Education, Employment and Human Capital Investment in China: Reality and Expectation*

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Abstract: *With the national population census data and sample survey data of 1990, 2000, 2005, 2010 and 2015, this paper examines the evolving relationship between education and unemployment, and carries out an empirical analysis on how such correlation affects the expected return on education. Our findings suggest that education can significantly reduce the risk of unemployment, but this effect varied over time during 1990-2015. Education's effect in reducing unemployment significantly increased from 1990 to 2000, but diminished from 2005 to 2015, particularly for the young group. This paper arrives at the ex post return on education estimated with 1995, 2002, 2007 and 2013 data of the Chinese Household Income Project (CHIP) and calculates the expected return on education based on such data. Results indicate that from 1995 to 2007, the expected return on education kept on the rise until it peaked in 2007. For the young group aged 22-29, the expected return on education started to decline after 2002. This result is of great significance to unravelling return on education during China's transition period and households' decisions to invest in education.*

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1. Introduction

According to the human capital theory, investments in education, training, migration and health will yield return that benefits workers in the labor market. As a major form of human capital investment, education will make workers not only more productive, but more receptive to new knowledge and skills and thus more adaptive to new work environments. As such, return on education finds expression in both higher wage levels and reduced unemployment risk. Such effects of education are particularly important for developing countries where jobs are often unstable and found in the informal sector as well-educated professionals are more likely to land stable jobs. In China, education is also a main avenue for rural populations to receive urban citizenship that matters to urban job opportunities (Xing, 2013). While existing studies focus on income effect, this paper investigates education's effect in reducing unemployment based on the demographic census and sample surveys from 1990 to 2015.

Since the 1990s, China's labor market has transformed beyond recognition. The transition from

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the planned economy to a market-based one, in particular, exposed workers to the risks of layoffs and unemployment. The late 1990s saw massive layoffs and a steep rise in the unemployment rate due to SOE ownership restructuring in urban areas (Feng *et al*., 2017). Market-based labor market reform meant that economic volatility and policy-making could influence unemployment. While some social groups are better-positioned to cope with the volatility, others are not. Such heterogeneity means that the problem of unemployment is a structural one, i.e. unemployment risk varies significantly across social groups. Normally, well-educated workers are less vulnerable to losing their jobs. The distribution of workforce education, therefore, affects not only the relative level of unemployment across social groups, but the overall unemployment rate as well.

Since the launch of reform and opening up in 1978, China has seen a dramatic increase in the education level of its population, as manifested in a swelling number of college graduates over the past two decades. Since 1999, China has steadily expanded college enrolment. From 2000 to 2017, China saw a rise in college enrolment from 2.21 million to 27.61 million, and the numbers of college students and graduates grew from 5.56 million to 27.53 million and from 950,000 to 7.36 million, respectively. The extent to which education helps reduce the overall unemployment rate depends on the relative unemployment rates of workers with different educational backgrounds. Relative unemployment rates are also influenced by the distribution of education level. After years of college enrolment expansion, college graduates found it harder to land desirable jobs, which implies that education became less effective in reducing unemployment than before. This will, in turn, discourage human capital investment.

As China strives to reform its labor market, the correlation between education and personal income becomes increasingly evident. Research indicates a rapid rise in return on education in China since the 1990s. After the dawn of the 21st century, return on education in China fell in the range between 9% and 10% despite the enrolment expansion. Traditionally, return on education is measured by the incomes without considering education's effect in reducing unemployment. If education does reduce joblessness, the personal and social benefits of education may be underestimated if measured merely by wage incomes.

This paper estimates education's effect in reducing unemployment based on the national population census data of 1990, 2000 and 2010, together with the 1% population survey data of 2005 and 2015. The results indicate that a higher level of education corresponds to a smaller chance for unemployment, but the relationship between education and unemployment evolves over time. Specifically, education's effect in reducing joblessness intensified from the 1990s to the early 2000s but started to diminish thereafter. In addition, this paper examines the heterogeneity in the relationship between education and unemployment rate, which varies across genders, age brackets, city size and the identity as urban or rural population (*hukou*).

Moreover, this paper employs the China Household Income Project (CHIP) 1995, 2002, 2007 and 2013 data to adjust the estimated return on education and obtain the expected return on education and its evolving trend. With education's diminishing effect in reducing joblessness after the 2000s, the expected return on education also decreased. The main marginal contribution of this paper is the revelation of education's significant and evolving effect in reducing joblessness. For more than a decade, education's diminishing effect in reducing unemployment has been a major contributor to the falling expected return on education.

2. Literature Review

As Mincer (1991) points out, one of the major benefits of education is that more educated workers are less likely to lose their jobs. Many international academics have examined the relationship between education and unemployment. In our earlier studies, Nickell (1979) uncovers a strong correlation between education level and unemployment rate: Higher education level means a smaller chance for

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unemployment. Based on the data of adult male workers in the United States, Ashenfelter and Ham (1979) and Mincer (1991) find that schooling significantly reduced workers' unemployment probability. Based on a study of the US labor market, Riddell and Song (2011) concludes that education makes it more likely for the jobless to be re-employed while higher education makes it less likely for individuals to be unemployed. Moretti (2010) offers evidence that the less educated are more vulnerable to unemployment in an era of technology progress and globalization. Moretti also points out that well-educated workers are more adaptive to new environments and more mobile across regions, making their unemployment rate low with smaller regional variations. Less-educated workers, on the contrary, are more likely to bear the brunt of regional economic shocks. However, there is a paucity of Chinese literature on how education helps reduce unemployment.

In contrast, studies on the income effect of education can be found in abundance. Return on education and its evolving trend have also been extensively discussed by Chinese academics. According to Zhang *et al.* (2005), return on education in urban China increased from 4.0% in 1988 to 10.2% in 2001. Meng *et al.* (2013) finds that return on education grew slowly or stagnated after the 2000s as college graduates swarmed into the labor market after the enrolment expansion.

There is an academic interest in how return on education varies with the relative supply and demand of different types of workers in the labor market. The reason is that return on education will not only influence income gaps, but will sway people's decisions to invest in education. Regretfully, most existing studies shed no light on the relationship between education and unemployment, as well as its evolving trend, and thus cannot offer a comprehensive evaluation of how incentives to education change over time. Liang (2010) points out that unemployment risk will cause human capital investment to dip below the optimal level by dampening the expected return on educational investment. Yet Liang overlooks the effect of education in reducing unemployment risk. By reducing unemployment risk, education will incentivize human capital investment even if wage growth stagnates.

With a focus on unemployment risk, this paper is also related to a growing body of literature on the uncertainties in human capital investment. Zhao and Lai (2006) find that personal educational investment is subject to many uncertainties: While such investment risk is associated with the length of education and the choice of occupation or specialty, unemployment risk tends to diminish with more education. Yang (2008) argues that risk in educational investment sways people's decision to invest in education, especially higher education. This type of studies generally emphasize the risks of human capital investment, i.e. the uncertainties of employment and income at a given level of education, and seldom discuss how human capital investment helps mitigate unemployment risk.

Li *et al*. (2014) and Xing *et al.* (2018) discuss the impact of college enrolment expansion on the unemployment of college graduates without elaborating how unemployment rate and expected return vary across different levels of education. In estimating return on education, international academics rarely take unemployment rate into account. However, Nichell (1979) is an exception. By estimating return on education measured by expected after-tax income and adjusted for unemployment, the study finds that return on education estimated without taking unemployment risk into account has a slightly downward bias. This paper attempts to fill the gap in the Chinese literature by conducting a systematic and in-depth empirical study on the relationship between education and unemployment as a key determinant of the expected return on education and human capital investment decisions.

3. Model Specification

When unemployment presents a major risk, it will sway people's decisions to invest in education. Firstly, we show that the expected return on education consists of wage return and employment return. Then, the model is specified to estimate education's effect in mitigating unemployment.

In estimating return on college education as compared with high school education, we assume

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that individuals or households are risk-neutral and exclude dynamic changes in wage level and unemployment from consideration. When making a decision to invest in college education, a person considers the expected income after college graduation as compared with high school graduation. We assume that after college graduation, the wage level is w_c, and the unemployment probability is u_c; after high school graduation, the wage level is w_h, and the unemployment probability is u_h. Then, the expected return on education after college graduation as compared with high school graduation can be expressed as:

$$\mathrm{Ln}\frac{w_c(1-u_c)}{w_h(1-u_h)} = (\ln w_c - \ln w_h) + (\ln(1-u_c) - \ln(1-u_h))$$

$$\approx (\ln w_c - \ln w_h) + (u_h - u_c) \quad (1)$$

Obviously, the expected return on education can be divided into two parts: ex post return on education ($\ln w_c - \ln w_h$) and the benefit of a smaller risk of unemployment ($u_h - u_c$). The return on college education normally estimated in the literature is actually the ex post return on education rather than not the expected return.

Wage difference between various levels of education can be obtained by estimating the following Mincer wage equation:

$$\ln w_i = \delta_0 + \sum \delta_l \times edu_{li} + \lambda Z_i + \xi_i \quad (2)$$

Where, edu_{li} is the education level of individual i, and l=0, 1, 2, 3, 4, respectively denoting primary school and below, junior middle school, high school or technical secondary school, junior college, and undergraduate education or above. Among them, education level at or below primary school is the control group. Z denotes other control variables, and ξ is error term. Equation (2) estimates wage return on education for the wage-earning group, which is not related to the unemployment risk.

Notably, the sample selection correction for the above equation (such as the Heckman two-stage method) is not an adjustment of wage return for unemployment or labor participation rate. Many studies, especially those targeted at women, believe that observations with wage data may not be random samples but result from selection based on certain unobservable traits (e.g. Heckman, 1974; 1979). Given this, numerous studies have employed self-selection correction methods. A typical method for the treatment of selection bias is to specify a latent variable equation:

$$y^* = \theta_0 + \sum \theta_l \times edu_{li} + \eta X_i + \nu_i \quad (3)$$

When $y^*>0$, wage is observable; otherwise, it is not. When $y^*>0$, the conditional expectation is:

$$\mathrm{E}[\ln w_i | edu_i, Z, y^* > 0] = \delta_0 + \sum \delta_l \times edu_{li} + \lambda Z_i + E[\xi_i | \nu_i > -(\theta_0 + \sum \theta_l \times edu_{li} + \eta X_i)] \quad (4)$$

Equation (4) means that if unobservable traits simultaneously affect sample selection and wage determination (ξ_i and ν_i are correlated), the OLS estimation based on observable samples may be biased. But as can be seen from equation (4), even if the selectivity of wage samples is taken into account, the purpose of the sample selection correction model (such as the Heckman two-stage method) is to obtain a consistent evaluation of δ_l without considering education's employment return. If ξ_i and ν_i are independent from each other, i.e. sample selection bias does not exist, the unemployment or labor participation rate may still vary among workers with different levels of education, which will affect the expected return on education.

This paper employs the following linear probability model (LPM) to examine the relationship between education level and unemployment.

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$$U_i = \beta_0 + \sum \beta_l \times edu_{li} + \gamma X_i + \varepsilon_i \quad (5)$$

Where, U_i is the dummy variable of unemployment (when unemployed, $U_i = 1$; otherwise it is 0). edu_{li} is defined the same as in equation (2). X is other control variables, including gender, age, city of residence, and *hukou*, and ε is error term. Since equation (5) is a linear probability model, the second part $(u_h - u_c)$ in equation (1) can be expressed as:

$$\mathrm{E}(U_i|edu_2 = 1, X) - E(U_i|edu_4 = 1, X) = \hat{\beta}_2 - \hat{\beta}_4 \quad (6)$$

Of course, if unobservable factors also influence decisions to invest in education, both equations (2) and (5) will be biased, and so will the result of equation (1). The treatment of such bias, however, is not the focus of our research, but will be discussed in the empirical analysis in a following section.

4. Data and Descriptive Statistics

This paper examines the relationship between education level and unemployment rate with random samples of the population census of 1990, 2000, and 2010, and the 1% population survey of 2005 and 2015.[1] The 1995, 2002, 2007 and 2013 data of the China Household Income Project (CHIP) are also employed to estimate the return on education in terms of wage income. CHIP data are nationally representative household survey data collected by the Chinese Academy of Social Sciences (CASS), Beijing Normal University, and other organizations. This paper employs the urban household samples of such data.[2]

The random samples of census and mini-census data of 1990, 2000, 2005, 2010 and 2015 were collected by NBS following a similar sampling procedure from 31 (30 for 1990) provinces, autonomous regions and municipalities. Given the theoretical college graduation age at 22 and the women's retirement age at 55, this paper limits the samples to urban populations aged between 22 and 55. To test education's impact on unemployment, this paper excludes the samples of college students, those who have lost the ability to work, retirees and housekeepers, and the sample size available for analysis is 774,138, 134,905, 391,296, 187,562 and 217,196, for each year respectively.

According to the International Labor Organization (ILO), a person is unemployed if he or she is (i) jobless, (ii) looking for a job, and (iii) available for work at the same time for a certain period. Since such information as whether a person is "available for work" in 2000 is lacking, this paper defines samples without jobs and looking for jobs as unemployed persons in 2000, 2005, 2010 and 2015. However, 1990 is an exception, when the unemployment status of samples can only be indicated by jobless status and waiting-for-job registration. Hence, this paper defines those without a job and registered as "waiting for a job" in urban areas as unemployed samples in 1990.

In the population census and the 1% population survey data, key variables involved in this paper include age, gender, *hukou*, education level, unemployment status, and city of residence. As Table 1 shows, the average age of sample populations increased from 34.8 in 1990 to 37.6 in 2015, indicating a significant trend of aging. Female samples who participate in the urban labor market as a share of total samples decreased substantially from 1990 to 2000 and slightly after 2005. This decline may have resulted from women's falling labor participation rate (Wu, 2015) or the dominance of male migrant populations. The percentage of urban households in cities continuously decreased before 2010, which indicates a growing number of migrants who moved from the countryside to cities.

[1] They are the 1% random samples of the population census of 1990, the 1‰ random samples of the national census data of 2000, the 20% random samples of the 1% population survey data of 2005, the 1‰ random samples of the 2010 census and the 9.5% of the 2015 1% population survey.

[2] Data of 1995 and 2002 were jointly collected by CASS and NBS, and data of the following years were collected by Beijing Normal University and NBS.

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Table 1: Descriptive Statistics (urban samples aged 22-55)

Variable	1990	2000	2005	2010	2015
Age	34.77	35.87	36.93	36.78	37.57
Female	0.562	0.435	0.444	0.432	0.423
Urban *hukou*	0.885	0.666	0.626	0.609	0.719
Education level					
Primary school or below	0.158	0.140	0.128	0.076	0.066
Junior middle school	0.409	0.408	0.395	0.384	0.341
High school or secondary technical school	0.326	0.292	0.275	0.260	0.268
Junior college	0.065	0.107	0.122	0.152	0.162
Undergraduate education or above	0.043	0.053	0.081	0.127	0.163
Unemployed	0.014	0.083	0.055	0.056	0.066
Sample size	774,138	134,905	391,296	187,562	217,196

Notes: (i) After excluding those with missing *hukou* information for 2005, there are 391,093 remaining observations. (ii) Since the survey data of 2015 no longer makes any distinction between agricultural *hukou* and urban *hukou*, the type of *hukou* for 2015 is determined by the entitlement to rural land contract rights. 0.719 is the percentage of samples without rural land contract rights.
Source: Calculated based on the demographic census data of 1990, 2000 and 2015, as well as sample population survey data of 2005 and 2010.

The composition of workforce with varying levels of education changed over time. While those with primary school or below, junior middle school, and high school education accounted for a falling share, an increasing percentage of the workforce boast a college degree or diploma. In contrast to the percentage of populations with primary school education or below, which declined the most, college graduates with a bachelor's degree or above increased the fastest as a share of the workforce. By 2015, about one third of urban workforce held a college diploma or above, which beat the percentage of those with high school education and was more or less the same with the percentage of workers with junior middle school education. The proportion of jobless people was the lowest in 1990, when the government was still responsible for job assignments in the era of the planned economy. The spike in China's unemployment rate in 2000 can be attributed to China's market-oriented economic transition, two-way choice between employers and jobseekers, along with SOE reform that laid off workers. Unemployment rate started to fall in 2005 and remained more or less stable thereafter. In 2015, China's unemployment rate rose above the levels of 2010 and 2005.

5. Empirical Analysis: Education's Impact on Unemployment

5.1 Results of Full Sample Estimation

This paper examines education's impact on unemployment at the five time points of 1990, 2000, 2005, 2010 and 2015, respectively. Table 2 shows the estimation results of how different levels of

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education affect unemployment based on the overall samples. The results indicate that education has always played a significant role in reducing unemployment, and the effect increased at first before diminishing. In the first stage from 1990 to 2000, education contributed to the reduction of unemployment at an accelerating rate. In 1990, the planned economy was still dominant in China's urban areas, and the overall of urban unemployment rate was low. The rising level of education was accompanied by a continuous decline in the unemployment rate, which varied little among people with different levels of education. By 2000, however, the unemployment gap between people with different levels of education widened significantly. In particular, unemployment rate for junior college and university graduates were 6.9 and 9.3 percentage points lower than that for high school graduates, respectively. The reason is that the high educated workforce was less vulnerable to the layoffs and unemployment arising from SOE ownership reform as part of broader economic reforms in urban China since the mid-1990s, the repercussions from the Asian financial crisis, among other factors. Urban areas started to jettison government assignment of jobs, giving play to market-based allocation of labor resources. Naturally, college graduates stood out among jobseekers. Education's effect in reducing joblessness became striking.

In the second stage from 2000 to 2015, however, education's job effect became less potent. Compared with 2000, education's effect in reducing unemployment risk diminished in 2005. In 2005, unemployment rates for junior college and university graduates were 4.1 and 6.1 percentage points lower than that for high school graduates. By 2015, these figures dropped to 1.5 and 3.5 percentage points, respectively. College education was much less effective in mitigating unemployment. Further analysis reveals a decline in the unemployment rate for high school graduates and a rise in the unemployment rate for college graduates after 2000. College enrolment expansion is a key factor behind the rising unemployment rate of college graduates. College admissions swelled after the policy to expand college enrolment was enacted in 1999. As college graduates swarmed into the job market, jobs became less

Table 2: Education's Impact on Unemployment

	(1)	(2)	(3)	(4)	(5)
	1990	**2000**	**2005**	**2010**	**2015**
Junior middle school	-0.005***	0.003	0.005***	-0.002	-0.008***
	(0.000)	(0.002)	(0.001)	(0.002)	(0.002)
High school or secondary technical school	-0.014***	-0.036***	-0.003**	-0.006**	-0.009***
	(0.000)	(0.003)	(0.001)	(0.002)	(0.002)
Junior college	-0.021***	-0.105***	-0.044***	-0.032***	-0.024***
	(0.001)	(0.003)	(0.002)	(0.003)	(0.003)
Undergraduate and above	-0.025***	-0.129***	-0.064***	-0.051***	-0.044***
	(0.001)	(0.006)	(0.002)	(0.003)	(0.003)
Observations	774,138	134,481	391,093	187,517	217,196

Notes: (i) Populations with primary school education or below are the control group, and other control variables include gender, age, *hukou,* and city of residence. (2) Numbers in parentheses are standard errors. *** p<0.01, ** p<0.05, and * p<0.1.
Source: Calculated based on the demographic census data of 1990, 2000 and 2015 and the population sample survey data of 2005 and 2010.

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plentiful and unemployment rate started to rise.

It should be noted that although higher education became less effective in reducing unemployment compared with high school education, there was not much change in the difference between unemployment rates for university and junior college graduates. Since 2000, the unemployment rate for university graduates- has been lower than that for junior college graduates by around two percentage points.

5.2 Heterogeneity Analysis

The extent to which education affects unemployment varies with age, gender, place of residence, and *hukou*. This paper illustrates the differences in the unemployment rates between high school graduates and junior college/university graduates across various periods. Employment rate differences between junior middle school and high school graduates are much smaller and will not be discussed in this paper.

5.2.1 Education's impact on unemployment for graduates at different ages

To examine education's impact on unemployment for graduates of different age brackets, we divide samples aged 22-55[3] into the young group (22-29), the middle-aged group (30-39) and the elderly group (40-55). Chart A and B of Figure 1 report the decreases in unemployment rates for junior

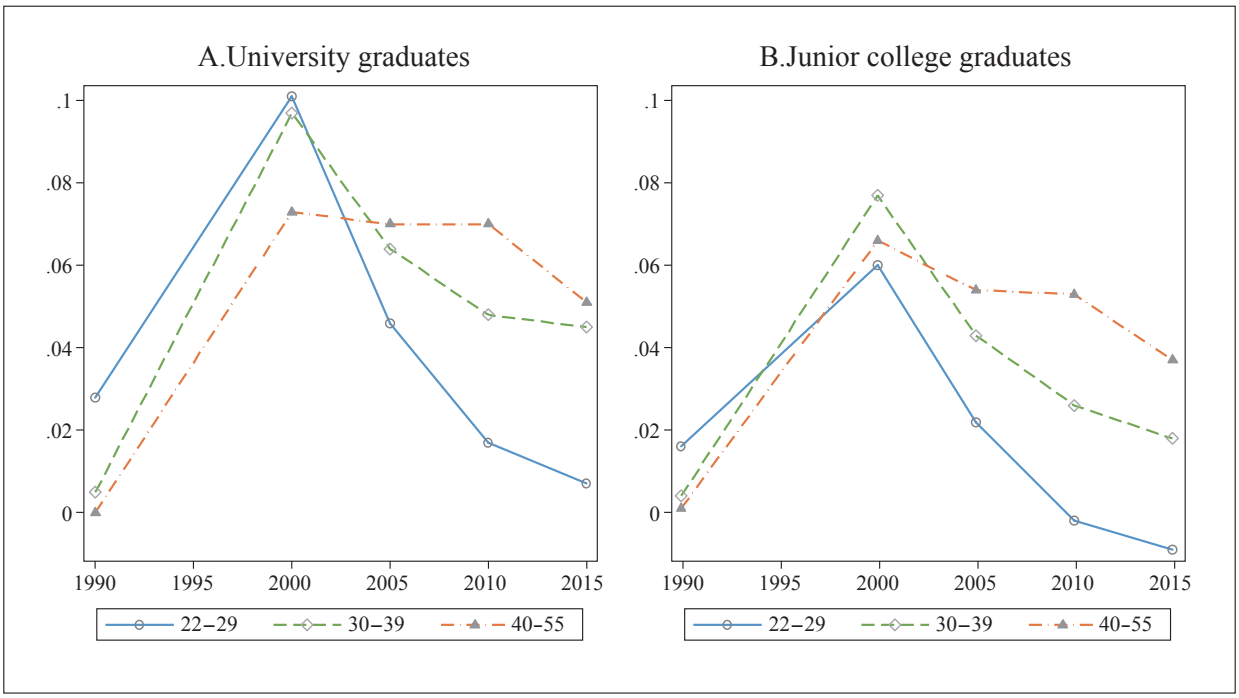

Figure 1: Education's Impact on Unemployment for Graduates at Different Ages

Notes: (i) Vertical axis denotes the difference in unemployment probabilities with high school graduates as control group. With the dummy variable of unemployment, we estimate a linear probability model and subtract the coefficients for junior college and university education from the coefficient for high school education, respectively. (ii) Control variables in the regression include gender, *hukou,* and city of residence.

Source: Calculated based on the demographic census data of 1990, 2000 and 2015 and the population sample survey data of 2005 and 2010.

[3] This age bracket is defined considering that the theoretical age for college graduates to enter the job market is 22 years and that the retirement age for women is 55 years.

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college and university graduates compared with high school graduates. Overall, the role of higher education in reducing joblessness increased at first before diminishing in a later stage. Yet the trend of education's impact on unemployment varies across age brackets. In 1990 and 2000, college education (Chart A) helped reduce unemployment more significantly for the young group than for the elderly group. In 2005, however, unemployment rate difference between college graduates and high school graduates became smaller for the young group than for the elderly group. Afterwards, unemployment rate difference between college graduates and high school graduates for the young group aged 22-29 continued to decline and became negligible by 2015. For the elderly group (aged 40-55), unemployment rate difference between college graduates and high school graduates remained significant. Similarly, unemployment rate difference between junior college graduates and high school graduates also varies a great deal across age brackets, and such heterogeneity kept on the rise after 2000.

According to the above results, the young group may explain the relative decline of higher education's impact on unemployment for the total samples. Difference in the relative unemployment rates across age brackets also indicates poor substitutability between working populations of different age brackets. This stems from either the human capital difference of working age populations with the same level of education but in different age brackets or insufficient competition in the job market. The young group's performance may have to do with the swelling number of college graduates after the enrolment expansion, which led to a rise in the unemployment rate of young college graduates who jostled for jobs.

5.2.2 Education's gender-specific impact on unemployment

China's market-oriented economic transition was accompanied by widening gaps of wage, labor

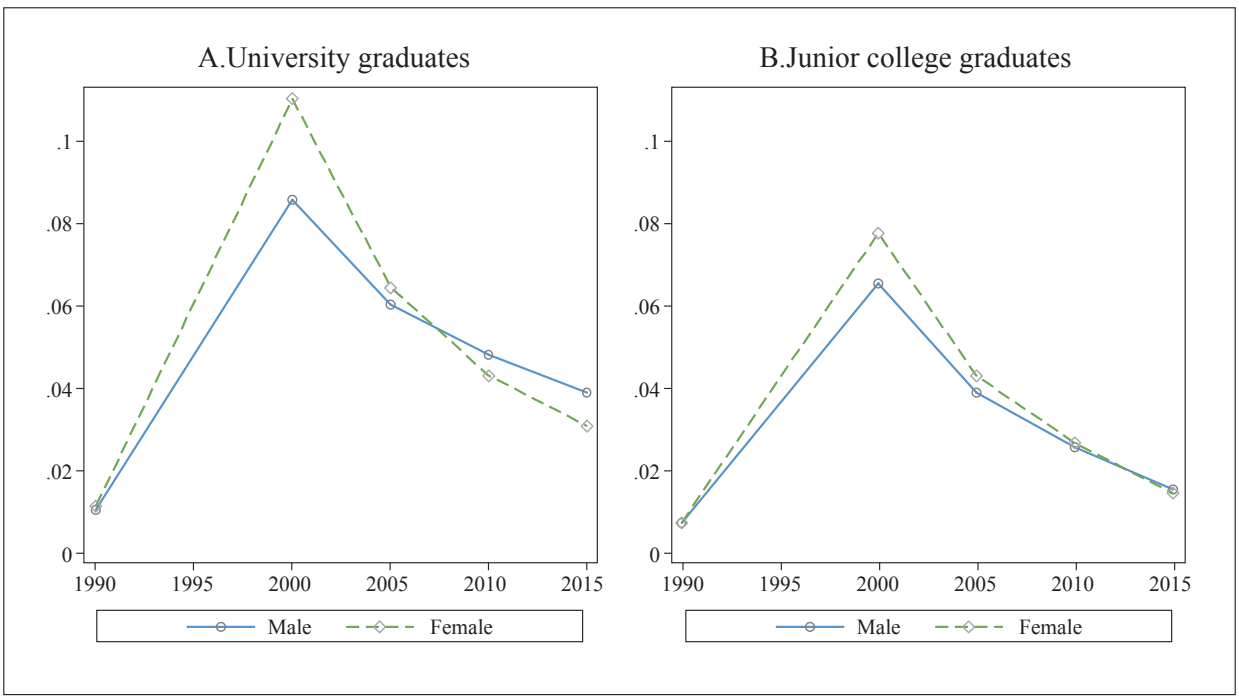

Figure 2: Education's Gender-Specific Impact on Unemployment (high school graduates as control group)

Notes: (i) Vertical axis denotes the difference between unemployment probabilities. With the dummy variable for unemployment, we estimate a linear probability model and subtract the coefficients for junior college and university education from the coefficient for high school education. (ii) Control variables in the regression includes age, *hukou* and city of residence.

Source: Calculated based on the demographic census data of 1990, 2000 and 2015 and the population sample survey data of 2005 and 2010.

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participation, employment and other aspects between men and women in the urban job market. Thus, we divide samples into two groups by gender to examine education's impact on unemployment for male and female working populations. Figure 2 reports how college and university education helps reduce unemployment relative to high school education by gender.

For given gender, education's impact on unemployment shows a generally consistent trend with the result of overall samples, and varies significantly between men and women. In comparison between college and high school graduates, education's impact on unemployment is more significant for women than for men from 1990 to 2005, and such difference peaked in 2000. After 2005, however, education's impact on unemployment was slightly more significant for men and for women. In comparison between junior college and high school graduates (Chart B), unemployment rate difference between female junior college and high school graduates was higher than that between their male counterparts, and such as gender difference peaked in 2000. The gender difference in the education's impact on unemployment is the most significant for the young group (result for the young group is not shown in this paper).

5.2.3 Education's hukou-specific impact on unemployment

Considering that education's impact on unemployment is heterogeneous for people with urban and rural *hukou*, we examine the role of education in reducing unemployment risk for people with agricultural and urban *hukou*, with results shown in Figure 3.

Results in Figure 3 indicate a great difference in education's impact on unemployment for people with different *hukou*. For urban households, the unemployment rate difference between college graduates and high school graduates coincides with the overall trend of full-sample analysis. For samples with

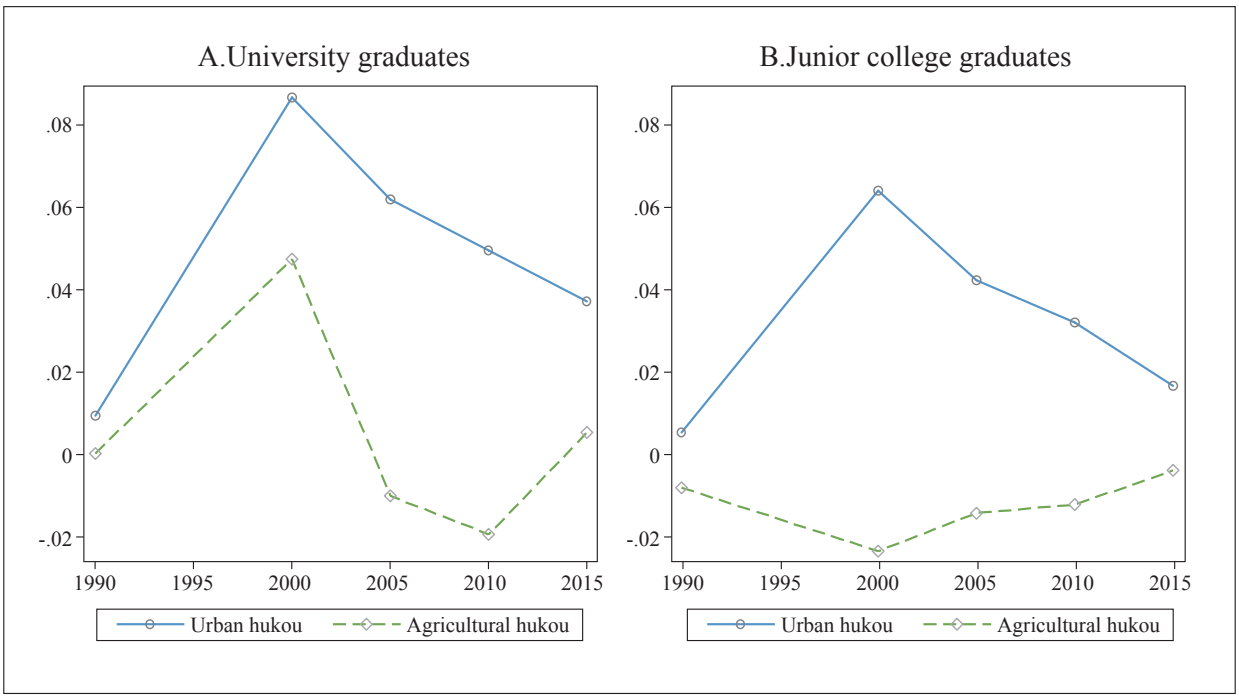

Figure 3: Education's *Hukou*-Specific Impact on Education (with high school graduates as control group)

Note: (i) Vertical axis denotes the difference between unemployment probabilities. With the dummy variable of unemployment, we estimate a linear probability model and subtract the coefficients for junior college and university education from the coefficient for high school education, respectively. (ii) Control variables in the regression include gender, age and city of residence.

Source: Calculated based on the demographic census data of 1990, 2000 and 2015 and the population sample survey data of 2005 and 2010.

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agricultural *hukou* but living in cities, the correlation between education and unemployment is much weaker and not significantly negative. In comparison between junior college and high school education, the unemployment rate for samples with a junior college diploma and agricultural *hukou* at the same time is higher than that for high school graduates.

The reason is that less educated workers with agricultural *hukou* usually took low-end jobs. Before migrating to cities, they would access job information from formal or informal sources. Once unemployed, they tend to return to the countryside, adding up to the unemployment in rural areas. This explains the low unemployment rate for less educated rural migrants as part of urban samples. More educated individuals, on the contrary, tend to look for jobs in cities and seldom return to the countryside even if unemployed. Their job expectations are higher than their less educated peers as well. Yet without an urban *hukou*, they may face discrimination in landing jobs in cities.

5.2.4 Education's city-specific impact on unemployment

Existing studies suggest that the wage return on education varies with the size of cities (Xing, 2016). Similarly, the relationship between education and unemployment may differ across cities of different size. Hence, this paper divides cities into large cities with populations above 5 million, medium-sized cities with populations from 1 million to 5 million, and small cities with populations below 1 million to investigate the relationship between education and unemployment in cities of different size. We still focus on reporting the decrease of unemployment rate and its trend, with results shown in Figure 4.

As shown in Figure 4, education's impact on unemployment increases at first before diminishing in a later stage. The impact also varies across cities of different size. In large cities, education tends to

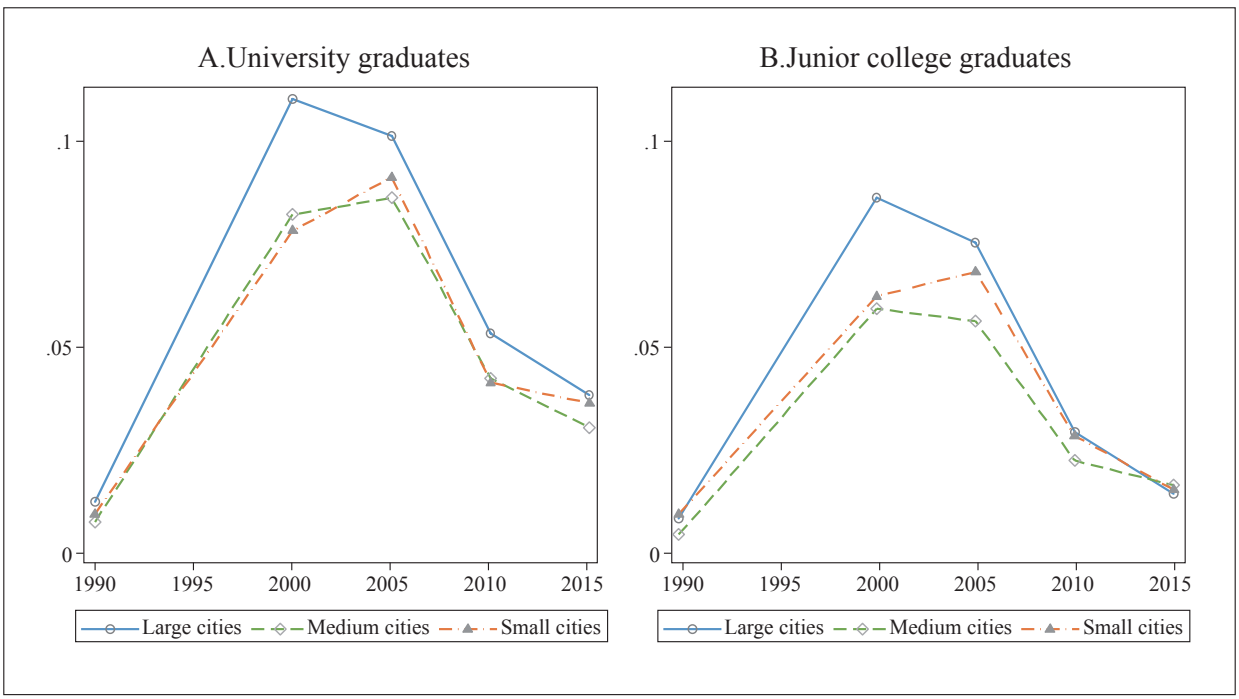

Figure 4: Education's City-Specific Impact on Unemployment (high school graduates as control group)

Note: (i) Vertical axis denotes the difference between unemployment probabilities. With the dummy variable of unemployment, we estimate a linear probability model and subtract the coefficients for junior college and university education from the coefficient for high school education, respectively. (ii) Control variables in the regression include gender, age and city of residence.

Source: Calculated based on the demographic census data of 1990, 2000 and 2015 and the population sample survey data of 2005 and 2010.

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bring down unemployment more substantially, particularly in 2001 when the overall unemployment rate was high. Second, the negative correlation between education and unemployment probability does not increase linearly as the size of cities increases. In small and medium-sized cities, education's effect in reducing unemployment does not increase as the size of cities increases. Furthermore, the relationship between education level and unemployment rate in large cities varies the most with time.

5.3 Causes for Education's Changing Impact on Unemployment

The above result suggests that the relationship between education level and unemployment rate has undergone a drastic change from 1990 to 2015. In the first stage (1990-2000), the unemployment rate difference between workers of different educational levels increased substantially. Of course, China's socio-economic transition and rising overall unemployment rate may partially explain its widening gap. This stage witnessed a moderately rising level in China's workforce education. Afterwards, the unemployment rate difference between workers of different educational levels continuously narrowed. From 2000 to 2015, China's rapid socio-economic development was accompanied by a substantial improvement in education thanks to the college enrolment expansion. For the young group, the unemployment rate difference between workers of different educational levels significantly narrowed (see Figure 1), which is indicative of the vital role of college enrolment expansion.

College enrolment expansion may influence the unemployment rate difference between university/junior college graduates and high school graduates in the following two ways. First, the enrolment expansion alters the ability distribution between college and high school graduates by lowering the threshold of admission. If the less competent are more likely to stay jobless, the enrolment expansion will increase the unemployment rate for college graduates by lowering the threshold of admission. Second, it alters the relative supply of university/junior college graduates and high school graduates, exposing them to different job market environments. Job market toughened for college graduates after the enrolment expansion. In comparison, high school graduates found it less difficult to land jobs probably because their number was smaller as well.

Yet empirical evidence does not support the first explanation. First, in examining the impact of college enrolment expansion on the unemployment of college graduates, Li *et al.* (2014) and Xing *et al.* (2018) assume that each age group conforms to the same ability distribution and use the percentage of college graduates in total populations with an education above junior middle school as proxy variable for the average ability of college graduates in the age bracket. These two studies find that after controlling for the proxy variable for ability, there is still a significant rise in the unemployment of young college graduates affected by the enrolment expansion. Second, Xing *et al*. (2018) also investigate the mid-term impact of college enrolment expansion on the unemployment rate of college graduates. They discover that although the unemployment rate was higher for the young group who entered the job market in 2005 after the enrolment expansion, the unemployment rate for college graduates of the same age fell sharply in 2010. The implication is that low-skilled workers may not always be more likely to be unemployed compared with their better educated peers. Lastly, despite our observation of a significant rise in the unemployment rate of young college graduates, we did not find any significant increase in the unemployment rate for high school graduates of the same age bracket.[4]

A more likely reason behind the rising unemployment rate of young college graduates after the enrolment expansion is the mismatch between their skills and available jobs on offer. A sharp increase in supply usually leads to a mismatch between jobs and skills in the short run (Pissarides, 2000). While expanding enrolment, institutes of higher learning failed to equip their students with the knowledge and skills in demand. Furthermore, the job market was too sclerotic to absorb an inrush of new graduates.

[4] See Figure 2 of Li *et al*. (2014).

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To some extent, differences between age groups and cities demonstrated in this paper's heterogeneity analysis indicates the existence of labor market segmentation.

6. Expected Return on Education

Assuming that the unemployment rate difference between college and high school graduates stems from the mismatch between skills and jobs rather than the gaps of personal abilities, we may arrive at the expected return on education based on the results of Part 5 and the estimated ex post (or wage) return on education.[5] Since the population census (or population survey) data of 2005, 1990, 2000 and 2015 contain no income information, this paper estimates the ex post return on education based on CHIP1995, 2002, 2007 and 2013 data. Here, this paper identifies employed urban residents aged between 22 and 55 as samples excluding private business owners and the self-employed for regression with the natural logarithm of sample annual income as dependent variable, with results shown in Table 3.

As shown in Table 3, the wage return on education in China varied with time. Before 2007, return on college education relative to high school education kept on the rise. From 1995 to 2002, in particular, return on education rose significantly before peaking in 2007. To compare the actual return on education and the employment return of education, we assume that there is a linear change in education's impact on unemployment over time for the two periods, and thus calculate the employment return of education in the corresponding years of CHIP data.

Specifically, the unemployment rate of high school graduates relative to college graduates in 1995 is replaced with the average between 1990 and 2000. By the same token, the employment return for 2002, 2007 and 2013 is replaced with the average values between 2000 and 2005, 2005 and 2010, together with 2010 and 2015. Table 4 reports the return on education and education's impact on unemployment,

Table 3: Estimated Return on Education

	(1)	(2)	(3)	(4)
	1995	2002	2007	2013
Primary school	-0.346***	-0.462***	-0.300***	-0.266***
	(0.022)	(0.044)	(0.053)	(0.041)
Junior middle school	-0.157***	-0.270***	-0.198***	-0.174***
	(0.011)	(0.017)	(0.022)	(0.021)
Junior college	0.098***	0.287***	0.305***	0.200***
	(0.013)	(0.016)	(0.020)	(0.021)
Undergraduate and above	0.156***	0.482***	0.563***	0.424***
	(0.018)	(0.022)	(0.021)	(0.021)
Observations	10,758	9,009	5,815	7,616

Notes: (i) In all the four years, return on education is estimated with annual wage income, and income for 2007 is calculated by multiplying monthly income by 12. (ii) The omitted group is high school or secondary technical school graduates. (iii) Control variables include gender, age, *hukou* and place of residence. (iv) Numbers in parentheses are standard errors. *** p<0.01, ** p<0.05 and * p<0.1.
Source: Calculated based on 1995, 2002, 2007 and 2013 data from CHIP data.

[5] See equation (1) for calculation method.

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Table 4: Adjusted Return on College Education Compared with High School Education

	1995		2002		2007		2013	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Overall	Young	Overall	Young	Overall	Young	Overall	Young
(Actual) return on education	0.156	0.110	0.482	0.421	0.563	0.405	0.424	0.199
Impact on unemployment	0.052	0.065	0.077	0.074	0.053	0.032	0.040	0.012
Expected return on education	0.208	0.175	0.559	0.495	0.616	0.437	0.464	0.211
Share of impact on unemployment (%)	25.00%	37.14%	13.77%	14.95%	8.60%	7.32%	8.62%	5.69%

Notes: (i) In all the four years, the return on education is estimated with annual wage income, and income for 2007 is calculated by multiplying monthly income by 12. (ii) The omitted group is high school or secondary technical school graduates. (iii) Control variables include gender, age, hukou and place of residence. (iv) Numbers in parentheses are standard errors. *** p<0.01, ** p<0.05 and * p<0.1.
Source: Calculated based on 1995, 2002, 2007 and 2013 data from CHIP data.

whose sum is the expected return on education. Results suggest that the expected return on education shares a similar trend with the wage return on education: It increased before 2007 and started to decline thereafter. A main reason is that the wage return on education played a dominant role in the expected return on education. Education's effect in reducing joblessness accounted for a falling share of the expected return on education, down from 25% in 1995 to around 8.6% in 2013. Education's diminishing effect in reducing unemployment contributed to the falling expected return on education.

Considering the inter-group differences, we have also calculated the results for the young group. For the young group, the ex post return on education increased during 1995-2002 and started to fall in 2007 before plummeting in 2013, and so did the expected return on education. But it should be noted that the low expected return on education for the young group does not suggest a plunge in the return on educational investment. As college graduates come of age, their income will grow fairly rapidly and their chance of getting unemployed will shrink.

7. Conclusions

Existing studies have paid little attention to education's effect in reducing unemployment risk, which is a major motivation behind educational investment. Based on the population census and the 1% population survey data from 1990 to 2015, this paper investigates the correlation between educational level and unemployment risk and its evolving trend. Our findings suggest that education's effect in reducing unemployment risk steadily increased from 1990 to 2000 before diminishing since 2005, and that the downward trend persisted during 2010-2015. In the heterogeneity analysis, we find that the relationship between education and unemployment varied with age, gender, city size and *hukou*. For the young group, in particular, education's impact on unemployment varied the most due to the college enrolment expansion.

From the perspective of human capital investment, people make decisions to invest in education based on the expected, rather than the ex post, return on education. Without unemployment taken into account, the return on education by the traditional standard tends to be understated, as education not only

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boosts personal income but makes unemployment less likely. With high school or secondary technical school as benchmark, this paper estimates the ex post return on college education by estimating the wage equation, and then arrives at the expected return on college education based on the relationship between education level and unemployment rate. Results indicate that from 1995 to 2007, the overall expected return on education steadily increased before peaking in 2007 and fell thereafter. For the age group of 22-29, the expected return on college education started to decline earlier than other sample groups. These results are of great significance in unraveling the return on education during China's transition period and Chinese households' decisions to invest in education.

Of course, this paper has limitations. First, the inconsistency between CHIP data and the census data in terms of time and survey groups may cause the approximated expected return on education to deviate from the real value. Second, this paper focuses on the correlation between education level and unemployment rate without addressing the endogeneity problem stemming from missing variables such as personal abilities. Yet existing studies suggest that this problem may not be a serious one. Lastly, we did not further discuss how expected return on education will influence people's decisions to invest in higher education. These questions are left for future research.

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