413*
Experience	0.030***	0.136***	0.054***	0.020**	0.032
	0.003	*0.023*	*0.014*	*0.008*	*0.076*
Experience square	-0.000***	-0.002***	-0.001***	-0.001***	0.001
	0	*0*	*0*	*0*	*0.003*
R-squared	0.598	0.484	0.614	0.605	0.308
N	17212	2962	5706	7891	653

Marginal effects of schooling (OLS)

	Percentile	5%	25%	50%	75%	95%
	Experience	3.41	11.57	21.39	31.83	47.98
Employee sample	Marginal effects	0.058***	0.052***	0.046***	0.038***	0.028***
	standard error	*0.004*	*0.003*	*0.003*	*0.003*	*0.004*
Born before 1950	Marginal effects	0.085***	0.071***	0.053***	0.035***	0.006
	standard error	*0.018*	*0.014*	*0.009*	*0.004*	*0.007*
Born 1950-1961	Marginal effects	0.047***	0.048***	0.048***	0.049***	0.049***
	standard error	*0.012*	*0.008*	*0.005*	*0.006*	*0.012*
Born 1962-1980	Marginal effects	0.043***	0.048***	0.054***	0.061***	0.071***
	standard error	*0.006*	*0.004*	*0.005*	*0.008*	*0.015*
Born in 1981 or after	Marginal effects	0.084***	0.062***	0.036		
	standard error	*0.015*	*0.028*	*0.067*		

Note: The standard errors are in italics and adjusted by clusters. *** Significant at 1%, **significant at 5%, *significant at 10%. Constants and controlled variables are not reported.

Table 5: Heckman Selection Model

	Full sample	Born before 1950	Born 1950-1961	Born 1962-1980	Born in 1981 or after
Ln (real hourly wage rate)					
Years of schooling	0.052***	0.074***	0.049***	0.118***	0.221***
	0.005	*0.019*	*0.013*	*0.01*	*0.037*
School*experience/100	-0.059***	-0.135***	-0.028	-0.105**	-1.009**
	0.015	*0.052*	*0.046*	*0.052*	*0.499*
Experience	0.027***	0.117***	0.062***	0.116***	0.369***
	0.003	*0.023*	*0.014*	*0.01*	*0.103*
Experience square	-0.000***	-0.001***	-0.001***	-0.003***	-0.014***
	0	*0*	*0*	*0*	*0.004*
Select model					
Married	0.080**	0.248*	0.234**	-0.054	-0.220***
	0.034	*0.145*	*0.113*	*0.033*	*0.064*
Years of schooling	0.210***	0.246***	0.282***	0.182***	0.217***
	0.008	*0.038*	*0.028*	*0.012*	*0.029*
School*experience/100	-0.470***	-0.651***	-0.574***	-0.355***	-1.040***
	0.022	*0.09*	*0.083*	*0.06*	*0.398*
Experience	0.172***	0.062	0.193***	0.213***	0.535***
	0.005	*0.041*	*0.025*	*0.011*	*0.075*
Experience square	-0.003***	-0.001***	-0.003***	-0.005***	-0.022***
	0	*0*	*0*	*0*	*0.003*
Mills (lambda)	-0.04***	-0.06***	-0.04***	0.67***	0.80***
standard error	0.01	0.01	0.01	0.03	0.09
t value	-5.04	-3.81	-3.27	20.68	8.87
Wald test of indep. Eqns. (rho=0)	25.62***	13.51***	10.79***	342.22***	70.59***
	0	0.0002	0.001	0	0
N	40,933	9,494	11,668	17,218	2,553

Marginal effects of schooling (Heckman selection model)

	Percentile	5%	25%	50%	75%	95%
	Experience	3.41	11.57	21.39	31.83	47.98
Full sample	Marginal effects	0.050***	0.045***	0.039***	0.033***	0.024***
	standard error	0.004	0.003	0.003	0.003	0.004
Born before 1950	Marginal effects	0.069***	0.058***	0.045***	0.031***	0.009
	standard error	0.017	0.013	0.008	0.004	0.007
Born 1950-1961	Marginal effects	0.048***	0.046***	0.043***	0.040***	0.036***
	standard error	0.012	0.008	0.005	0.006	0.011
Born 1962-1980	Marginal effects	0.114***	0.106***	0.096***	0.085***	0.068***
	standard error	0.009	0.006	0.006	0.009	0.017
Born in 1981 or after	Marginal effects	0.187***	0.104***	0.005		
	standard error	0.023	0.030	0.075		

Note: The standard errors are in italics and adjusted by clusters. *** Significant at 1%, **significant at 5%, *significant at 10%. Year dummies and province dummies are included for all regressions. Constants and controlled variables are not reported.