北京师范大学经济与工商管理学院

工作论文（working paper）系列

经济类 No.52

李实、John Whalley、邢春冰：
China's Higher Education Expansion and
Unemployment of College Graduates

2013 年 9 月

China's Higher Education Expansion and Unemployment of College Graduates[*]

Shi Li
Beijing Normal University
lishi@bnu.edu.cn

John Whalley
University of Western Ontario
Center for International Governance Innovation (CIGI)
NBER
jwhalley@uwo.ca

Chunbing Xing
Beijing Normal University
xingchunbing@gmail.com

July 2013

China's Higher Education Expansion and Unemployment of College Graduates

Abstract: We document the sharp expansion of higher education in China beginning in 1999 and analyze its impacts on the unemployment of college graduates, using nationally representative population surveys from 2000 and 2005. We show that the expansion policy has increased the probability of college attendance among high school graduates. Using a difference-in-difference strategy, we find that China's expansion policy has sharply increased the unemployment rate among young college graduates, and that the unemployment rate for college graduates increases more in non-coastal (especially central) regions than in large coastal cities. We suggest that encouraging regional mobility of college graduates and increasing matching quality can potentially reduce the unemployment rate at the national level.

1. Introduction

Since the beginning of economic reform and market opening, China's scale of higher education in terms of numbers of students admitted and college graduates produced has increased continually. However, the increase in the 1980s and through most of 1990s was modest, especially compared to increases from 1999 onwards. In 1999, the Chinese government made a strategic decision to expand higher education. As a result, the number of new students admitted to college increased by more than 40 percent between 1998 and 1999 and expansion continued in subsequent years. From 1998 to 2005, the number of new college students had more than quadrupled (4.7). We consider two questions in this paper: How has this radical change affected the educational opportunities for individuals? How has this expansion policy affected the unemployment rate of college graduates?

These questions seem to have simple answers but are often, nonetheless, raised in public debate. In particular, many blame the expansion policy for the high unemployment rate of college graduates, while others argue that unemployment rates for graduates would still be high. Others argue that unemployment is not caused by the expansion policy but reflects low ability or a high reservation wage among college graduates. Unfortunately, there is little empirical research addressing these issues.

In this paper, we show that the expansion policy has increased the probability of going to college among high school graduates, but that the same expansion has also sharply increased the unemployment rate for college graduates. Our strategy is to

compare the unemployment rate of younger college graduates affected by the expansion policy to that of those not affected by the policy using a population survey for 2005. To control for age differences in unemployment rates, we use data from the 2000 census to calculate the age differential at which no college graduates were affected by the expansion policy.

To provide a more detailed picture, we perform the same exercises to investigate how the expansion effect differs across regions and between males and females. We find that the unemployment rate for young college graduates increases more in non-coastal (especially central) regions than in large coastal cities. This is true for both males and females, with males experiencing a larger increase in unemployment across the country. Females experienced smaller increase in unemployment, because a large number of them were not actively seeking jobs, working informally at home. These results suggest that allowing (or encouraging) free mobility by eliminating institutional impediments such as the Hukou system (an institution with the power to restrict population mobility) could reduce the unemployment rate at the national level.

Although the exercises in this paper are simple and rely on strong assumptions, they are, to our knowledge, the first in the literature to use econometric methods to establish relationships between China's higher education expansion and rising youth unemployment. The paper is related to the work of Li et al. (2011), Freeman (2009), and Meng et al. (2010). Li et al. (2011) document the significant transformation of higher education that has been underway in China since 1999, not only in scale but also in many other aspects, including institutional arrangements and incentive

structures. They also discuss the expansion's potential global impacts. Freeman (2009) discusses the potential impact of China's expansion policy on the U.S. Although both Li at al. (2011) and Freeman (2009) mention employment pressures for college graduates following the expansion, neither presents empirical evidence on this. Meng et al. (2010) studies the wage structure and earnings inequality between 1988 and 2007. They notice that both observed and unobserved skill prices slowed down at the turn of the century and attribute this to the college expansion program. They do not, however, consider unemployment.

This paper is organized as follows. Section 2 briefly describes the higher education transformation in the late 1990s. Section 3 discusses how expansion policy affects educational opportunities. Section 4 investigates how the expansion policy has affected the employment of college graduates. Section 5 briefly discusses why expansion caused unemployment among college graduates and the implications of this study's results.

2. Background and data

2.1 The Transformation in Higher Education in China

With economic reform and market opening, China's education system also underwent both major expansion and transformation. Closely related to our research are the following three aspects of this transformation: scale expansion, abolishment of large subsidies (increase in tuitions), and changes in the mechanism for matching college graduates with employers.

From 1978 to 1998, the scale of higher education increased continually: the number of colleges increased from 598 to 1,022, the number of new college students enrolled increased from 0.4 million to 1.08 million, and the number of college students increased from 0.86 million to 3.41 million. Although the scale of higher education increased continuously, the growth rate before 1998 was much lower than rates from 1999 onwards.

In early 1999, the central government increased the number of students admitted to tertiary education by 0.22 million. In June, the central government and the Ministry of Education announced that a further 0.33 million new students would be admitted. These decisions made 1999 a historic year in the development of China's higher education. The number of new college students experienced its largest increase since 1978 (48 percent). The expansion was unexpected for many high school graduates and their families. Given that the college entrance exams were held in early July, the announcements made in early 1999, especially the one in June, did not change the behavior of high school graduates considerably. The unexpectedness of the announcement made this policy more like an experiment.[1] In subsequent years, the number of new college students continued to increase. In 2005, the number of new college students was 5.04 million, 4.7 times that of 1998.

[1] The initiation of higher education expansion in the late 1990s is also closely related to economic conditions at that time. In 1997, the 15th National Congress of the Communist Party of China quickened the reform of the economic regime. Many formerly state owned enterprises were privatized. This generated large numbers of laid-off or unemployed workers, some seeking college entrance. Meanwhile, the Asian financial crisis of 1997 also had a negative impact on the Chinese economy, raising unemployment rates. Against this background, higher education expansion was initiated to alleviate the unemployment problem and to stimulate consumption.

Under the earlier central planning regime, higher education had been heavily subsidized. With economic reform and enlargement of the scale of higher education, the Chinese government gradually lowered subsidies for higher education. In "Guidelines for China's Education Reform and Development" published in 1993, the central government made it clear that *higher education is noncompulsory, and students should pay tuition in principle* (State Council, 1993). From 1995 to 2004, tuition fees increased from 800 RMB per person per year to 5,000 RMB per person per year on average (Yang, 2006). Expenditures on education ranked first in total household expenditures in the 10th 5-year plan (CYCRC, 2007). The high tuition levels resulted in severe financial constraints for some families, and some students from poor families gave up college opportunities. This also meant that poor families would benefit less from the expansion policy.

In addition to abolishing heavy subsidies, another major reform in the 1990s cancelled the planning system for allocating college graduates to work positions. The new system is effectively a two-sided market, with graduates finding jobs based on mutual agreements with employers, and with much less intervention from the government. In addition, with the expansion of higher education, college graduates face more severe competition, putting pressure on the labor market.

Another part of higher education is adult continuing education, including universities offering education via radio and television; schools of higher education for professional staff, workers, and peasants; colleges for management cadres; pedagogical colleges; independent correspondence colleges; and evening schools or

correspondence courses provided by institutions of higher education. Similar to formal higher education, adult continuing education also expanded after 1999, but this expansion was mainly seen in evening schools and correspondence courses provided by higher education institutions.[2]

2.2 Data

We use random samples of the census data for 2000 and the 1 percent population survey data for 2005 to investigate links between college expansion and graduate unemployment. Both datasets are collected by the National Bureau of Statistics (NBS) following similar procedures of random sampling[3], and are representative of Mainland China. In particular, a household is sampled based on the place where this household had resided for more than six months, which is not necessarily its place of official registration (Hukou).[4] Information on each household member was then collected. This sampling process guarantees a representative sample for migrants,

[2] The number of new students in adult continuing higher education increased from around 1 million in 1998 to 2.2 million in 2002. The number of new students in adult continuing higher education provided by universities increased from 0.5 million to 1.7 million during the same period (National Bureau of Statistics, various years).

[3] For the 2000 census data, 10 percent of the population was randomly sampled for a long form questionnaire, which collected information that is used in our research.

[4] The Hukou system is an institutional arrangement that was originally designed to control rural to urban migration in the 1950s by registering household members in designated rural or urban locations. To migrate permanently, one needs to change one's registration location; as such, the government strictly controls migration. Hukou policies have been becoming more flexible since the 1980s. It has become easier for workers and households to transfer their registrations to other locations (in particular, to small- and medium-sized cities), and temporary residence permits are being granted more often. Also, it became possible for people to migrate and get a job without a valid permit. See Wu and Treiman (2004), Fan (2008), and Chan and Buckingham (2008) for more detailed discussions.

which is important for our research. Increasing numbers of college graduates find or try to find jobs in cities where they do not have local Hukou status. These college graduates, whether they are employed or not, are equally likely to be sampled as those who have local Hukou, minimizing the potential bias when estimating the effect of the expansion policy on unemployment.

The numbers of individual level observations in these data are 1,180,110 and 2,585,481 for 2000 and 2005 respectively before cleaning, and are randomly distributed in 31 provinces, municipalities or autonomous regions. Because our focus is the effect of the expansion policy on higher education, we only keep those who have graduated from high school and who have attained education beyond the high school level. For the 2000 census, there are five education levels left, namely, high school, vocational school, three-year (or professional) college, four-year college, and graduate school. The 2005 data considered the same levels, except that we cannot distinguish between vocational school and high school. In the following analysis, we use three broader categories: (1) high school or vocational school,[5] (2) three-year college, and (3) four-year college and above. It is worth mentioning that college degrees could be obtained from formal higher education or adult continuing education. It is more likely that a continuing education degree falls into the category of three-year college,[6] but we cannot distinguish different types of higher education

---

[5] We combined high school graduates and vocational school graduates into one category so that both 2000 and 2005 data have three broader categories. Also, according to the timing of education in China, high school graduates and vocational school graduates would have the same number of years of schooling (see footnote 8).

[6] In 2005, two-thirds of the adult continuing college graduates held three-year college degrees. Source:

along that dimension.

Because we do not have information on when people take the college entrance exams, we assume that students enter primary school at age six and go to college at age 18.[7] The *theoretical* year for the 2000 sample to take the college entrance exams is between 1983 and 1996, and in this period no observation was affected by the expansion policy. For the 2005 sample, between 1988 and 2001, some were affected by the policy, and some were not. Many students had not taken the college entrance exams and may have dropped out of school before attaining a high school degree. To know whether they belong to the cohorts affected by the policy, we require a hypothetical college exam year. In both datasets age is restricted to 22 to 35.

Summary statistics for these samples are reported in Table 1. In 2000, about 33 percent of the sample had received education beyond the level of professional college degrees, among whom graduates with four-year college degrees and above accounted for 10 percent of the sample. In 2005, the education levels increased significantly. The number of observations with professional college degrees and above increased to 44

---

http://www.stats.gov.cn/tjsj/ndsj/2006/indexch.htm.

[7] The typical timing of education in China is as follows: enrollment in primary school at age six (for six years) followed by enrollment in junior middle school (for three years). Completing junior middle school became compulsory from the 1980s on (the so-called nine-year compulsory education). After junior middle school, students choose whether to go to high school, which takes three years to complete. They can also go to technical or vocational school (*zhongzhuan*). Upon graduation from high school, graduates participate in college entrance examinations if they seek college education. Usually people with lower scores go to three-year college (*dazhuan* or professional college) and those with higher scores go to four-year college. It is worth mentioning that, even until very recently, the education regime has differed in various regions. In some areas, primary school is only five years, with students enrolling at age seven. This difference should not have an effect on our results.

percent, and those with four-year college degrees and above accounted for 16 percent of the sample. Otherwise, the characteristics of the observations in both years (age, gender, minority status, etc.) did not change significantly.

(Table 1 around here)

3. Higher Education Expansion and Education Opportunity

For each age group, we calculate their theoretical year for college entrance exams. Figure 1 gives the share of different education levels in each age group in 2005. From the 1988 cohort (who were 35 years old in 2005 and whose hypothetical college exam year is 1988) to the 1995 cohort (who were 28 years old in 2005), the number of high school graduates decreased continuously. But from the 1995 cohort (28 years old in 2005) to the 2001 cohort (22 years old in 2005) there is considerable fluctuation in the number of high school graduates. A notable feature is that the number of high school graduates dropped significantly for the 1998 cohort. The reasons for this drop are unclear. We offer the following possible explanations:

First, the total number of students in the 1998 cohort is relatively small. Second, some graduates who were expected to take college exams postponed their exams to the next year in anticipation of the expansion in higher education in 1999, while others who failed in 1998 took the exams again in 1999 and succeeded. This retiming is possible, but is not consistent with the fact that the expansion was largely unexpected. Third, this drop might have been caused by the one-child policy.[8] This

---

[8] We are grateful to an anonymous referee who pointed out this possible reason.

policy took effect in 1980, causing the population to decline, affecting the numbers of those who would be part of the 1998 cohort (i.e., those who were 18 years old in 1998). This explanation has limitations, mainly because it cannot explain the increase in numbers among the younger cohorts (1999 and 2000) with high school degrees. Once we consider the proportion instead of the number, the trend is less volatile. The proportion of high school graduates increased gradually until this trend stopped in 1998 and began to decline thereafter.

(Figure 1 around here)

The change in the number of four-year college graduates and above is remarkable. Before 1998, the change in the number of college graduates was small, with the number of male college graduates decreasing slightly and females increasing slightly. In 1999 and thereafter, both the number of male and female college graduates increased dramatically. The number of new college students increased by nearly 50 percent in 1999, and this sharp increase continued in subsequent years.

The two panels in the middle column of Figure 1 show the numbers and shares of professional college graduates. For the absolute numbers, males and females show different trends. The number of male professional graduates decreased, whereas the number of females increased; proportions increased for both genders. However, the trend stopped even before 1998 (1995 for males and 1997 for females), and there seems to be little relationship between expansion policy and the change in the number of professional graduates.

We next investigate how the expansion affects an individual's educational choice using a multinomial logit model (see Table 2). An individual with at least high school level education has three choices upon graduation: employment, professional college, or four-year college. We use the following models to capture these outcomes:

$$\Pr(I = 0 | policy, \text{X}) = \frac{1}{1 + \sum_{j=1}^{2} \exp(\beta_j + \gamma_j * policy + \delta_j * \text{X})}, \tag{1}$$

$$\Pr(I = s | policy, \text{X}) = \frac{\exp(\beta_j + \gamma_j * policy + \delta_j * \text{X})}{1 + \sum_{j=1}^{2} \exp(\beta_j + \gamma_j * policy + \delta_j * \text{X})} \quad (s=1,2) \tag{2}$$

I=0, 1, 2 represent the above three choices for a high school graduate (0 for employment, 1 for professional, and 2 for four-year college). I=0 is used as the reference group in the estimation. *policy* is a dummy for expansion policy (policy=1 and policy=0 for younger and older groups respectively). X is a vector including time trend and region dummies. We can therefore calculate how the expansion policy affects an individual's choice (holding others constant):

$$RRR \equiv \frac{\Pr(I = s | policy=1, \text{X}) / \Pr(I = 1 | policy=1, \text{X})}{\Pr(I = s | policy=0, \text{X}) / \Pr(I = 1 | policy=0, \text{X})} = \exp(\gamma_s) \tag{3}$$

Suppose s=2. The probability ratio of *going to four-year college* to *employment* increases by $\exp(\gamma_2)$ times after expansion. $\gamma_s > 0$ implies that the relative probability of going to four-year college increases. Results are reported in part A of Table 2. The first two columns are for males. The relative probability of going to four-year college increases with the expansion policy (RRR=EXP(0.2)>1); however, the relative probability of going to professional college does not change significantly. In addition,

there is no significant increasing trend of going to four-year college for males (T for the year of college entrance exams). Columns 4 and 5 present results for females, demonstrating that similar to males, the relative probability increases significantly with expansion, and the relative probability of going to professional college does not change significantly around the time of expansion. Different from males, the increasing trend of going to college is significant for females.

(Table 2 around here)

We use a placebo study to further investigate whether the increase in relative probability is due to the expansion policy. Instead of treating those who took college entrance exams after 1999 as a single category, we separate them into three subgroups (1999, 2000, and 2001). Meanwhile, we also create a dummy for the 1998 cohort. It turns out that coefficients for 1998 are not significant. This means that the significance for dummies in 1999, 2000, and 2001 is due to the expansion policy, not to other factors influencing the time trend.

We next perform an independence test. We consider two scenarios. In the first, a high school graduate chooses between employment and going to four-year college. With the expansion policy, the probability of going to four-year college increases and that of seeking employment with a high school degree decreases. In the second, there is a third choice (professional college). High school graduates can choose professional college in this scenario. Those planning to go to professional college may also choose four-year college. Therefore, the choice between employment and four-year college

education may be dependent on the availability of a third choice.

To test this dependence statistically, we remove professional graduates from the sample; the results are in columns 3 and 6 for males and females respectively. As there are only two choices, the multinomial logit model degenerates to a binary logit model. For males, the coefficients in the choice of four-year college are close to their counterparts in the multinomial logit model. For both parts A and B, we cannot reject the hypothesis that the two sets of coefficients are equal. The result for females is a little different, and our statistical test rejects the hypothesis that the coefficients are equal, even though the difference is small in magnitude for the estimates. In general, the results suggest that the alternative of professional college has no significant effect on the choice between employment and four-year college. This conclusion is important because it simplifies the study by allowing us to concentrate on how the expansion policy affects individuals' choices between two alternatives: employment upon graduation from high school and going to four-year college.

Considering the fact that the expansion policy has the largest and most significant effect on the probability of choosing four-year college, we will focus on its effect on unemployment for four-year college graduates. If not specified, college graduates in the following section refers to four-year college graduates.[9] Another advantage of focusing on this group is to minimize the impact of the expansion of adult continuing education on our estimation results, because those graduates are less

---

[9] We also tried to put the three-year college and four-year college categories into one group to run the same regressions as model (4) in section 4. We got similar results, which are not reported to save space.

likely to hold four-year college degrees.

4. Higher Education Expansion and Unemployment

In this section we investigate how the expansion of higher education has affected the employment of four-year college graduates. We first drop all observations that were either in school, handicapped, or doing housework.[10] Those who did not have a job in the week before the survey are defined as *unemployed*. Using this information to define unemployment has several shortcomings. First, it only considers a short period of time. If younger cohorts change jobs frequently, they will be more likely to be defined as *unemployed* in such a short period of time; this is a reflection of the nature of youth employment, which is not necessarily a problem given that the sample is random. Second, those who did not work might not be actively looking for a job or would be unready to accept a job when offered. If the youth are more likely to be inactive in the labor market after the expansion, our definition will overestimate the unemployment effect of the expansion. These caveats should be kept in mind when the results are interpreted.[11]

The solid line in Figure 2-a shows the unemployment rates for different ages in

[10] We have kept these observations in the analyses of the previous section since we investigate the effect of expansion on educational opportunity rather than its effect on employment.

[11] We perform robustness checks using more information to define unemployment, sacrificing some consistency between 2000 and 2005. In 2005, the unemployed workers are those who (1) did not work in the last week, (2) have been actively seeking employment in the last three month, and (3) were available for work. The last two pieces of information are not available in the 2000 data; therefore, unemployment is defined by the work status in the week before the survey. Otherwise, the model specification and the variables are identical to model (4) in section 4.1. The results are similar and our conclusions do not change. These results are available upon request.

both 2000 and 2005. The younger group, aged 22 to 24 in 2005 (those affected by the expansion), had a much higher unemployment rate than the older group. The unemployment rate of those aged 22 is above 20 percent, while that for people older than 26 is below 5 percent. However, we cannot attribute this entire age differential in unemployment rates to the expansion policy, because younger people tend to have higher unemployment rates even without this labor supply shock. The dashed line in the same figure shows the unemployment rate of various age groups in 2000. We note that none of these observations were affected by the expansion policy. The age differential in unemployment rates reflects only behavioral differences associated with age. Not surprisingly, younger people still had higher unemployment rates than older people. However, the unemployment rates for younger people in 2000 were lower than those of their counterparts in 2005. Equally important is that older people have roughly the same unemployment rate in both years.

(Figure 2 around here)

If the change in economic environment affected employment of different age groups differently, this change could still cause a difference in unemployment rates, even if only for younger people, between 2000 and 2005. If this was the case, we are more likely to observe similar patterns for other education levels. Figure 2-b and Figure 2-c report the unemployment rates of people with professional degrees and with high school degrees. We find that unemployment rates were higher in 2005 than in 2000 for each age group. However, a larger difference for younger people is not detected. Therefore, we are confident in claiming that higher education expansion has

driven up unemployment rates among young college graduates.

4.1 Model Specification

To separate out the effects of the expansion of higher education on the employment of college graduates quantitatively, we use a difference-in-difference strategy. As observed earlier, due to the age difference in unemployment rates, we cannot simply compare the (un)employment rates of those who were affected by the expansion policy and those not affected because they differ in age. We therefore use data from the 2000 census to control for age differences in unemployment rates. We use a difference-in-difference strategy by estimating the following Linear Probability Model (LPM) model:[12]

$$unemployed = \alpha + \beta_1 age_{22-24} + \beta_2 year_{2005} + \beta_3 age_{22-24} * year_{2005} + \gamma X + \varepsilon \qquad (4)$$

where *unemployed* is a dummy variable indicating whether an individual is unemployed (=1) or not (=0). age_{22-24} is a dummy variable indicating whether an individual is between 22 and 24 years of age. For the 2005 observations, those between ages 22 and 24 (age_{22-24}=1) were affected by the expansion policy. The dummy variable $year_{2005}$ equals one if observations are from the 2005 survey and equals zero otherwise. We also construct a variable for the interaction of these two dummy variables as $age_{22-24}*year_{2005}$. When we run a regression of the variable *unemployed* on age_{22-24}, $year_{2005}$, and $age_{22-24}*year_{2005}$, the coefficient of the

---

[12] Using a Linear Probability Model makes the results easier to interpret, particularly when there is an interaction term in the regression. Alternatively we can use a probit or logit model, but the interpretation will be more complicated (Ai and Norton, 2003).

interaction term captures the effect of the expansion of higher education on unemployment, while the age difference and time difference can be captured by the coefficients of $age_{22\text{-}24}$ and $year_{2005}$, respectively.

The presence of the expansion of adult continuing higher education may pose a challenge for this strategy, because older people were also likely to be influenced by the expansion. In this case, our estimates provide a lower bound (in absolute terms) of the unemployment effect of the expansion. In fact, the empirical evidence we present in Figure 2-a suggests that the expansion of adult continuing higher education did not have a significant impact on the unemployment of older age groups, making us more confident in using this difference-in-difference strategy.

X is a vector of control covariates including gender (*male*), ethnicity (*han*), provincial GDP per capita (*gdppc*), GDP growth (*gdpgr*), share of tertiary sector in GDP (*tertiaryshare*), the ratio of trade volume over GDP (*tradegdp*), and provincial dummies. We allow for a non-linear unemployment-age pattern for each province by controlling for age, age squared, and their interactions with provincial dummies. ε is the error term.

Another potential challenge to our empirical strategy is that some changes in the demand side of the labor market may have different impacts on the unemployment of college graduates in different age groups. If this is the case, we will not be able to separate the effect of the expansion policy from the effects of other factors. To alleviate this concern, we construct interaction terms of the above demand-side

variables with the age group dummy (age_{22-24}) and include them as additional controls. In so doing, we allow changes in demand-side factors to affect the unemployment of different age groups differently. Results suggest that adding these interactions does not have a major impact on our conclusions.[13] Therefore, we focus on a more parsimonious model without those interactions.

4.2 Results: Expansion and College Graduate Unemployment

Estimation results are reported in Column 1 of Table 3. The coefficient for the interaction term is 0.088 and the unemployment rate increases by 9 percent in absolute terms due to the expansion. Except for variables *age22-24* and *tradegdp*, none of the control variables reported in the table is significant after controlling for provincial dummies and province-specific age-unemployment patterns. The trade variable is significantly negative, which implies that regions with more economic openness tend to absorb more college graduates. Other variables reflecting economic conditions (demand factors) also have negative coefficients. In other words, advantageous economic conditions can alleviate employment pressures for college graduates. However, there are coefficients that have relatively large standard errors.

We also consider the main income sources of individuals in place of their employment status. For the working age population, we are interested in whether an

---

[13] Getting similar results is not surprising, because we have already controlled for the interactions of age (and age squared) and provincial dummies. This allows all provincial-level factors (observed or unobserved) to affect the unemployment of different age groups differently. The results from regressions controlling for these interaction terms are available upon request.

individual's living expenses were covered by family members rather than from his/her labor income. We construct a dummy variable indicating whether an individual was in such a situation. Using this variable as the dependent variable, we estimate a model similar to model (4).

(Table 3 around here)

The results are reported in column (3) of Table 3. Not surprisingly, the results are similar to results obtained when the unemployment dummy is used as the dependent variable. The coefficient for the interaction term is 0.086, significant at a 1 percent level. It is close to the unemployment case and suggests that most of the unemployed are not registered in the official statistical system and therefore are not entitled to unemployment insurance. Instead, the family is the main source of income when one is unemployed.

For those who were unemployed in 2000 and 2005, there are two possibilities: unemployment due to separation from a former employer and unemployment since graduation. Similarly, we estimate a difference-in-difference model using unemployed observations. The dependent variable is a dummy variable indicating whether an individual had been searching for work upon graduation. The interaction term remains significantly positive (column 5 Table 3).

All of the above regressions use observations based on four-year college graduates, but one might wonder what the results would be if the same regression model were to be run using observations with professional degrees or high school

degrees. Results for these cases are reported in Table 4. For observations with professional degrees, the coefficients for the interaction term are significantly positive but are much smaller in magnitude than those of four-year college graduates. If we consider high school graduates, the coefficient for the interaction term becomes insignificant. Therefore, for the same age groups the unemployment effect of the expansion of higher education is concentrated in the four-year college graduate population.

(Table 4 around here)

4.3 Accounting for Compositional Change

In essence, the college entrance examination system determines who can go to college and who cannot; it is a screening process. Higher education expansion has allowed more high school graduates to go to college by lowering requirements. Therefore, the expansion of higher education has been associated with a compositional change in ability (assuming that grades obtained on college entrance examinations are good proxies for ability). Without an expansion policy, some current college graduates would only have obtained high school degrees and would also have higher unemployment rates. In other words, the higher unemployment rate caused by the expansion policy may be a reflection of this compositional change.

To account for the compositional change, we assume that the ability distribution for each age group is identical. As the college entrance examination system selects students admitted to college from the top examination scores, the more students

admitted to college the lower the average ability of the college graduates. For both 2000 and 2005 data and for each age group, we calculate the share of college graduates in all observations with at least junior middle school degrees. This variable (named *ratio*) is then added to the regression. The results are reported in columns 2, 4, and 6 of Table 3.

In columns 2 and 4, the coefficients for this ratio are significantly positive, which means lower average ability is associated with a higher unemployment rate. The coefficients for the interaction term ($age_{22\text{-}24}*year_{2005}$) also become smaller. In both columns, the coefficients are around 0.06, one-third smaller than when the ability proxy is not controlled. Another implication of the change in magnitude of the coefficients is that even controlling for ability, the educational expansion policy still causes sharp increases in unemployment rates for college graduates.

4.4 Results by Region

Location is also an important factor influencing a college graduate's employment choice. To assess the regional dimension of the expansion's impact on the unemployment rate, we divide the country into three regions: coastal (eastern), central, and western, and assess the effect of expansion policies for each region separately. We display unemployment rates for college graduates by region and by year in Figure 3. In 2000 (see Figure 3-a), the central and eastern regions had roughly the same level of unemployment for the 22 to 35 age range. The unemployment rates for western provinces were much higher than in central and eastern provinces, but this is only true

for younger groups (22 to 24). The pattern changed dramatically in 2005: younger people tended to have much higher unemployment rates (see Figure 3-b). But the changes in youth unemployment rates are not evenly distributed across regions, since the central provinces experienced the sharpest increases in unemployment.

(Figure 3 around here)

The quantitative results are reported in Table 5. Using the same difference-in-difference estimation strategy we find the unemployment rate of the youth after the expansion increased by 7 percent in the eastern region and 17 percent in the central region. Due to an already high unemployment rate in the west, the increase in the unemployment rate associated with the expansion policy is small (3 percent and insignificant). Another factor is that residents in the west were less likely to benefit from the expansion policy in terms of educational opportunity.

(Table 5 around here)

We also separately consider the effects of the expansion of higher education on the unemployment of college graduates in large and small-to-medium sized cities. Large cities include Beijing, Shanghai, Tianjin, and cities in Guangdong province. Other cities are classified as small-to-medium. The results are reported in columns 5 and 6 of Table 5 and panel (c) and (d) of Figure 3. Similar to the results by region, the expansion policy has had a larger positive effect on unemployment in small-to-medium sized cities than in large cities. This partly explains why large numbers of college graduates seek jobs in large cities.

24

4.5 Results by Gender

Finally, we estimate the effects of the expansion policy by gender. As mentioned in Freeman (2009), the increase in education levels for females is a prominent feature of the higher education expansion, as affirmed in the previous section. We investigate whether the expansion has had differential effects on the unemployment rates of males and females. In Figure 4 there appears to be a significant difference between males and females. For males (Figure 4-a) the difference in unemployment rates between 2000 and 2005 is concentrated in the population aged 22 to 24, especially for those aged 22 and 23. The differences for other age groups are small. For females (Figure 4-b) the difference is also concentrated in the younger population groups, but the difference is relatively small in comparison with their male counterparts.

(Figure 4 around here)

In Table 6 we repeat the same exercises as in Table 3, estimating the model by gender. From the magnitude of the coefficients we reaffirm that the expansion had a larger impact on males than on females. With the expansion, the male unemployment rate and the proportion depending on family increased by around 11 percent, while that of females increased by 7 percent. After controlling for ability, the expansion effects for males deceased only slightly (to 9 to 10 percent), while those for females decreased to 3 percent and became insignificant. However, among those unemployed, a higher proportion of young females did not have a job after graduation until the time of the population survey.

(Table 6 around here)

In Table 7 we use an unemployed dummy as a dependent variable and run difference-in-difference regressions by gender and by region. For every region, young male observations are affected to a larger extent by the expansion policy than young females. For both genders, young people in central provinces and in small-medium sized cities experienced the largest increase in unemployment rates.

One reason for this gender difference is that females were more likely to work informally at home, and we drop such observations when estimating the effect of expansion on unemployment. Between 2000 and 2005, the share of the population working informally at home increased sharply from 22 percent to 45 percent for those aged between 22 and 35, and this increase mainly came from the increased number of females working informally at home during this period. This fact should be kept in mind when interpreting the gender difference in the impact of expansion on unemployment.

(Table 7 around here)

4.6 Expansion and Unemployment of High School Graduates

While higher education expansion caused an increase in unemployment among college graduates, the relative decline in the number of high school graduates could reduce their unemployment rates. Although our focus is the unemployment of college graduates, considering the younger population (between 18 and 21 years of age) can provide a more comprehensive picture of the consequences of the expansion.

Figure 5 depicts unemployment rates by age for different education levels. For those aged 22 to 35, the unemployment rates are the same as those in Figure 2 (they look different due to the use of different scales). For all education levels, the unemployment rate for those aged 18 to 21 was higher in 2000 than in 2005, suggesting that the expansion policy could possibly reduce the unemployment of younger age groups. We do not put much weight on the results for college graduates, because the number of college graduates aged between the ages of 18 and 21 is small. However, the results for high school graduates convey important information. When more students go to college, this reduces the unemployment of high school graduates aged between 18 and 21.

(Figure 5 around here)
(Table 8 around here)

Next, we estimate how the expansion policy has affected the unemployment rate of the 18 to 24 age group. The model specifications and variables are the same as in Section 4.3, but the age range is enlarged to investigate how the expansion has affected the younger population. Results are reported in Table 8. For college graduates (columns 1 to 2), including those aged 18 to 21, we increased the numbers of observations slightly (from 27,205 to 27,509), and the effects on unemployment rates are still significantly positive and large. On the contrary, the expansion turned out to have a significantly negative impact on the unemployment of high school graduates (column 4), and from Figure 5 we can tell that this effect is mainly driven by the decreased unemployment rates for those aged 18 to 21. In the last column of Table 8, we combine all education levels to run the same model, and we do not find a

significant effect of the higher education expansion on the unemployment rate of high school graduates and those who are more educated as a whole. This is because (1) the expansion transformed unemployed high school graduates to unemployed college graduates, and (2) more students remained in school longer than they would have without expansion. Both are significant changes brought about by the higher education expansion.

5. Policy Implications of The Analysis

5.1 Why Has Higher Education Expansion Caused Unemployment?

The analysis above provides several potential answers to this question. First is the compositional change in the labor market due to lowered requirements for high school graduates to be admitted to college. In this case, the counterfactual unemployment rate would be high if students did not go to college because of the expansion policy. However, after accounting for composition change, our results show that the expansion policy resulted in a high unemployment rate for youth.

A second possible reason is locational mismatch. The results in section 4.4 suggest that the increase in the unemployment rate associated with the expansion policy is higher in central and western regions (in particular central regions). Although the unemployment rate also increased in coastal provinces, it is relatively lower than in non-coastal provinces. To alleviate unemployment at the national level, young college graduates should thus be encouraged to find jobs in coastal regions. As job vacancies and unemployed workers coexist, we discuss this implication using a

simple two-region example under the matching framework (Pissarides, 2000). Two regions have the same matching function (a matching function describes how the number of vacancies (v) and the number of unemployed workers (u) together create new relationships/jobs (m)): $m_i = \mu u_i^a v_i^b$, where i=1 and 2 refer to region 1 and region 2, μ, a, and b are constant parameters. If we assume (1) the total number of unemployed workers is fixed ($u_1 + u_2 = \bar{U}$), and (2) the number of vacancies is the same in two regions ($v_1 = v_2$), the total number of jobs will be maximized when $u_1 = u_2 = \bar{U}/2$. This is analogous to allocating input factors between two production units to maximize output; permitting unemployed workers move across regions will increase total employment as long as the number of unemployed workers is different in the two regions.

However, there are impediments preventing college graduates from choosing locations freely. One is the Hukou system. Many college graduates find it difficult to obtain official permanent resident status in destination cities, especially large coastal cities such as Beijing and Shanghai. They are thus not entitled to benefits or the welfare system associated with Hukou status. The other is the limited supply of housing due to monopolistic control of land by local governments. In addition, there are unfavorable attitudes (of the urban residents) towards large cities. Policy-makers also tend to encourage college graduates to find jobs in central-western regions or small-medium sized cities, where the college premia are significantly lower than in coastal regions (Whalley and Xing, 2010).

Skills mismatch is another possible reason for higher unemployment rates among

college graduates. As mentioned in Pissarides (2000), greater skills mismatches often occur when there are exogenous shocks or structural changes in labor supply or demand. Even if there was already an increasing demand for college graduates, as evidenced by the increasing college premium, the increasing supply of college graduates was so large and increased in such a short period of time that both the education system and the labor market need time to adjust.

Strong evidence for skills mismatch is the shortage of skilled labor in coastal regions in 2003 and 2004, despite a high unemployment rate among college graduates. According to statistics from the Ministry of Human Resources and Social Security, the ratio of vacancies to applicants for positions requiring skilled labor was well above one (see Table 9). For senior level engineers or technicians, the number of vacancies opened was twice that of applicants. Even in 2010 the demand for skilled labor was still much higher than the supply.

(Table 9 around here)

Finally, a higher education level may increase a worker's reservation wage. Previous research has found that those affected by the expansion policy were more likely to come from a single child family. College graduates from single child families tended to decline low pay and low status jobs.

5.2 Why Go to College?

Given the high unemployment rate of college graduates, it remains a puzzle that Chinese parents are still enthusiastic about sending their children to college. The

answer partly lies in the high college premium. The college premium increased dramatically in the 1990s. By the end of 1990s, the return to college education reached 30 to 50 percent (Heckman and Li, 2004, Zhang et al., 2005, Li and Ding, 2003, and Meng et al., 2010). Possibly due to the expansion policy, the increasing trend stopped after 2003, but college premia were still approaching 40 percent (Meng et al. 2010). Even with an unemployment rate of 20 percent, the expected return from college education could still be as high as 30 percent. In fact, the unemployment rate for college graduates of older age was much lower than other education levels. Therefore, college education still seems to be an attractive investment.

In addition, the Chinese labor market is segmented. Higher education is often the channel through which an individual can move upward (e.g., from the countryside to the city) (Xing, 2010). Given large differences in income, social status, and welfare benefits between different sectors, the return on higher education remains high.

5.3 Concluding Remarks

The surge in the number of college graduates and their high unemployment rate has major implications for China's economic growth. The labor shortage in coastal areas has raised concerns about constraints on labor supply. Indeed, labor constraints have proven to be an important factor in the slowdown of some other fast-growing economies, such as the Post-war Soviet Union in the 1960s (Weitzman, 1970). The results we present here suggest that China's economy is far from being constrained by

labor supply, and lack of skilled labor will not be a bottleneck for development.

As China is becoming more integrated into the world economy, the high unemployment rate of college graduates may also have impacts on world labor markets. Companies will find cheaper college graduates in China, and consequently college graduates in other countries will face fierce competition from China.

Finally, we have estimated a short-term effect. As young college graduates accumulate more labor market experience, the effect of the expansion policy may decrease. Unfortunately, we do not have suitable data to test this hypothesis, and we leave this for future research.

Figure 1 Numbers and Proportions of Students at Different Education Levels
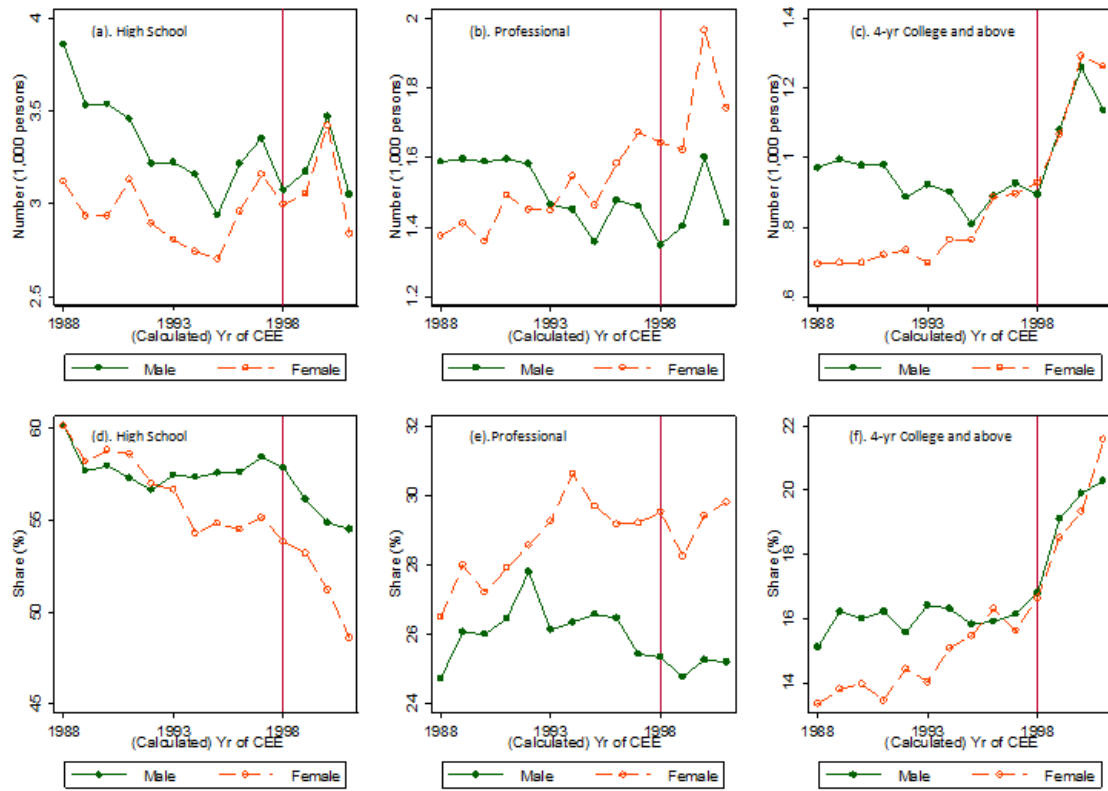
Note: From left to right, each column is for high school, three-year college (professional), and four-year college (and above) respectively. The upper panels give absolute numbers and the lower panels give proportions. CEE denotes college entrance exam.

Sources: The 2005 one percent population survey.

Figure 2 Unemployment Rates by Age (22-35)
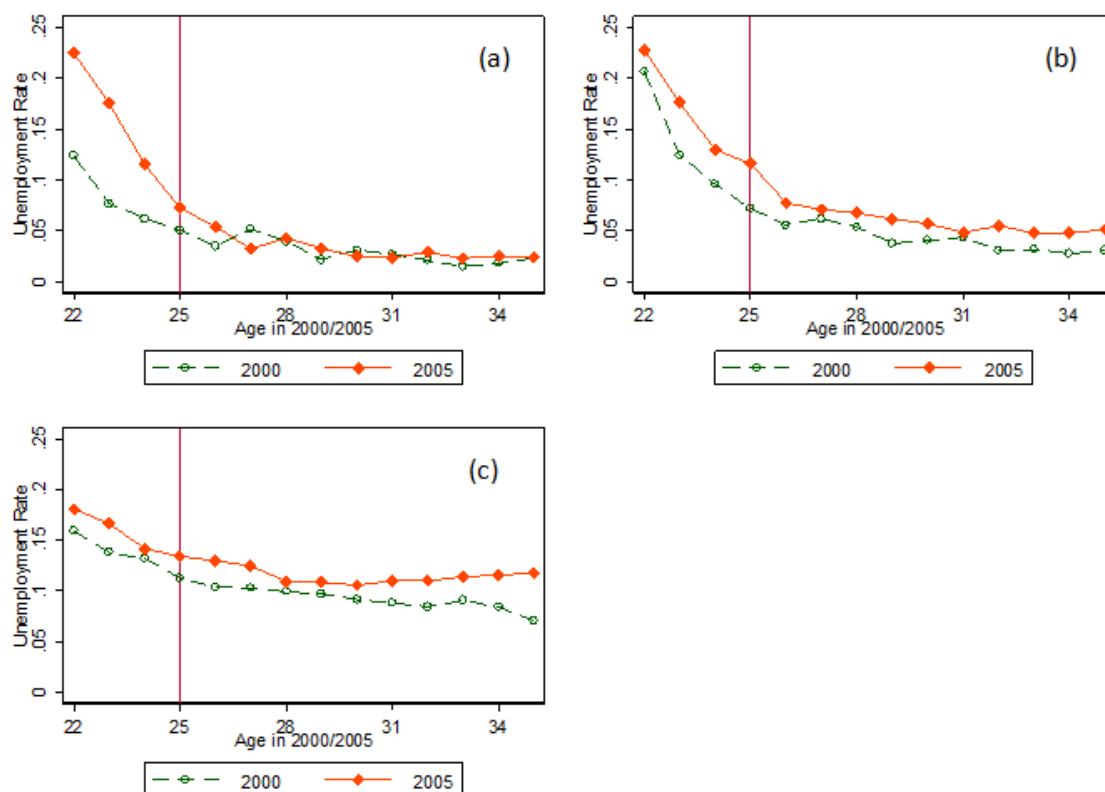
Notes:

(1). Those who did not have a job in the week before the survey are defined as *unemployed*.

(2). Panels (a), (b), and (c) are results for four-year college and above graduates, three-year college (professional) graduates, and high school graduates, respectively.

Sources: The 2000 census and the 2005 one percent population survey.

Figure 3. Unemployment Rates by Region and by City Size, 4-year College, 2000/2005

Notes:

(1). Those who did not have a job in the week before the survey are defined as *unemployed*.

(2). Panels (a) and (c) are the results for 2000 data, and panels (b) and (d) are the results for 2005 data.

Sources: The 2000 census and the 2005 one percent population survey.

Figure 4 Unemployment Rates by Gender, 4-year College, 2000/2005

Note: Those who did not have a job in the week before the survey are defined as *unemployed*.

Sources: The 2000 census and the 2005 one percent population survey.
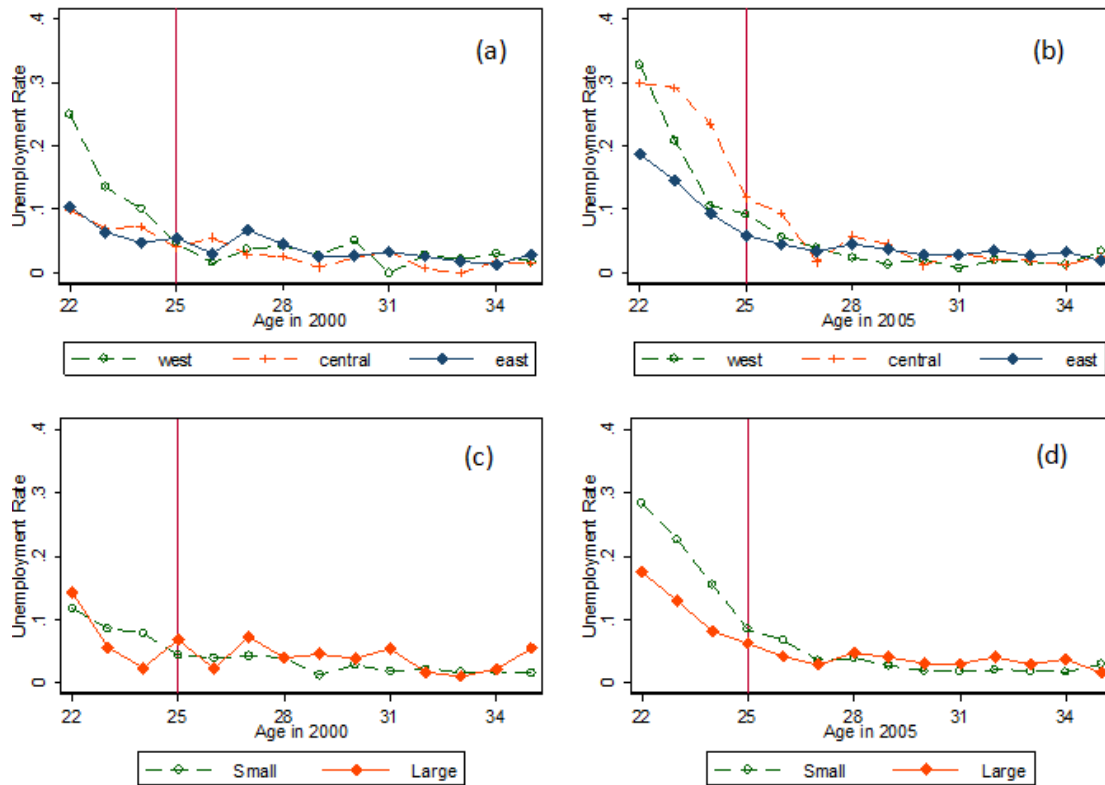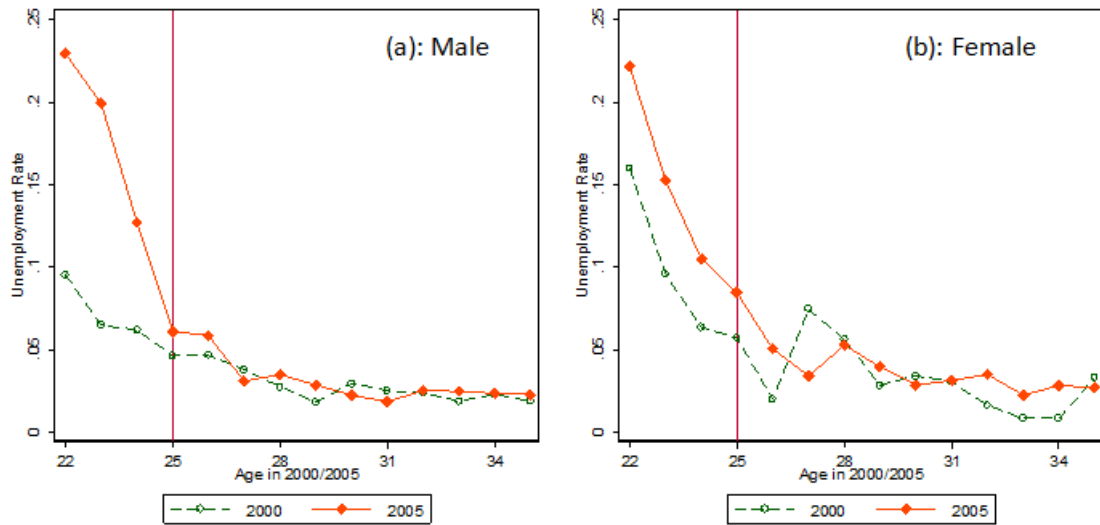
Figure 5 Unemployment Rates by Age (18-35)
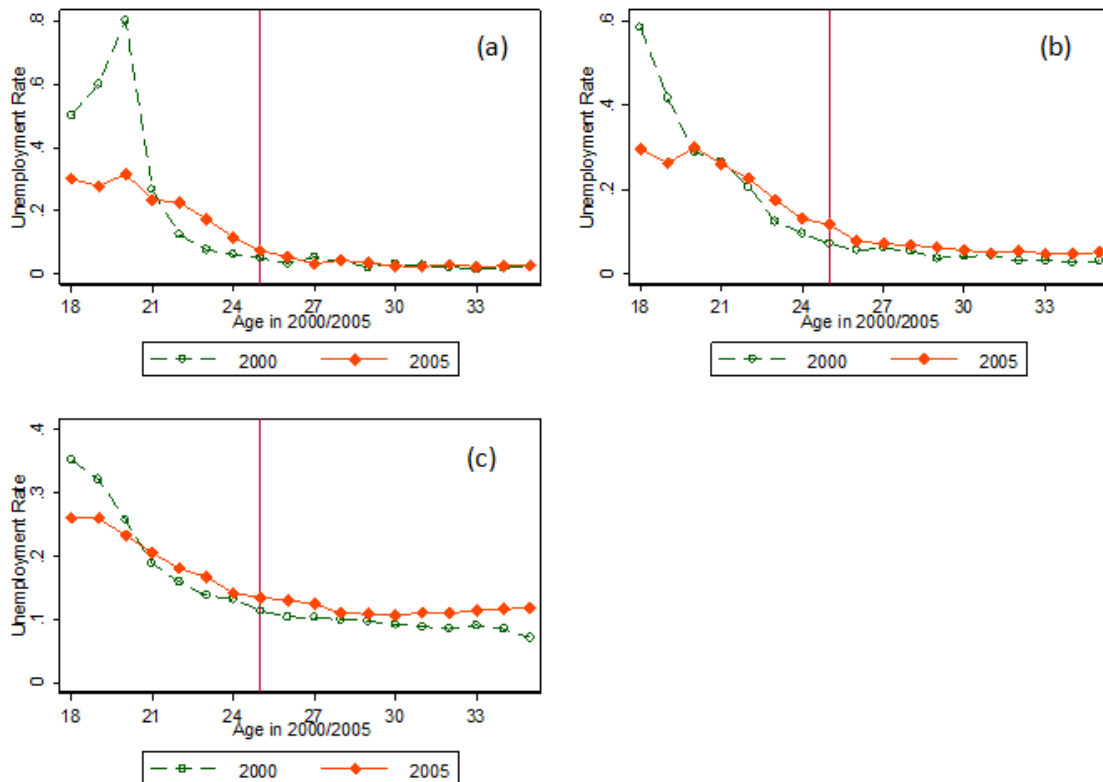
Notes:

(1). Those who did not have a job in the week before the survey are defined as *unemployed*.

(2). Panels (a), (b), and (c) are results for four-year college and above graduates, three-year college (professional) graduates, and high school graduates, respectively.

Sources: The 2000 census and the 2005 one percent population survey.

Table 1 Summary Statistics for 2000 and 2005 Data

	Census 2000		One percent population survey 2005	
	mean	s.d.	mean	s.d.
age (years)	28.36	3.990	28.43	4.100
male (male=1/female=0)	0.554	0.497	0.517	0.500
han (han=1/non-han=0)	0.932	0.252	0.933	0.251
east (east=1/otherwise=0)	0.449	0.497	0.551	0.497
single child (yes=1/otherwise=0)			0.198	0.399
education level				
high school or vocational (yes=1/otherwise=0)	0.674	0.469	0.563	0.496
3 year (professional) college (yes=1/otherwise=0)	0.223	0.416	0.273	0.446
4 year college and above (yes=1/otherwise=0)	0.103	0.303	0.164	0.371
Obs.	61889		156417	

Sources: The 2000 census and the 2005 one percent population survey. See the text for the construction of these samples.

Table 2 Expansion and Education Choice in Mlogit/Logit Using Employment as Reference Group

	(1)	(2)	(3)	(4)	(5)	(6)
	Male			Female		
	Model 1:		Model 2:	Model 3:		Model 4:
	Multinomial Logit		Logit	Multinomial Logit		Logit
	professional	4-year college		professional	4-year college	
A:						
T	0.004	0.003	0.003	0.022***	0.031***	0.030***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
policy	-0.007	0.200***	0.202***	-0.028	0.152***	0.156***
	(0.029)	(0.034)	(0.034)	(0.028)	(0.035)	(0.034)
Psuedo_R2	0.005		0.008	0.006		0.013
N	80835		59911	75582		53804
Test	H0: Model 1=Model 2			H0: Model 3=Model 4		
Chi2(4)	6.06			11.48		
Prob > Chi2	0.1948			0.0217		
B:						
T	0.006*	0.001	0.001	0.023***	0.028***	0.027***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
yr1998	-0.054	0.016	0.016	-0.033	0.011	0.011
	(0.039)	(0.046)	(0.046)	(0.037)	(0.046)	(0.046)
yr1999	-0.051	0.163***	0.164***	-0.088**	0.095**	0.100**
	(0.040)	(0.046)	(0.046)	(0.039)	(0.047)	(0.047)
yr2000	-0.013	0.224***	0.225***	-0.032	0.141***	0.144***
	(0.041)	(0.047)	(0.047)	(0.040)	(0.048)	(0.048)
yr2001	-0.015	0.250***	0.250***	0.013	0.277***	0.282***
	(0.045)	(0.051)	(0.051)	(0.043)	(0.052)	(0.052)
Psuedo_R2	0.005		0.008	0.006		0.013
N	80835		59911	75582		53804
Test	H0: Model 1=Model 2			H0: Model 3=Model 4		
Chi2(7)	5.92			14.92		
Prob > Chi2	0.549			0.037		

Notes:

(1). *T* denotes the year of college entrance exams; *policy* and *yr1998-yr2001* are dummy variables.

(2). ***, **, * represent the significance level of 1%, 5%, and 10% respectively.

(3). Standard errors are in parentheses.

(4). We control for a constant and region dummies in the regressions.

Source: The 2005 one percent population survey.

Table 3 Effects of Education Expansion on Unemployment for Four-year College Graduates, LPM

	Dependent Variable=					
	Unemployed (yes=1/no=0)		Income from family (yes=1/no=0)		Unemployed after graduation (yes=1/no=0)	
	Ability not controlled	Ability controlled	Ability not controlled	Ability controlled	Ability not controlled	Ability controlled
	(1)	(2)	(3)	(4)	(5)	(6)
$age_{22\text{-}24}*year_{2005}$	0.088***	0.062***	0.086***	0.058***	0.314***	0.348***
	(0.013)	(0.016)	(0.012)	(0.015)	(0.084)	(0.116)
$year_{2005}$	0.027	-0.008	0.007	-0.031*	-0.049	0.014
	(0.020)	(0.023)	(0.017)	(0.019)	(0.230)	(0.268)
$age_{22\text{-}24}$	-0.033**	-0.019	-0.034***	-0.019	-0.300***	-0.319***
	(0.013)	(0.014)	(0.012)	(0.013)	(0.093)	(0.106)
$male$	0.000	0.000	-0.004	-0.004	0.046**	0.046**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.022)	(0.022)
han	0.000	0.000	0.004	0.004	-0.012	-0.010
	(0.006)	(0.006)	(0.005)	(0.005)	(0.049)	(0.049)
$gdpgr$	-0.080	-0.079	-0.184	-0.184	-3.504**	-3.549**
	(0.182)	(0.182)	(0.155)	(0.155)	(1.730)	(1.723)
$gdppc$	-0.019	-0.017	0.021	0.024	0.195	0.188
	(0.034)	(0.034)	(0.028)	(0.028)	(0.392)	(0.393)
$tertiaryshare$	-0.124	-0.128	-0.094	-0.097	0.157	0.169
	(0.088)	(0.088)	(0.076)	(0.076)	(1.124)	(1.126)
$tradegdp$	-0.053***	-0.055***	-0.042***	-0.044***	0.023	0.022
	(0.017)	(0.017)	(0.014)	(0.014)	(0.205)	(0.205)
$ratio$		1.335***		1.450***		-2.121
		(0.433)		(0.386)		(4.664)
R-squared	0.062	0.062	0.075	0.076	0.355	0.354
N	27205	27205	27205	27205	1465	1465

Notes:

(1). $year_{2005}$, $age_{22\text{-}24}$, $age_{22\text{-}24}*year_{2005}$, han, and $male$ are dummies; $gdppc$ denotes real GDP per capita (2000 Yuan) in log terms; $gdpgr$, $tertiaryshare$, $tradegdp$, and $ratio$ denote GDP growth rate, share of tertiary sector in GDP, the ratio of trade volume over GDP, and the share of college graduates in all observations with at least junior middle school degrees within each age group.

(2). Age, age squared, and their interactions with provincial dummies, provincial dummies, and a constant term are controlled for.

(3). Standard errors in parentheses.

(4). *, **, and ***significant at 10%, 5%, and 1% levels.

Sources: The 2000 census, the 2005 one percent population survey, and China Statistical Yearbook 2001/2006.

Table 4 Effects of Education Expansion on Unemployment for Professional and High School Grad.

	Sample: Professional degrees			Sample: High school graduates		
	Dependent variable=			Dependent variable=		
	Unemployed (yes=1/no=0)	Income from family (yes=1/no=0)	Unemployed after graduation (yes=1/no=0)	Unemployed (yes=1/no=0)	Income from family (yes=1/no=0)	Unemployed after graduation (yes=1/no=0)
	(1)	(2)	(3)	(4)	(5)	(6)
$age_{22-24}*year_{2005}$	0.025***	0.025***	-0.001	0.001	0.002	-0.012
	(0.009)	(0.008)	(0.035)	(0.005)	(0.005)	(0.019)
$year_{2005}$	0.019	0.032**	-0.052	-0.036***	-0.004	-0.139***
	(0.017)	(0.015)	(0.110)	(0.014)	(0.012)	(0.049)
age_{22-24}	-0.002	-0.000	0.013	0.007	0.007	0.033
	(0.009)	(0.009)	(0.043)	(0.006)	(0.005)	(0.024)
$male$	-0.010***	-0.012***	0.082***	-0.044***	-0.047***	0.032***
	(0.002)	(0.002)	(0.013)	(0.002)	(0.002)	(0.007)
han	0.011**	0.006	-0.093***	0.005	0.008**	0.002
	(0.005)	(0.004)	(0.029)	(0.004)	(0.003)	(0.015)
$gdpgr$	-0.037	0.078	-0.300	-0.524***	-0.316***	-0.953**
	(0.154)	(0.133)	(1.030)	(0.121)	(0.103)	(0.455)
$gdppc$	0.003	-0.020	0.148	0.115***	0.064***	0.151*
	(0.031)	(0.027)	(0.191)	(0.024)	(0.021)	(0.087)
$tertiaryshare$	0.022	0.039	-0.030	0.164***	0.136**	-0.228
	(0.078)	(0.070)	(0.545)	(0.062)	(0.053)	(0.260)
$tradegdp$	-0.011	-0.005	0.039	-0.010	0.001	-0.050
	(0.015)	(0.013)	(0.115)	(0.012)	(0.011)	(0.047)
R-squared	0.040	0.048	0.349	0.021	0.030	0.216
N	52811	52811	4210	120254	120254	14360

Notes:

(1). $year_{2005}$, age_{22-24}, $age_{22-24}*year_{2005}$, han, and $male$ are dummies; $gdppc$ denotes real GDP per capita (2000 Yuan) in log terms; $gdpgr$, $tertiaryshare$, and $tradegdp$ denote GDP growth rate, share of tertiary sector in GDP, the ratio of trade volume over GDP.

(2). Age, age squared, and their interactions with provincial dummies, provincial dummies, and a constant term are controlled for.

(3). Standard errors in parentheses.

(4). *, **, and ***significant at 10%, 5%, and 1% levels.

Sources: The 2000 census, the 2005 one percent population survey, and China Statistical Yearbook 2001/2006.

Table 5 Effects of Education Expansion on Unemployment by Region, LPM

	Dependent variable: Unemployed (yes=1/no=0)					
	Samples from:					
	West	Central	West&	East	Medium-Small	Large Cities
	(1)	(2)	(3)	(4)	(5)	(6)
$age_{22\text{-}24}*year_{2005}$	0.031	0.171***	0.112***	0.073***	0.105***	0.062***
	(0.037)	(0.028)	(0.023)	(0.015)	(0.017)	(0.019)
$year_{2005}$	-0.142*	-0.071	-0.007	0.002	0.022	0.268
	(0.083)	(0.064)	(0.042)	(0.032)	(0.023)	(0.347)
$age_{22\text{-}24}$	0.001	-0.038	-0.031	-0.032**	-0.021	-0.037*
	(0.037)	(0.029)	(0.023)	(0.016)	(0.017)	(0.020)
$male$	0.004	0.003	0.004	-0.003	0.002	-0.004
	(0.006)	(0.007)	(0.004)	(0.004)	(0.004)	(0.004)
han	0.008	-0.038*	-0.002	0.003	-0.002	0.004
	(0.007)	(0.021)	(0.007)	(0.009)	(0.006)	(0.011)
$gdpgr$	-0.534*	-0.272	-0.125	1.356	-0.053	-
	(0.308)	(0.501)	(0.236)	(0.920)	(0.205)	-
$gdppc$	0.209*	0.116	0.023	-0.033	-0.013	-0.369
	(0.120)	(0.104)	(0.066)	(0.043)	(0.042)	(0.480)
$tertiaryshare$	0.526	0.068	0.113	-0.215*	-0.062	-0.548
	(0.325)	(0.201)	(0.133)	(0.119)	(0.105)	(0.761)
$tradegdp$	0.228	0.608	0.039	-0.042*	-0.053**	-0.224
	(0.291)	(0.593)	(0.219)	(0.024)	(0.023)	(0.268)
R-squared	0.079	0.121	0.099	0.038	0.087	0.029
N	5433	5054	10487	16718	15882	11323

Notes:

(1). $year_{2005}$, $age_{22\text{-}24}$, $age_{22\text{-}24}*year_{2005}$, han, and $male$ are dummies; $gdppc$ denotes real GDP per capita (2000 Yuan) in log terms; $gdpgr$, $tertiaryshare$, and $tradegdp$ denote GDP growth rate, share of tertiary sector in GDP, the ratio of trade volume over GDP.

(2). Age, age squared, and their interactions with provincial dummies, provincial dummies, and a constant term are controlled for.

(3). Standard errors in parentheses.

(4). *, **, and ***significant at 10%, 5%, and 1% levels.

Sources: The 2000 census, the 2005 one percent population survey, and China Statistical Yearbook 2001/2006.

Table 6 Effects of Education Expansion on Unemployment by Gender, LPM

	Dependent variable:					
	Unemployed (yes=1/no=0)		Income from family (yes=1/no=0)		Unemployed after graduation (yes=1/no=0)	
	Male	Female	Male	Female	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)
without controlling for ability						
$age_{22\text{-}24}*year_{2005}$	0.112***	0.066***	0.108***	0.067***	0.217*	0.446***
	(0.017)	(0.021)	(0.016)	(0.020)	(0.118)	(0.118)
Controlling for ability						
$age_{22\text{-}24}*year_{2005}$	0.098***	0.032	0.094***	0.034	0.260*	0.423**
	(0.019)	(0.026)	(0.019)	(0.024)	(0.138)	(0.191)

Notes:

(1). $age_{22\text{-}24}*year_{2005}$ is the product of $year_{2005}$ and $age_{22\text{-}24}$, and it is a dummy variable. Age, age squared, and their interactions with provincial dummies, provincial dummies, and a constant term are controlled for. Other control variables are the same as those reported in Table 3 and Table 5.

(2). Standard errors in parentheses.

(3). *, **, and ***significant at 10%, 5%, and 1% level.

Sources: The 2000 census, the 2005 one percent population survey, and China Statistical Yearbook 2001/2006.

Table 7 Effects of Education Expansion on Unemployment by Region and by Gender

	Dependent variable: Unemployed (yes=1/no=0)					
	Samples from:					
	West	Central	West&	East	Medium-Small Cities	Large Cities
	(1)	(2)	(3)	(4)	(5)	(6)
male						
$age_{22\text{-}24}*year_{2005}$	0.074	0.196***	0.143***	0.092***	0.127***	0.092***
	(0.049)	(0.038)	(0.030)	(0.020)	(0.023)	(0.021)
female						
$age_{22\text{-}24}*year_{2005}$	-0.035	0.148***	0.075**	0.064***	0.086***	0.038
	(0.061)	(0.044)	(0.037)	(0.024)	(0.026)	(0.033)

Notes:

(1). $age_{22\text{-}24}*year_{2005}$ is the product of $year_{2005}$ and $age_{22\text{-}24}$, and it is a dummy variable. Age, age squared, and their interactions with provincial dummies, provincial dummies, and a constant term are controlled for. Other control variables are the same as those reported in Table 3 and Table 5.

(2). Standard errors in parentheses.

(3). *, **, and ***significant at 10%, 5%, and 1% level.

Sources: The 2000 census, the 2005 one percent population survey, and China Statistical Yearbook 2001/2006.

Table 8 Effects of Education Expansion on Unemployment for the Age Group of 18-24

	Dependent variable: Unemployed (yes=1/no=0)				
	Samples from:				
	4-year College and Above	4-year College and Above (ability controlled)	3-year College	High School	High School and Above
	(1)	(2)	(3)	(4)	(5)
$age_{18-24}*year_{2005}$	0.070***	0.038**	0.014*	-0.014***	0.003
	(0.013)	(0.017)	(0.008)	(0.004)	(0.004)
R-squared	0.070	0.070	0.061	0.043	0.049
N	27509	27509	55583	145473	228565

Notes:

(1). $age_{22-24}*year_{2005}$ is the product of $year_{2005}$ and age_{22-24}, and it is a dummy variable. Age, age squared, and their interactions with provincial dummies, provincial dummies, and a constant term are controlled for. Other control variables are the same as those reported in Table 3 and Table 5.

(2). Standard errors in parentheses.

(3). *, **, and ***significant at 10%, 5%, and 1% level.

Sources: The 2000 census, the 2005 one percent population survey, and China Statistical Yearbook 2001/2006.

Table 9 Demand-Supply Conditions of Skilled Labor in Human Resource Agencies

	vacancies/applicants ratio	
Skill level	2005	2010
Occupation Certificates (Technician)		
level 5	1.52	1.47
level 4	1.57	1.48
level 3	2.10	1.63
level 2	1.85	1.87
level 1	2.08	1.89
Junior Engineer	1.31	1.53
Middle Level Engineer	1.51	1.59
Senior Engineer	2.06	1.87

Note: For technical level 1 to 5, the higher the level the more skilled the worker.

Source: Ministry of Human Resources and Social Security. The data are collected from labor market intermediate agencies in 116 cities.

References:

Ai Chunrong, and Edward C. Norton (2003). "Interaction terms in logit and probit models", *Economics Letters*, 80 (2003) 123–129

Chan, Kam Wing, and Will Buckingham (2008). "Is China Abolishing the Hukou System?" *China Quarterly*, (195):582-606.

China Youth and Child Research Center (CYCRC) (2007). *Report on the Development of the China Youth During the 10th and 11th 5-Year-Plan*. (in Chinese)

Fan, C. (2008). *China on the Move: Migration, the State, and the Household.* Routledge, London and New York.

Freeman, Richard (2009). "What Does Global Expansion of Higher Education Mean for the US?" *NBER Working Paper, No. 14962*.

Heckman, J. J. and Xuesong Li (2004). "Selection Bias, Comparative Advantage and Heterogeneous Returns to Education: Evidence from China in 2000", *Pacific Economic Review*, 9: 3.

Li, Shi and Sai Ding (2003). "Long-term Change in Private Returns to Education in Urban China", *Social Science in China*, No. 6. (in Chinese)

Li, Yao, John Whalley, Shunming Zhang, and Xiliang Zhao (2001). "The Higher Educational Transformation of China and its Global Implications", *The World Economy*, 34(4), 516–545.

Meng, Xin, Kailing Shen, and Xue Sen (2010) "Economic Reform, Education Expansion, and Earnings Inequality for Urban Males in China, 1988-2007", *IZA Discussion Paper No. 4919*.

Pissarides, C. (2000). *Equilibrium Unemployment Theory*, 2nd edition, MIT Press.

State Council (1993). *Guidelines for China's Education Reform and Development* http://www.moe.edu.cn/edoas/website18/level3.jsp?tablename=208&infoid=3334. (in Chinese)

Weitzman, Martin L. (1970). "Soviet Postwar Economic Growth and Capital-Labor Substitution," *American Economic Review*, 60(4): 676-692.

Whalley, John and Chunbing Xing (2010). "The Regional Distribution of Skill Premia in Urban China," NBER Working Paper, No. 16575.

Wu, X, and Treiman D. (2004). "The Household Registration System and Social Stratification of China, 1955-1996." *Demography* 41(2):363-384.

Xing, Chunbing (2010). "Migration, Self-Selection, and Income Distributions: Evidence from Rural and Urban China." IZA Discussion Papers 4979.

Yang, Dongping (2006). *Transition and Development of China's Education*, Social Science Academic Press. (in Chinese)

Yuan, Cheng, and Lei Zhang (2009). "Parental Income and Return to College Education in Urban China," *Economic Research*, No. 5. (in Chinese)

Zhang, Junsen, Yaohui Zhao, Albert Park, and Xiaoqing Song (2005). "Economic returns to schooling in urban China, 1988 to 2001," *Journal of Comparative Economics*, 33, 730-752.