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THE VALUE OF EDUCATION AND JOB TRAINING IN THE DEVELOPING WORLD: NEW EVIDENCE FROM MIGRANT WORKERS IN CHINA

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The Value of Education and Job Training in the Developing World: New Evidence from Migrant Workers in China*

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Abstract

This paper utilises a new survey to evaluate the impact of education and on-the-job training on earnings by migrant workers in China. It accounts for job-skill mismatch and selection bias in training, and examines the sources of a gender gap. The evidence is as follows: the return to *required* education is 9.5% while that of job training is three times as high; the effect of migrant work experience is considerable; women earn more than men due to endowment effects. This evidence calls for new policy initiatives in China to raise the skills of migrant workers and abolish discrimination against them.

Keywords: Earnings; Education; Mismatch; Training; Overeducation; Undereducation; China

JEL Classification: C5, I2, J2, J3, J4, O1, O2, P2

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1. Introduction

Major economic reforms since 1978 have transformed China into the 'world's most successful economy' with an average of 8 percent per capita annual growth and unprecedented gains in average living standards. Internal labour migration has been the backbone of China's economic development since it has provided special economic zones and other coastal regions with abundant labour supply.[1]

Meanwhile, China has also seen a trend toward growing income disparities. The rural-urban divide has been a conspicuous feature of the rise in income inequality in China (Ravallion and Chen 2007; Au and Henderson 2006; Sun 2004). Evidence suggests that worker migration has helped China bridge the rural-urban income gap since it has allowed rural households to share in the economic gains (Wan 2004).

Labour economics has highlighted a positive relation between human capital and wages. In an attempt to make this relation work for rural households, China has introduced mandatory schooling in 1986 and nation-wide training programs for potential migrants in 2004. However, the public education and training system discriminates against migrant workers who live in urban areas since public expenditures are allocated on the basis of the Hukou system of permanent residence.[2]

The value of education for migrant workers in China has been examined in several studies and the overall evidence points to modest and diminishing

[1] See details in Sachs (2005).
[2] Hukou is a Chinese term referring to the Household registration system.

returns to schooling.[3] The role of on-the-job training, on the other hand, has been neglected according to Liu and Xiao (2006) who recommend that greater attention is paid to the diverse roles of education and training in China and other transition economies since the skills acquired during formal education under a planned economy may differ substantially from those required at the workplace in a market economy.

In view of China's policy emphasis on education, this study builds on the above recommendation to extend the literature on three main directions. First, it utilises data from a new survey in China's Zhejiang Province that allows us to estimate the value of education and on-the-job training for migrant workers in China. Second, it adopts a new methodology that distinguishes between skills acquired and skills on demand to account for non-linear effects of education. The approach owes to the literature of job-skill mismatch,[4] where undereducation and overeducation are two measures of discrepancy between formal education attainment and the level of education that is required to perform particular jobs. Workers with more education than the required level are called 'overeducated' while those with less years of education are seen as 'undereducated'. Studies in several countries have consistently found that the overeducated earn more than their peers with less education, but that the return to extra education is about half of that associated with required education. In contrast, the undereducated earn less but the earnings penalty is smaller than the returns to required education. This methodology seems

[3] For example, de Brauw and Giles (2006) and Zeng (2004).
[4] See Duncan and Hoffman (1981), Hartog (2000), and Voon and Miller (2005).

appropriate for developing countries where new evidence suggests that skills matter more than formal education.[5]

Third, the study utilises a new survey to examine the role of *time* spent on job training as an independent factor. This is highly significant in the light of three major developments in labour economics. First, two new theories have challenged the traditional view of job training that sees training as a substitute for education. One is *search and matching theory* that perceives job training to be complementary to formal education; namely, it bridges the gap between generic skills and job-specific skills.[6] Another is the *human capital depreciation* theory that highlights skill obsolescence as a result of wear, atrophy and technological change.[7] The international literature suggests that job training is valuable to workers, especially the low-skilled.[8]

Second, economic theory suggests that firm behaviour can potentially produce sub-optimal levels of employer-based job training (Acemoglu and Pischke 1999). The temporary residence status of migrant workers in China may exacerbate this problem. Third, the new data set used here provides explicit information on training *time* that, in turn, allows us to addresses Kuruscu's (2006) criticism that participation in job training is subject to selection bias.

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[5] See Hanushek and Wößmann (2007b).

[6] For more details, see Linsley (2005) and van Smoorenburg and van der Velden (2000).

[7] Mincer and Ofek (1982), Baldwin and Johnson (1995) and de Grip (2004) are key studies that attempt to model skill obsolescence and account for job training.

[8] van Smoorenburg and van der Velden (2000), de Grip and van Loo (2002) and Arulampalam *et al.* (2004) find evidence of substantial returns to training.

The paper is organised as follows. Section two summarises the literature on which this paper draws. Section three outlines our empirical methodology. Section four presents the empirical results. Finally, the paper concludes with a discussion on the implications of the new evidence for China's policy on domestic migrant workers.

2. Background

China is characterised by a dual economy by which the vast rural population has considerably lower levels of incomes and considerably less access to key social services, namely education, medical and insurance services and social welfare.[9] Most striking is the fact that 75 per cent of the 85 million illiterates and semi-illiterates in China were concentrated in the Western rural areas of the country (Communist Party's School 2005).

Sharp spatial disparities are also discernible in education. In rural China, education up to middle school (eight to nine years of education) became mandatory only in 1986 with the Law on Compulsory Education (Tsang 1996). According to a survey conducted by the Communist Party's School (2005) in the 16 provinces of China, the average years of education received by the rural population in China was below 7 years, almost three years lower than their urban counterparts. Likewise, less than one per cent of all labourers between the age of 15 and 64 in rural China received tertiary education, 13 per cent lower than their urban counterparts. Moreover, despite mandatory

[9] For a detailed description of unequal access to social services, see Tong (2006).

schooling to year nine (6 years of the primary school education and three years of middle school education), less than 30 per cent of the rural children at the school age were able to finish their nine years of education. It was also found that increases in school fees, poverty and poor educational quality in rural areas were major contributors to the low levels of education achieved in rural China.

China's dual economy has also experienced a remarkable surge in domestic migration by workers who leave rural communities to seek jobs in big cities. Initially conceived as a solution to severe shortages of labour in fast-growth urban regions, migrant workers were granted special rights of temporary residence in the early 1990s. Since, worker migration has grown immensely (Sachs 2005). According to a Chinese Government report (The Research Group on China's Farmer Turn Workers 2006), the number of migrant workers increased from 30 million in 1989 to 62 million by 1993. In 2004, the number of migrant workers reached 118 million, or 23.8 per cent of the total rural labour force in China.

On the assumption that China's growth is sustainable, worker migration emerges as a major policy instrument via which rural China can catch up with the living standards enjoyed by much of the urban population. There is growing evidence of this potential. China's Ministry of Agriculture estimated that there were around 98 million of domestic migrant workers in 2003 and their remittance reached 370 billion RMB (44.7 Billion US$), that constitutes 40 per cent of total rural household income in China (Ministry of Agriculture 2004). Du *et al.* (2005) report that migrant workers increase a household's per

capita income by 8.5 to 13.1 percent. Also, the wages of migrant workers have been significantly higher than those earned by agricultural workers. Wan (2004) found that the average wage of migrant workers in the Henan Province reached 4,717 Rmb in 2003, 82.4% higher than the average net income of agricultural workers in the province.[10]

With the world economy relying heavily on low wages, it is no wonder that public policy in China has focused on domestic migration as the principal source of low-cost labour (Zheng 2004; Chen 2004) and there has been little attention to education and skill development for migrant workers in China. Economic intuition highlights human capital as a 'crucial aspect in development' (Wößmann 2003) but little is known about the nature and drivers of human capital growth in developing nations. As major players in world economic development, domestic migrant workers offer researchers the opportunity to learn about the process of learning in the developing world since domestic migrants are part of the same national education system but have little prior knowledge of the jobs they fill. Moreover, migrants do not fit in well with established labour coalitions since they have a strong work ethic and often face hostile attitudes and discriminatory policies as temporary urban residents.[11] These characteristics make it easier to disentangle the role of education from that of learning at the workplace.

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[10] Note that migrant workers incur higher living expenses in urban areas. Thus, Wan (2004) overestimates the net income gap between migrant workers and agricultural workers.

[11] Some cities restrict the entry of migrant workers into certain industries. Relative to their urban peers, migrant workers face higher costs for further education, medical care and school fees for their children, and receive lower entitlements with respect to bonus income and retirement benefits. This discrimination stems from their

The current state of knowledge of the human capital of migrants is limited to few basic indicators. One is that the average level of education of migrant workers in China is significantly higher than that of rural labourers but lower than their urban co-workers. Zhang et al (2004) estimate that of all the migrant workers, 10% are of high school graduates, 30% middle school graduates, 30% of primary school graduates and some are illiterate. Moreover, 80% of migrant workers have received no formal training at all. Also, migrant workers tend to concentrate in unskilled employment (Fleicher and Wang 2004).

Private returns to education have improved over time as China shifted from a planned to a market economy (Li and Zhang 1998; Yang 2004). In a survey of 616 migrant workers in Chengdu City in 2000, Zeng (2004) found that the return of an extra year of education on income is positive but only small at 1 per cent. It was also found that women earned 10 per cent less than men. Also, the effect of the years working experience as a migrant worker is positive, at 0.5 per cent.

With respect to job training, migrant workers seem to be twice disadvantaged. First, employer-based training appears to be inadequate since there are a few incentives to job training given the temporary nature of employment for migrant workers (The Research Group on China's Farmer Turn Workers 2006). According to the research group, it was common for many employers not to provide even the basic occupational training to migrant

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status as temporary residents due to the Hukou system of registered permanent residence which is location specific (Zhang et al 2004; Whalley and Zhang 2004).

workers as required by the state and the legal system in China. According to the data provided by the Ministry of Construction, of 32 million migrant workers employed in China's construction industry, only 10 per cent received some kind of training. Second, current state-funded training programs are of little benefit to migrant workers since funds are mainly targeted towards retrenched workers from state enterprises. Only since 2004, the central government has begun to allocate funds for potential migrants on the basis of the Hukou system of residence. Thus, if at all, migrant workers receive state-funded training prior to migration when there is little knowledge of the skills required in big cities. Further, migrants contribute to urban taxation but local governments have no obligation to subsidise training for migrant workers.

To our best knowledge, we can cite only two empirical studies that explore the link between job training and earnings in China. One is by Liu and Xiao (2006) who utilise a 1998 survey of 16,485 employees from 365 firms in six provinces. Although they do not control for selection bias, they find that participation in on-the-job training (i.e., a binary variable) has a positive but modest effect on wage growth. Zeng (2004) is the only study that examines the impact of training for migrant workers. He uses information on trade-specific skills to construct a measure of 'skill mastering' that enters a standard Mincerian equation (see next section) as a proxy for 'informal training'. He concludes that 'informal training' contributes to income by 2.8 per cent. However, it is impossible to know whether this measure is as a proxy for current on-the-job training or whether it is endogenous (i.e., higher income or higher education may enable individuals to invest in skills).

Given the surge in worker migration in recent times, the search for new insights on the value of education and training in China seems highly desirable. Below, we outline an empirical methodology and a new data set that enable us to obtain unbiased estimates of returns to both education and on-the-job training.

3. Methodology and Data

Methodology

Mincer's (1974) pioneer work has equipped economists with a powerful methodology that allows them to estimate the value of investment in education to individuals. The approach is summarised in the standard 'Mincerian' equation:

$$\boldsymbol{LW_i} = \beta \boldsymbol{S_{A,i}} + \sum_{\boldsymbol{n}=1}^{2} \gamma_{\boldsymbol{n}} \mathrm{E}_{\mathrm{i}}^{\mathrm{n}} + \mathrm{X}_{\mathrm{i}} \delta + \varepsilon_{\boldsymbol{i}} \qquad (1)$$

Here, LW_i is the log of earnings for worker i, $S_{A,i}$ is her actual years of education, β is the rate of return to one year of education, E_i is potential work experience in a second-order polynomial, X_i is a vector of other explanatory variables such as marriage and gender, γ and δ are coefficient vectors and ε_i is a random error term. Equation (1) has been widely applied to estimate returns to education in various countries. Decades of research has led to a

literature consensus that points to several key findings: estimates of β range from 0.05 to 0.15; women earn more than men; there are diminishing returns to education, and the payoff to education is higher for more disadvantaged individuals.[12]

Notwithstanding thirty years of success, a new generation of economists has sought to extend the Mincer equation to account for a disparity between the demand for skills and the supply of skills. Following Duncan and Hoffman (1981), Hartog (2000) has extended (1) to allow for a mismatch between generic skills acquired during formal education and skills that are appropriate for particular jobs or occupations. Central to his model are the concepts of undereducation and overeducation as two possible measures of mismatch between actual years of formal education and the required level of education appropriate for particular occupations. The latter is seen as a benchmark whereby workers with more education than the required level are defined as overeducated while those with fewer qualifications are said to be undereducated.[13]

There exist three methods of estimating required education. First is the objective method with professional assessments of the minimum years of training required to perform key tasks in particular occupations. Second is the statistical method that defines required education as the mean or median of the observed distribution of years of education in a particular occupation.

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[12] See Krueger and Lindahl (2001), Heckman *et al*. (2003) and Psacharopoulos and Patrinos (2004). On average, the OLS estimate is 0.066 while the 2SLS estimate is 0.093 (Krueger and Lindahl 2001).

[13] Undereducation and overeducation have been linked to diverse causes that are associated with *search and matching theory, assignment theory, and technological change theory*. For detailed discussion, see Voon and Miller (2005).

Third, the subjective method relies on worker self-reported estimates of the years of education required for various jobs.

Numerous international studies have concluded that the overeducated earn more than their peers with less schooling, but an extra year of education yields a return that is about half of that associated with required education. Conversely, undereducation carries an earnings penalty that is smaller than the return to required education.[14] So far, the Hartog (2000) methodology has been employed in OECD countries where expenditures in education have grown considerably over the last two decades. This methodology, however, can be useful when applied to the developing world since there are serious concerns that the gap between formal education and skills required at the workplace is much wider than previously thought (Hanushek and Wößmann 2007a, 2007b). Further, the methodology seems highly appropriate for China in transition to a market economy. As Liu and Xiao (2006) acknowledge, it is expected that the gap between formal education and skills demanded at the workplace will be considerable in China since the skills, knowledge and values provided by formal education derive from a system of central planning.

In this paper, we adapt this new modelling approach to integrate the undereducation and overeducation literature with a Mincerian tradition that focuses on job-specific learning and job training, in the spirit of Mincer (1962, 1989), Mincer and Ofek (1982) and Veum (1999). More formally, we examine the following model:

[14] As observed in Hartog (2000), Dolton and Vignoles (2000), Büchel and Mertens (2004), and Voon and Miller (2005).

$$\boldsymbol{LW_i} = \beta_{\boldsymbol{r}} \boldsymbol{S_{R,i}} + \beta_{\boldsymbol{u}} \boldsymbol{S_{U,i}} + \beta_{\boldsymbol{o}} \boldsymbol{S_{O,i}} + \sum_{\boldsymbol{n}=1}^{4} \gamma_{\boldsymbol{n}} \mathrm{E}_{\mathrm{i}}^{\mathrm{n}} + \mathrm{X}_{\mathrm{i}} \delta + \varepsilon_{\boldsymbol{i}} \quad (2)$$

Again, LW_i is the log of average weekly earnings but (2) differs from (1) in three ways. First, following Hartog (2000), (2) decomposes actual years of education, S_A, into required education, S_R, undereducation, S_U, and overeducation, S_O. Here, we define required education here on the basis of the statistical or 'realised matches' method, as in Voon and Miller (2005). Hence, S_R is the mean of observed actual years of education by occupation, S_O is equal to (S_A-S_R) if $S_A > S_R$ and zero otherwise, and S_U is equal to (S_R-S_A) if $S_A < S_R$ and zero otherwise. Second, model (2) employs a fourth-order polynomial for work experience, E_i, as it appears in recent literature (Murphy and Welch 1990; Card 1999; Robinson 2000; Trostel 2005; Lemieux 2006). This quartic term provides more flexibility in addressing nonlinearities. Third, the X_i vector comprises of the following covariates: job training time, marriage, and gender.[15]

Note, however, that we also deal with the possibility that participation in job training may be subject to selection effects (Kuruscu 2006). He shows that returns to training in the USA are much smaller than previously thought once he accounts for such bias. Here, we exploit data on time spent on job training and employ a two-step estimation procedure to account for selection effects. In the first step, we model training time that accounts for employer selection in job training and allows us to predict training time selected by workers. In the

[15] For more detail on the rationale for training as an independent factor in (2) see Messinis and Olekalns (2007).

second step, we utilise these latter predictions to recover unbiased estimates of returns to job training.

Data

The data for this article are taken from a new 2005 survey of 400 migrant workers in Hangzhou of Zhejiang Province. The Chinese census defines migrant workers as rural labourers transferred out of their home county for more than six months. Most inter-provincial migrant workers originate from the Central and Western provinces and are employed in the coastal provinces.

Zhejiang was selected as a province with a high concentration of migrant workers. Given the rapid development of private enterprises and foreign investment in the province, Zhejiang is one of the primary destinations for migrant workers in China. The survey of migrant workers in Hangzhou of Zhejiang Province was conducted in December 2004 and January 2005. A total of 400 migrant workers were randomly selected for the survey, although consideration was given for the survey to cover migrant workers across a wide range of industries. Of the 400 people surveyed for this study, 87 percent were Han Chinese. The remaining 13 percent of people identified as Miao, Tujia, Mongol, and other ethnic groups. Migrant workers in the study represent a younger and more highly educated work force from rural China, especially from lower-income areas of China. Nearly 95 percent of the migrant workers studied are literate, although 10 percent have less than four years of formal education and have difficulty reading and writing while 30 percent have less than a middle school education. Women migrant workers,

representing 28 percent of the sample, have slightly lower levels of education. Of those surveyed, 70 percent were married, and 60 percent chose to leave their children back at their place of origin.

The interviews were conducted by agricultural economics undergraduate students at Zhejiang University, supervised by a staff member of the university. The survey contains information on basic wages, bonus income, remittances, years of education completed, work experience as a migrant worker, time spent in job training provided by one's employer, industry sector, occupation and skill, consumption expenditures and personal characteristics. With respect to training, participants were asked the following question: "At your current working unit, have you received training? If yes, how many days of formal training received?"[16]

However, there is a concern with the measurement of wages. Survey participants were requested to report their monthly basic wage in their current job. We convert this to weekly wages and add the weekly rate of bonuses to obtain the first, 'income-based', estimate of wages, W^1. We expect that W^1 will under-estimate earnings due to under-reporting or due to payments in kind such as free accommodation or free meals. These benefits will vary across industries and may be higher for women. Thus, we utilise an alternative 'expenditure-based' measure; that is, the sum of weekly total expenditure and the average weekly remittance sent home during 2003-2004. Note, however, that this second measure of wages, W^2, does not include savings that workers

[16] Since these data relate to the total time of training received from the current employer, we have adjusted for tenure by converting the raw data, TT0, into hours per week; i.e., TT = TT0/(4*TEN/12) where TEN is months of employment with the current employer.

keep in the city. Yet again, it is intuitive that such savings would most likely form part of savings sent home as remittances, a component of W^2. Hence, we consider this to be a more accurate estimate of migrant worker earnings.

4. Empirical Results

In column 1 of Table 1, we begin with summary statistics for our sample by occupation, industry, skill and gender. It appears that 59.8% of migrants in the sample report to be unskilled or have no trade. Also, the overwhelming majority works in manufacturing, construction and the services sector. This is consistent with previous studies in China. According to The Research Group on China's Farmer Turn Workers (2006), of all the migrant workers in China, 30.3 per cent were employed in the manufacturing industry, 22.9 per cent in the construction industry and 10.4 per cent in the service sector. However, a study of non government employees in Guangzhou, the capital of Guangdong Province, reports that about 55 per cent of the labour force in the city was employed in the manufacturing industry, 10 per cent in construction, 25 per cent in the service sector, and the rest were employed in transportation (6 per cent), communications (1.4 per cent), computer and softwares (1.1 per cent), and public infrastructure maintenance (Guangdong Enterprises Survey Team, 2006). In general, migrant workers have been employed in the more market-oriented industries where there was high demand for unskilled labour (Sun *et al.* 2005).

Table 1. Incidence of Undereducation, Overeducation and Training by Occupation: Migrant Workers, China 2005

Occupation	Share (% of sample)	Education (years)	Undereducation (%)	Overeducation (%)	Training (%)	Training (hours/w)
No trade	49.7	6.9	14.6	11.6	27.1	3.3
Drivers	6.2	7.6	4.0	8.0	56.0	8.3
Cooks	7.0	6.7	10.7	7.1	14.3	7.5
Barbers	1.2	8.0	20.0	20.0	40.0	32.6
Tailors	1.2	7.2	20.0	20.0	40.0	3.5
Mechanics	9.7	8.5	12.8	18.0	41.0	11.6
Builders	5.2	8.3	4.8	19.0	23.8	1.6
Carpenters	3.0	8.7	8.3	0.0	8.3	1.7
Foremen	1.7	8.4	14.3	14.3	14.3	0.4
Managers	2.0	6.9	25.0	12.5	25.0	1.2
Services	10.0	6.6	10.0	5.0	50.0	11.0
Skilled-Other	2.7	8.7	9.1	9.1	45.4	2.1
Transport	8.3	6.6	15.2	12.1	45.5	5.6
Construction	18.5	6.6	16.2	8.1	10.8	2.0
Manufacturing	25.0	7.8	14.0	12.0	32.0	4.0
Services	18.5	7.0	13.5	8.1	28.4	7.4
Other	29.8	7.7	7.6	14.3	42.0	8.0
Men	72.0	7.7	10.0	13.9	29.5	4.8
Women	28.0	6.3	18.7	4.4	36.6	7.5
Skilled workers	40.2	7.9	10.6	12.4	32.3	7.1
Unskilled workers	59.8	6.9	13.8	10.5	31.0	4.6
All workers		7.3	12.5	11.2	31.5	5.6

Note: Percentages may not sum up to 100 due to rounding. The ('unskilled') 'skilled workers' group comprises of all workers who reported (not) having an occupation or a trade and (includes) excludes workers in services. Summaries in columns 3-4 are based on the convention of plus or minus one standard deviation from required years of education as the thresholds for overeducation and undereducation respectively.

Columns 2-4 of Table 1 are summaries of average years of actual education and the incidence of undereducation and overeducation by skill, industry and gender.[17] As expected, skilled workers[18] exhibit higher levels of education but cooks, managers and women also report below average education levels. The incidence of undereducation seems higher for low skill workers, women, barbers, tailors and managers. On the other hand, men, builders, barbers, tailors are over-represented amongst the overeducated. With respect to job training, 31.5% of all migrant workers, 36.6% of women and only 29.5% of men have undergone training. These results contrast sharply with the finding in Liu and Xiao (2006) that 64% of all workers received on-the-job training during 1993-1998. They also confirm the suspicion that employers will be more reluctant to provide training to migrant workers than to other workers. The incidence of training, however, varies substantially across occupation with only 14.3% of cooks, 8.3% of carpenters and 14.3% of foremen have participated in training. In contrast, drivers, barbers, mechanics, and services workers have experienced strong participation in training. The last three groups, in particular, have dedicated considerable time in training that can be attributed to apprenticeships.

Next, Table 2 presents the results from OLS robust estimation of (2) that excludes job training. The first column uses the log of W^1 as a measure of wages. The results show that required education contributes to wages at the

[17] Summaries in Tables 1-2 are based on the convention of plus or minus one standard deviation from the mean of required years of education as the thresholds for overeducation and undereducation respectively.

[18] We define ('unskilled') 'skilled' workers as those who report (not) to have an occupation or a trade; services sector workers are treated as 'unskilled'.

rate of 10.6%. As expected, the coefficient is positive and statistically significant. Undereducation and overeducation, however, do not have any effect on earnings. Years of work experience as a migrant worker (EXP) also yields a high rate of return at 15.2%. Gender has also implications for wages. Here, women earn 16% less than men, a finding that seems consistent with previous studies in China (Wu 2001, p.100). Note, however, that the experience effect is linear and marriage (MAR) does not appear to play a role as in other studies.[19]

Column 2 of Table 2 repeats the above estimation procedure using the log of the second measure of wages, $\ln W^2$, as the dependent variable. The results are striking. With the exception of undereducation and overeducation, all other coefficients are highly significant. Now, marriage has a premium of 15% and women seem to earn almost 20% more than men. Also, the coefficients for undereducation and overeducation now have the expected signs. Moreover, one year of work experience seems to boost wages by 31.8%.[20]

We proceed with the estimation of model of (2) that incorporates weekly hours in job training, TT. However, OLS estimation of (2) would certainly yield biased estimates of the training effect if there is a selection bias in training participation. Kuruscu (2006) has advanced the proposition that firms will select skilled workers for training on the expectation that these workers will

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[19] See Wu (2001, pp.100-104) and Zhang and Si (2006).

[20] This is the net quartic effect. We have also estimated equation (2) for both LW^1 and LW^2 using standard measures of education (i.e., years of education or dummies for 0-4, 5-8, and 9 or more years of education) but none of the education coefficients were significant. Results are available upon request.

contribute relatively more to productivity gains. We address this issue by adopting a two-step procedure. First, we model training time to predict training hours purely selected by the worker. In step two, we exploit these predictions to recover estimates of returns to training selected by the worker.

Table 2. Returns to Education in China:
Migrant Workers, China 2005

	(1) Wage (W^1)	(2) Wage (W^2)
Constant	4.396	3.903
	(0.259)	(0.311)
Required Education (S_R)	0.106	0.100
	(0.035)	(0.039)
Undereducation (S_U)	0.005	-0.003
	(0.017)	(0.020)
Overeducation (S_O)	0.013	0.017
	(0.018)	(0.019)
Experience (EXP)	0.152	0.392
	(0.071)	(0.086)
Experience^2 /10 (EXP^2)	-0.208	-0.798
	(0.183)	(0.203)
Experience^3 /10 (EXP^3)	0.013	0.063
	(0.016)	(0.017)
Experience^4 /100 (EXP^4)	-0.003	-0.015
	(0.004)	(0.004)
Married (MAR)	-0.030	0.151
	(0.055)	(0.065)
Female (FEM)	-0.160	0.197
	(0.064)	(0.075)
Observations	371	382
R^2	0.16	0.17

Standard errors in parentheses. The dependent variable is the log of current wage, LW^1, in (1) and the log of long-term wage, LW^2 in (2). In other regressions, S_R, S_U and S_O were substituted with either actual years of education or dummies for four, six and at least nine years of education but none of these two alternative sets of education measures produced significant coefficients.

First, we account for firm selection bias in training. The empirical literature has neglected this issue and, as a consequence, is silent on the question of what estimation procedure is most appropriate in dealing with this issue. One possible strategy is the approach adopted by Di Tommaso (1999) who models the joint decisions of women's participation in the labour market and fertility to

account for the problem of endogeneity and correlation between these two decisions. However, the empirical question tackled by Di Tommaso (1999) is very different to the one we face here. She deals with an individual who takes full responsibility for the two decisions that have binary outcomes but are jointly determined. The problem we confront here, in sharp contrast, pertains to decisions that are determined independently by two different agents. We analyse only employer-provided training and, therefore, it is the firm that makes the selection decision for training, while the worker takes the firm's decision as given and determines his or her level of participation in the labour market.

Panel (A) in Table 3 has the Heckman estimation results with the log of training time (LTT) as the dependent variable and the following covariates: a dummy variable for being new in the current job (NEW); years of migrant-worker experience (EXP); a dummy variable for temporary work (TEMP). The selection variables included a dummy for completing middle-school (i.e., 9 years of education) (S_9); an indicator variable for receiving bonus income (BONUS); a dummy for higher labour income (HINC)[21], and age (AGE).

The Heckman results indicate that training is indeed not free of selection bias. High education, high income, and high work effort all add significantly to the probability of being selected by the firm to participate in training. Conversely, older workers are less likely to be selected for training. The evidence is consistent with that in Xiao and Tsang (2004) who find that training participation depends significantly on socio-economic characteristics of

[21] HINC equals one if W^2 exceeds the median of W^2.

workers. Once we account for selection bias, we arrive at the intuitive result that new and temporary workers are the main recipients of training. In contrast, experienced workers spent less time in training.

Table 3. Returns to Education and Training:
Migrant Workers, China 2005

(A) On-the-Job Training Time: Heckman Selection

Training Equation		Selection Equation	
Constant	-0.863 (0.300)	Constant	-0.394 (0.225)
New Worker (NEW)	0.769 (0.200)	Middle School (S9)	0.380 (0.101)
Experience (EXP2)	-0.156 (0.040)	Bonuses (BONUS)	0.339 (0.115)
Temporary (TEMP)	0.961 (0.326)	High Income (HINC)	0.549 (0.109)
		Age (AGE)	-0.021 (0.007)
Observations	397	Rho (ρ)	-0.543 (0.141)
Sigma (σ)	1.279 (0.115)	Lambda (λ)	-0.694 (0.225)

(B) Migrant Worker Labour Income: Robust OLS

	(1)	(2)
	Wage (W^1)	Wage (W^2)
Constant	4.388 (0.258)	3.884 (0.310)
Required Education (S_R)	0.104 (0.034)	0.096 (0.039)
Undereducation (S_U)	0.005 (0.016)	-0.001 (0.020)
Overeducation (S_O)	0.012 (0.018)	0.013 (0.019)
Experience (EXP)	0.163 (0.072)	0.415 (0.084)
Experience^2 /10 (EXP^2)	-0.223 (0.183)	-0.838 (0.200)
Experience^3 /10 (EXP^3)	0.015 (0.016)	0.066 (0.016)
Experience^4 /100 (EXP^4)	-0.003 (0.004)	-0.016 (0.004)
Married (MAR)	-0.030 (0.054)	0.153 (0.065)
Female (FEM)	-0.168 (0.065)	0.179 (0.075)
Realised Training (TT_R)	0.143 (0.103)	0.317 (0.106)
Observations	371	382
R^2	0.159	0.180

Standard-errors in parentheses. The dependent variable is the log of current wage, LW^1, in (1) and the log of long-term wage, LW^2 in (2). The "svy: heckman" procedure in STATA 9 was used for the estimation of the Heckman selection model. Inter-quartile regression estimation was employed to test whether the coefficient estimates are the same between the lowest and the highest income quartile but 500 bootstrap replications produced no statistically significant coefficients.

The second step utilises the Heckman two-stage predicted scores, TT_N, the Heckman selection predictions, TT_S,[22] and actual training time, TT, to obtain a measure of *realised* training time, TT_R, which is free of firm selection bias. That is, we seek to account for the fact that individual workers may not accomplish the Heckman prediction. We identify two main scenarios as most relevant in identifying *realised* worker selected training, TT_R. These correspond to the respective cases in which TT > TT_N and TT < TT_N. When the former is true, realised training time is set equal to the predicted scores that control for firm selection bias; i.e., TT_R = TT_N. In cases where TT < TT_N, we acknowledge that *realised* training is limited by actual training time. We thus define TT_R = ρTT where ρ=TT_N/(TT_N+ TT_S). Finally, TT_R is set equal to zero if the worker did not participate in training.

Then, we use the above measure of *realised* training time, TT_R, to recover estimates of returns to education and job training time as in equation (2). Panel (B) in Table 3 presents OLS robust coefficient estimates. Again, we arrive at results that are very similar to those in Table 2. Also, the contrast between column 1 that uses the 'income-based' measure of wages, W^1, and column 2 that uses the 'expenditure-based' measure, W^2, is striking with respect to training. The coefficient of *realised* training time, TT_R, is 0.317 and highly significant when the log of is W^2 used as the dependent variable but is insignificant when the log of W^1 is used. The results suggest that the 'expenditure-based' measure of wages, W^2, is a more accurate measure of

[22] TT_N and TT_S are the Heckman predictions converted to hours, then standardised and re-centred to have the same mean and standard deviation as TT.

wages and that job training has a large and significant effect when this measure of earnings is utilised.

Finally, we pay more attention to gender differences. We employ the Blinder-Oxacana decomposition[23] to gain an insight on the source of gender wage differences in migrant workers. A brief explanation of the procedure follows. Suppose that Z_j is the vector of all explanatory variables in (2) for two groups of workers (j=0,1) where j=1 is the high income group and j=0 is the low income group.

$$\boldsymbol{LW_j = Z_j \beta_j + e_j}, \quad \boldsymbol{E(e_j) = 0}, \ \boldsymbol{j} \in \{0,1\}$$

Then the mean outcome difference is

$$\boldsymbol{D = \overline{LW}_1 - \overline{LW}_0 = (a_1 + \overline{Z}_1' \hat{\beta}_1) - (a_1 + \overline{Z}_0' \hat{\beta}_0)}$$

$\boldsymbol{\overline{LW}}$ is the sample mean of the income variable, $\boldsymbol{\overline{Z}}$ is the mean vector of regressors and $\mathbf{a}_1$ and $\mathbf{a}_0$ are the baseline predictions for the groups (i.e., constants). Then, group differences can be attributed to three components: (a) differences in observable characteristics (i.e., endowments); (b) differences in marginal effects (i.e., discrimination) and (c) differences in constants (i.e., unexplained). Hence, the group differences can be decomposed as

[23] See Chen *et al.* (2005) for details.

$$\boldsymbol{D} = \underbrace{(\overline{\boldsymbol{Z}}_1 - \overline{\boldsymbol{Z}}_0)'\hat{\beta}_1}_{\textbf{Endowment effect}} + \underbrace{\overline{\boldsymbol{Z}}_1'(\hat{\beta}_1 - \hat{\beta}_0)}_{\textbf{Discrimination effect}} + \underbrace{(\boldsymbol{a}_1 - \boldsymbol{a}_0)}_{\textbf{Unexplained}}$$

Table 4 has the results of the Blinder-Oxacana decomposition using equation (2) where experience enters as a quadratic term and the gender variable (FEM) is omitted. In column 1, the total endowment effect is 0.059 and statistically significant. Also, the combined effect of required education and experience explains 0.072 points of the total observed difference of 0.24. In contrast, the total discrimination effect is large but lacks statistical significance. Yet, the evidence suggests that the 'income-based' measure of wages, W^1, would have been 3.4% higher for the average female worker had women been treated in the same way as men.

When the 'expenditure-based' measure of wages in logs, LW^2, is used as the dependent variable, column 2 in Table 4 reveals that the total observed difference is reduced to 0.13. Now the total endowment effect is minimal and statistically insignificant but the combined effect of marriage, MAR, and realised time in training, TT_R, explains 72% of the total difference. Overall, the results suggest that gender discrimination with respect to training is a short-term effect and gender differences in wages can mainly be attributed to differences in endowments.

Table 4. Decomposition of Gender Differences in Wages:
Migrant Workers, China 2005

	(1) Wage (W^1)		(2) Wage (W^2)	
	Endowment	Discrimination	Endowment	Discrimination
Total Endowment	0.059		0.008	
	(0.024)		(0.083)	
Total Discrimination		-0.343		-0.310
		(0.729)		(0.892)
Total Unobserved	0.530		0.435	
	(0.655)		(0.804)	
Required Education (S_R)	0.033	-0.270	-0.020	-0.551
	(0.014)	(0.671)	(0.043)	(0.801)
Undereducation (S_U)	0.003	-0.042	0.019	0.043
	(0.004)	(0.061)	(0.030)	(0.039)
Overeducation (S_O)	-0.007	-0.078	-0.032	0.092
	(0.008)	(0.036)	(0.020)	(0.063)
Experience (EXP)	0.082	0.041	-0.099	-0.067
	(0.010)	(0.191)	(0.000)	(0.296)
Experience^2 /10 (EXP^2)	-0.043	-0.034	0.047	0.011
	(0.000)	(0.123)	(0.070)	(0.210)
Married (MAR)	0.006	0.006	0.070	0.147
	(0.013)	(0.132)	(0.039)	(0.129)
Realised Training (TT_R)	-0.016	0.034	0.022	0.014
	(0.005)	(0.015)	(0.000)	(0.010)
Joint Effect: S_R+EXP	0.072			
	(0.017)			
Joint Effect: MAR+TT_R			0.094	
			(0.038)	

Standard errors in parentheses. The dependent variable is the log of current wage, LW^1, in (1) and the log of long-term wage, LW^2 in (2). The total observed difference is 0.24 in (1) and 0.13 in (2). Note, mean wage is higher for men in (1) but higher for women in (2).

Summary of Results

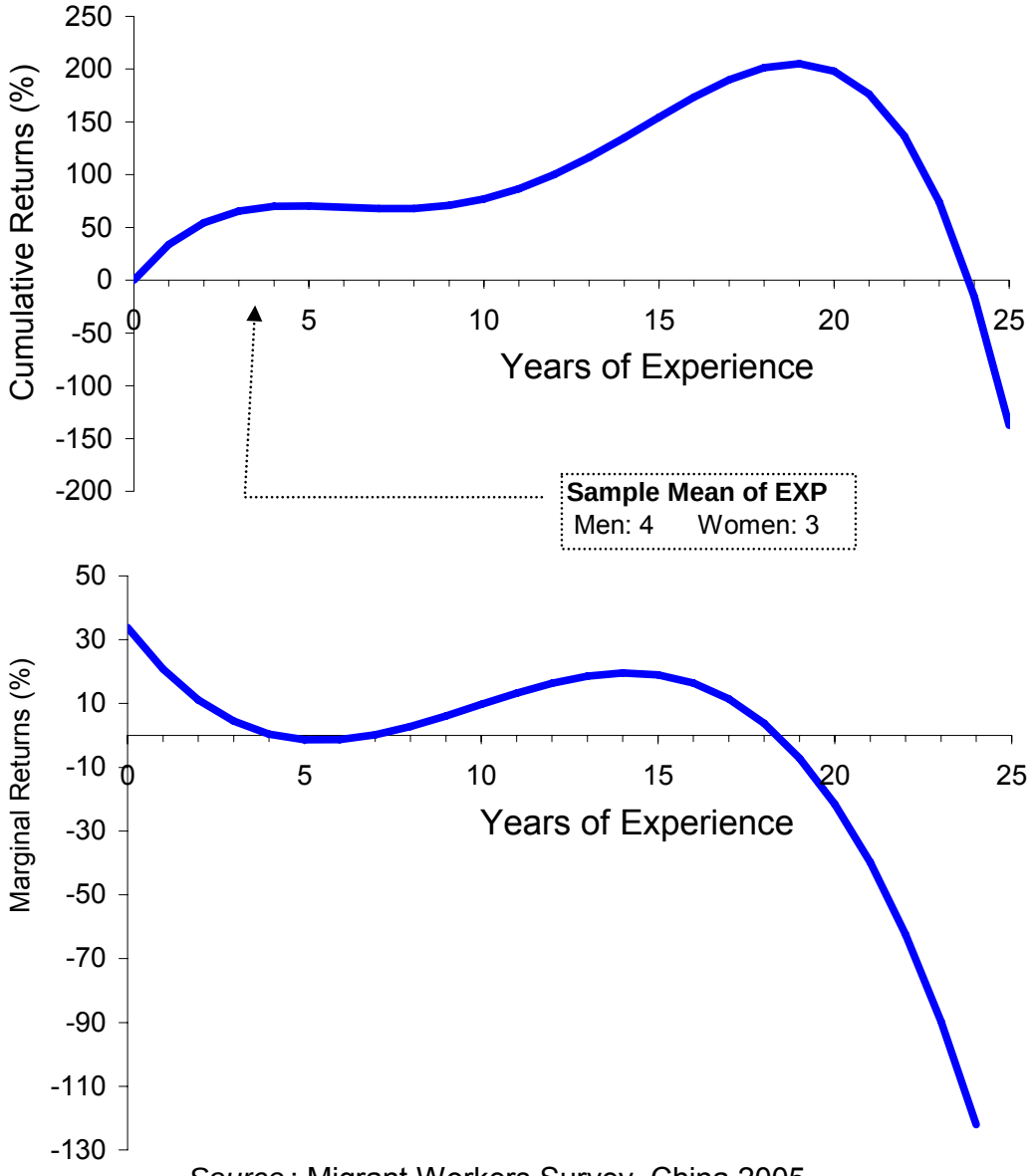
The empirical evidence in this paper can be summarised as follows. First, we find that a year of education boosts wages by almost 10% if that is what is required at the workplace. This suggests that education is more important than previously thought but its impact is mainly at the occupation level. It also shows that there is merit in accounting for a skill-job mismatch at the workplace.

Second, undereducation or overeducation does not seem to have any effect on wages. This result can be attributed to one or more of the following factors: (a) wage compression due to institutional constraints (Fleicher and Wang 2004); (b) poor quality of education in remote China (i.e., deviation from required years of education does not translate into variation in skills within occupations); (c) discrimination against migrant workers; (d) concentration of migrant workers in low-skill sectors where variation in skill or education is not important.

Third, the finding that returns to job training are three times as high as the returns to education suggests that on-the-job training is indispensable since it is job-specific skills that mainly drive gains in productivity and earnings. It also alludes to the failure of formal education in rural China as far as job skills are concerned. This is consistent with a growing empirical literature that emphasises the education-skills gap is very important in explaining why increases in education attainment may not deliver higher living standards, especially in the developing world (Pritchett 2001; Hanushek and Wößmann 2007a, 2007b).

Fourth, there is evidence of selection bias in training participation. This indicates that estimates of returns to training that do not account for selection effects would be biased and migrant worker training cannot be left to the discretion of the employer.

Figure 1. Cumulative and Marginal Returns to Work Experience: Migrant Workers in China, 2005



Source : Migrant Workers Survey, China 2005

Fifth, the finding that marriage and migrant work experience are associated with substantial returns points to considerable gains in earnings and productivity if China were to encourage migrant workers and their families to stay in big cities longer. To illustrate the impact of migrant-worker experience, Figure 1 depicts the cumulative and marginal effects of work

experience on earnings (in percentages) as reflected in the coefficient estimates of model (2) in Table 3. Clearly, returns to experience increase sharply after ten years of migrant worker experience and reach a peak around 15 years of experience. These periods contrast sharply with the sample averages of migrant experience of 4 and 3 years for men and women respectively.

5. Policy Implications: Migrant Workers and Development

The evidence presented above provides several new insights on the labour market experience of migrant workers in China. We identify three key findings that have important policy implications for China and developing nations in general. First, education matters very much but its value depends on the demand for skills at the occupational level. Intuitively, skills ought to be important in the path to economic development. Second, job training for people with low education such as migrant workers raises living standards considerably and is too important to be left to the individual firm. Third, work experience in big cities contributes significantly to income growth for migrant workers and rural households.[24]

The above findings become all too important for policy given that migrant workers are severely disadvantaged in China due to institutional distortions and the rural-urban divide in educational endowments. The former relates to

[24] He and Guo (2004) find that the intention for permanent migration is higher for migrant workers with higher levels of education, the young and those living in urban areas longer.

the Hukou system of residence that distorts the cost structure of further education, medical care and retirement and penalises migrant workers.[25] Lacking a permanent residence also means that migrant workers are largely banned from public sector jobs and professional occupations (Sun *et al.* 2005), and they are credit constrained by the major financial institutions (Cheng and Xu 2005).

Another source of disadvantage stems from uneven economic development and second-rate education in rural China. Migration provides an escape from credit constraints but also raises the opportunity cost of education. This makes migrant workers vulnerable to poverty traps as they are deprived of personal development and further education. This is consistent with evidence in de Brauw and Giles (2006) who find a robust inverse relationship between migration opportunities and enrolments at high school level. Similar results are observed in the Henan Province by Wan (2004).

The Chinese government has been working on a number of initiatives to remove discriminatory policies against migrant workers in China with the ultimate objective of improving their skills and welfare. In a recent document, the State Council (China's Cabinet) has issued a directive to its departments and local governments to lift their discriminatory rules and regulations against migrant workers in China and to treat migrant and urban workers equally (The State Council 2006). As far as the education and training of migrant workers

[25] According to Chen (2004), migrants pay their contribution towards old age pension, but they receive half of their contributions when they leave urban areas, an annual income loss of 200-300 billion RMB for migrant workers.

are concerned, the governments have so far focused on the exemption of school fees and other expenses for rural compulsory education for up to middle school. In 2004, the central Government initiated a nation wide pre-migration training program for workers who intend to migrate, the 'Sunlight Project'. The plan is expected to provide training to up to 2.5 million potential migrant workers each year from 2004-2005 and to further 20 million over the period 2006-2010, so as to encourage rural labourers to move to urban areas. The project has been implemented in the migrant source areas, including major grain producing areas, poor rural areas and old revolutionary areas of China (Sun et al, 2005, pp.161-3).

The evidence in this study sheds new light on the effect of education and training on the incomes of migrant workers in China. It shows that the return to required education for migrant worker has been substantial but the effect of under and over education is insignificant. Moreover, the return on job training is three times as high as the return on education. The relatively low return on required education and higher return of on-the-job training have been caused, inter alia, by the concentration of migrant workers in the unskilled sectors, mismatch between the skills required at the work place and the education received from rural schools, especially those schools in the poor areas, and possibly, a lack of on-the-job training for migrant workers.

An important policy recommendation from this study is that, in addition to the exemption of fees and other expenses for schools in rural areas, the government should also consider strengthening technical education in rural China. Currently, technical schools provide 2-3 years technical training for

middle school graduates (with nine years education). Parents are, however, required to pay high fees and board expenses in order to register their children with such schools, as they are beyond the compulsory education system. The training provided at these technical schools should be of high quality and market oriented. Equipped with the training received from technical schools, more rural labour can move directly into the industries that required more skills and so as to increase their incomes and improve their job security.

Another policy recommendation is that, given the high return of on job training, extra public resources should be dedicated toward on-the-job training to complement the general training provided by local government agencies in the migrant source areas. Understandably, it is difficult to find qualified managers and teachers to provide quality training to potential migrant workers in the poor and remote counties of China, and it is also difficult for the local governments in these poor and remote areas to understand the changing demand for the skills of migrant workers. Thus, the Central Government should provide more incentives and subsidies to employers in the destination areas to match the contribution from the employers for the on job training provided to the migrant workers.

The effectiveness of worker training programs depends on the quality and the relevance of the training provided as well the motivations from the migrant workers to receive the training, and employer incentives to provide training. The new evidence here shows that, on average, a migrant worker reaches the peak of her income around 15-20 years of work experience and the returns to

migrant work experience are considerable. Thus, the evidence suggests that both migrant worker and employer incentives to training ought to increase substantially if migrant workers are allowed to stay in urban areas longer, or even permanently. It follows that the removal of barriers to long-term residency in urban areas for migrant workers and their families would be a sensible policy initiative of high priority. Obviously, an improvement in the education and training system for migrant workers and the removal of the dual labour market will greatly assist China to develop more value-added industries in manufacturing and services so as to sustain China's high rate of growth.

Finally, some of the above recommendations may be useful to other developing countries that rely on domestic migrant workers. Countries such as India can only benefit from China's experience.

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