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Higher Education Expansion and Labor Market Outcomes for Young College Graduates

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ABSTRACT

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We examine the causal impact of China's higher education expansion on labor market outcomes for young college graduates using China's 2005 1% Population Sample Survey. Exploiting variation in the expansion of university spots across provinces and high school cohorts and applying a difference-in-differences model, we find that the expansion of higher education in China decreases unemployment rates, especially among males and high school graduates. However, the policy also decreases women's labor force participation and individual earnings in highly-skilled white-collar jobs. We further discuss potential channels affecting the observed outcomes. Our results illustrate the strong demand for a skilled labor force in China and the broad economic benefits of higher education.

JEL Classification: I23, I28, J31, O15

Keywords: higher education expansion, labor force participation, unemployment, wage, difference-in-differences

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Higher Education Expansion and Labor Market Outcomes for Young College Graduates

1. Introduction

The consequences of higher education expansion extend beyond straightforward economic gain (Hannum and Buchmann, 2005; Machin and McNally, 2007; Li, Walley and Xing, 2014). China began increasing university enrollment spots in 1999, investing in education to fuel future development, increase domestic consumption and relieve employment pressure on the labor market after the 1998 Asian financial crisis (Wu and Zhang, 2010). China's higher education expansion policy has effectively increased tertiary education rates in the 21st Century (Liu, 2007), driving up the gross enrollment rate from 9.8% in 1998 to 22% in 2006. On the one hand, whilst research has shown that increasing the share of highly educated workers may result in improved employment rates and higher earnings among the newly educated (Machin and McNally, 2007), most existing studies on China's higher education expansion have identified negative impacts on labor market outcomes for college graduates (Wu and Zhao, 2010; Li, Walley and Xing, 2014; Yu, 2014).

On the other hand, while there is some evidence that higher education expansion in China has narrowed the gender gap in college access (Wu and Zhang, 2010), it is not yet clear whether the higher education expansion has brought about increased earnings for women(Hou and Ou, 2015). Even as formal schooling improves individuals' economic well-being, other contextual factors may keep women from obtaining the optimal benefits of increased education. Improved skills may not be rewarded in the local labor market, for example, and cultural norms

may continue to limit women's opportunities (Hannum and Buchmann, 2005). These limits on employment prospects may reduce the benefit of expanded higher education to women.

Three important studies examine labor market outcomes as a function of higher education expansion in China. Wu and Zhao (2010) use data from the 2000 and 2005 population surveys and apply a difference-in-differences (DID) model to compare the labor force participation rate, unemployment rate, and hourly wages for cohorts before and after the expansion policy. They further apply a difference-in-differences-in-differences (DDD) model to compare outcomes for students who completed college and high school before and after the policy. Their findings suggest that higher education expansion in China has reduced the labor force participation rate and the wage rate and increased the unemployment rate for college graduates. Similar to Wu and Zhao (2010), Li, Walley, and Xing (2014) used the 2000 population survey and data from the 2005 mini-census to compare the unemployment rate of college graduates in cohorts born before and after the 1999 reform. They find that the expansion policy has increased the unemployment rate for four-year college graduates, especially for males, and for graduates in small-to-medium–sized cities and western provinces. Finally, Yu (2014) uses data from the 1997 and 2006 China Health and Nutrition Studies and methods similar to the other two studies to examine full-time employment, unemployment, and monthly earnings of cohorts that entered college before and after the expansion. That study also finds that the expansion had a negative effect on the labor market for young college graduates, lowering the full-time employment rate, raising the unemployment rate and decreasing monthly earnings.

Those studies have generated a consistent set of findings, but they have limitations: none of them exploit regional variations in the intensity of the expansion to produce a natural experiment in their DID or DDD models; instead each study treats national policy as a brute condition. Building upon work by Duflo (2001) and Bratti, Checchi and de Blasio (2008)[1], our study is one of the first to explore the mechanisms behind the expansion policy's effects by examining individuals' demographic and socioeconomic characteristics. In particular, we exploit variation in the intensity of the expansions in university enrollment quotas across provinces/regions and high school cohorts, and we use a DID model to evaluate outcomes before and after expansion. Furthermore, we distinguish highly-skilled white collar workers from others and consider possible spillover to less-educated individuals rather than solely evaluating high school and university graduates.

In contrast to previous literature (Li, Whalley and Xing, 2014; Wu and Zhao, 2010; Yu, 2014), our results indicate that higher education expansion decreases the probability of unemployment, especially for male college graduates. However, consistent with other studies, we do find that the average yearly increase in new university spots available to high school graduates during the expansion period was associated with a slight decrease in earnings and hourly wages for highly-skilled white-collar workers. The results imply that the increased supply of college students following higher education expansion in China induced more young people, particularly males, to lower their reservation wages when first entering the labor market instead of refusing job offers and remaining unemployed. Our results suggest that policymakers and

[1] Duflo (2001) takes advantage of regional variation in the construction of new schools in Indonesia to estimate the impact of the school expansion program on years of schooling as well as wages. Similar to Duflo (2001), Bratti and colleagues (2008) examine differences in the extent of course and program offerings for university students to assess the impact of higher education expansion in Italy.

universities must find ways to assist young college graduates transitioning into the labor market. The methodology and framework used in our study can also be useful in the study of labor market consequences of higher education expansion in other countries, such as Brazil, which resembles China in the ways higher education is financed and in its high level of income inequality (Carnoy, 2011).

The rest of the paper is organized as follows. The next section briefly describes the higher education expansion policy of 1999. Section 3 describes the data and empirical methods. Section 4 discusses the results and robustness checks, and Section 5 concludes.

2. A Brief Overview of Higher Education Expansion in China

China's provision of higher education has long been viewed as too limited, particularly given the strong demand for high-quality human capital to meet the needs of the information economy (Levin and Xu, 2005) and the country's double digit growth rate. The gross higher education enrollment rate was only 1.55% in 1978, and had increased to only 9.76% by 1998.

China began to expand its higher education system in 1999. In December 1998, the government set a goal of achieving 15% participation in higher education by 2010 (Ministry of Education of the People's Republic of China, 1998). In May 1999, the decision was made to implement the expansion immediately with the 1999–2000 academic year beginning that September (Liu, 2007). In addition to the goal of investing in education for future development, the expansion of student spots in Chinese universities was also intended to increase domestic

consumption and to relieve employment pressure on the labor market by absorbing high school graduates into college at a time when the nation was confronting the recession that resulted from the Asian financial crisis (Wan, 2006; Wu and Zhao, 2010; Wu & Zhang, 2010).

Figure 1 illustrates that, beginning in 1999, the number of university spots in China increased dramatically, and consequently around 2002 or 2003 the number of university graduates began to surge as well.

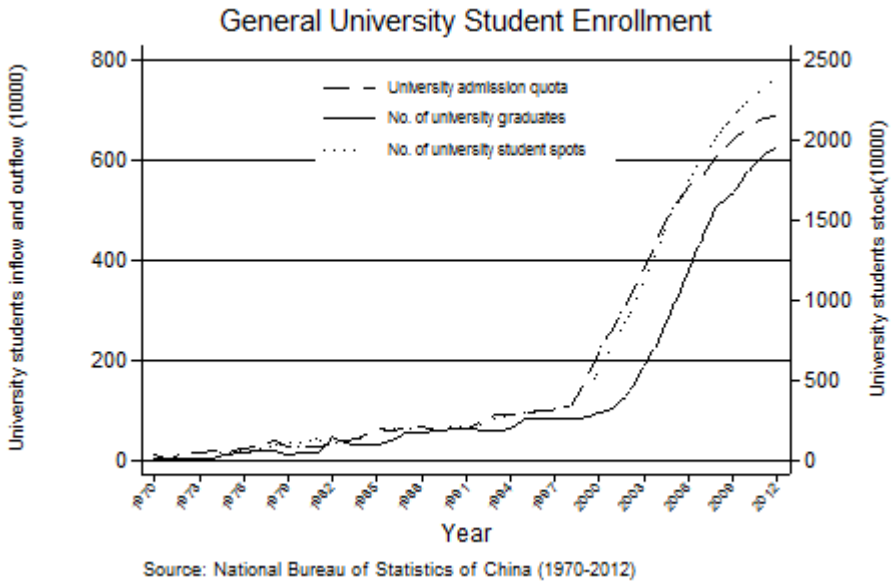

Figure 1: University student inflow and outflow by year, 1970-2012 (Hou and Ou, 2015)

Under the traditional central planning regime, higher education in China was heavily subsidized and mostly free. However, in 1997, just 2 years before the expansion policy was implemented, China enacted a universal tuition policy that gradually shifted responsibility for financing higher education from the government to families (Carnoy, 2011; Wang, Fleisher, Li

and Li, 2007; Yeung, 2013). In fact, while total spending on general higher education more than doubled between 1998 and 2001, the proportion paid by the government dropped from 64.94% to 54.24% in that period. The contribution from nongovernment resources also increased consistently during that period. For instance, tuition and fees rose as a proportion of total funding from 13.31% in 1998 to 24.21% in 2001 (National Bureau of Statistics of China, 2000; 2001). Moreover, the ratio of tuition and fees per student to the per capita disposable income of urban households increased from 39.53% in 1998 to 57.26% in 2001 (National Bureau of Statistics of China; 2000, 2001, 2013).

The Chinese government has provided students with financial assistance in the form of grants, loans, and scholarships since the introduction of universal tuition in 1997. However, many of these have emerged recently or have not offered amounts that cover the increases in tuition and fees (Wan, 2006). Consequently, these programs have provided little assistance to students. They have also been less than clear with regard to access restrictions or repayment policies. The limited effectiveness of the financial aid system is further hampered by Chinese cultural factors, such as the tendency of families to avoid loans (Chung, Gong and Lu, 1996).

3. Data and Methods

The main data for our study come from China's 2005 mini-census, which surveyed 1 percent of the population in 31 provinces using a multistage sampling design. This is the only census that collects detailed employment and wage data in China, including respondents' current occupation, employment status, monthly wage, and weekly working hours. Using the

two-digit International Standard Classification of Occupations, we code highly-skilled white-collar jobs and low-skilled white-collar jobs as in PISA studies (OECD 2012). The data set also includes detailed demographic indicators, including gender, month and year of birth, highest educational level attempted and highest education level completed. Using birthdates and years of education, we construct high school graduation cohorts,[2] enabling us to link our data to data on provincial higher education expansion.

Further, the Census data includes information on hukou registration province, hukou type (agricultural or nonagricultural), residential province and change in residence, allowing us to link provincial educational policy data to individuals and to estimate these policies' impact on their labor market outcomes.[3]

Provincial level data on higher education expansion, the number of high school graduates, tuition and fees, and budgetary expenditures per student in higher education are collected from the China Education Year Books.[4] Other provincial level data such as unemployment rates, GDP, etc. are collected from the Statistics Yearbooks of China.

Using differences in exposure to the reform and different intensities of expansion

[2] It is worth noting that using years of education might not precisely capture the year of high school graduation or the year college was entered because schooling systems in China in the 1970s and 1990s were not standardized across provinces (Wu and Zhao, 2010). As a robustness check, we remove a few high school graduate cohorts near the policy cutoff in the control group, and the main results remain the same. Details are discussed in later sections.

[3] One limitation is that we do not observe the province/region of residence when individuals were in high school and when decisions regarding university attendance were made. We follow the decision rule that if the current province is the same as the hukou registered province and that individual did not leave the hukou registration province over the last five years, we assign the hukou registration province as the province where the individual graduated from high school. As we discuss in a later section, such a rule is reasonable given that the increases in university spots apply mainly to students registered in the same province where the universities are located (Hou and Ou, 2015). However, we discuss this further in the robustness check section.

[4] We use the actual total numbers of students admitted to higher education institutions in our analysis. Ideally we would like to capture the planned admission quota instead of the actual admission number; however, such data are not publicly available. We were able to find some provincial educational statistics yearbooks to compare differences in planned and actual admissions quotas, and the differences were very small. For example, in 1992 the planned admission quota for higher education institutions in Beijing was about 39,000, while the actual admissions figure was about 41,000.

(explained below), we estimate the following equation following Duflo (2001):

$$Y_{ipt} = c_1 + \alpha_{1p} + \beta_{1t} + \gamma_1(Postreform_i * \Delta supply_p) + \gamma_2(R_p * Postreform_i) + \delta_1 X_i + \varepsilon_{ipt}, \quad (1)$$

where Y_{ipt} indicates the labor market outcome for individual *i*, who was born in province *p* and graduated from high school at time *t*. Cohorts affected by the reform were born between September 1979 and August 1983. Because the mini-census asked respondents to provide information as of November 1, 2005, the last cohort for which we can obtain labor market information is the cohort born in 1983[5], who graduated from college in 2005. To construct the same number of cohorts before higher education expansion, we limit the control group to those born between September 1975 and August 1979 (i.e., the 1994 college cohort to the 1998 college cohort).

In particular, we are interested in seven outcomes: (a) the individual's labor force participation rate, (b) the individual's probability of being unemployed, (c) the individual's probability of being in a highly-skilled white-collar job, (d) the individual's probability of being in a low-skilled white-collar job, (e) the log of the hourly wage,[6] (f) the log of the hourly wage for individuals in a highly-skilled white-collar job, and (f) the log of the hourly wage for individuals in a low-skilled white-collar job. Outcomes 2, 3 and 4 serve as proxies for general employability, highly-skilled (high-pay) employability and low- or middle-skilled (low-pay) employability, respectively. Outcomes 5, 6 and 7 measure the overall wage level, the wage level in highly-skilled (high-pay) jobs and the wage level in low- or middle-skilled (low-pay) jobs.

α_{1p} is the birth province fixed effect, β_{1t} is the birth cohort fixed effect, c_1 is a constant, and

[5] We also analyzed cohorts born in 1984 and 1985 who reported that they attended two-year universities. These individuals graduated from college by 2005 and were also potentially exposed to the expansion reform. Results are robust and resemble the main results reported in this paper.

[6] We have also used monthly wages to measure earnings, with similar results.

ε_{ipt} is a standard error term for individual i at province p born in cohort t. Postreform_i is a dummy variable coded 1 if the individual graduated from high school after 1998 and 0 if (s)he graduated in or before 1998. Δsupply_p denotes the average yearly increase between 1998 and 2001 in the number of university spots in province *p* divided by the total number of high school graduates in that province in 1999. γ_1 in Equation (1) is the coefficient of interest, because we want to know the overall effects of the policy. Figure 2 illustrates the geographic distribution of the increased supply in higher education across the regions examined in this paper. The most intense regions are Beijing, Shanghai, Tianjin, and Chongqing.

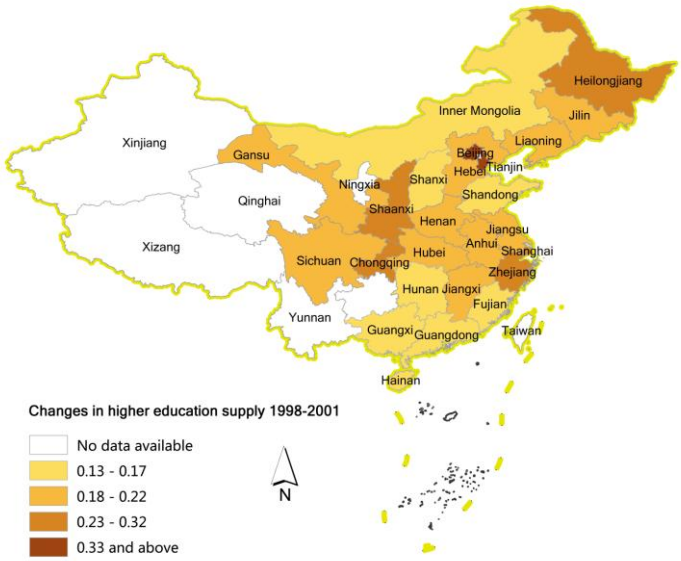

Figure 2: Changes in higher education supply 1998-2001. *Source:* China Educational Statistics Yearbooks.

$\Delta supply_p$ interacts with the $Postreform_i$ dummy, since only post-reform cohorts were exposed to the expansion. X_i is a vector of demographic and family variables, including gender, ethnicity, and age upon entering college. We do not include all possible second order interactions in the $Postreform_i$ dummy since our primary interest is isolating the effect of

higher education expansion. Similarly, to control for potential changes in the regional gradient after the reform and because our supply variable is measured at the provincial level, we include the interaction of the $Postreform_i$ dummy with R_p, a vector of provincial control variables from 1999 to 2001 that includes the change in the number of high school graduates, the absolute variance in unemployment rates, the real increase in per capita income, the real increase in tuition and fees per pupil for institutions of higher education, the real increase in financial aid per pupil for universities, the real increase in budgetary expenditures per pupil for higher education, and the change in the percentage of the labor force enrolled in unemployment insurance schemes. The rationale for including these provincial control variables is detailed as follows:

The validity of our estimates relies on the assumption that there are no omitted time-varying, region-specific effects correlated with both higher education expansion and individuals' labor market outcomes. For example, if the provincial government were to increase higher education supply in order to counter an increasing unemployment rate, the increase in unemployment at the regional level would then correlate with the regional expansion intensity. We control for the absolute variation in unemployment rates. In addition, educational resources are unevenly distributed across provinces in China. If an increase in university spots at the provincial level were correlated with a decrease in educational resources, then the estimated effects could be driven by the decline in university quality instead of the increase in supply. Therefore, we control for the changes in per pupil expenditures among higher education institutions at the regional level. Similarly, an increase in tuition and fees or a decrease in financial aid for college students could produce a decrease in demand for higher education. If the provincial government were to

adjust the regional expansion intensity based on expected demand for higher education, our estimates of the supply intensity would be biased. We include changes in financial aid, tuition and fees from 1999 to 2001 in the regional vector. If a faster-growing economy at the provincial level required a more highly-educated labor force, the growth could be positively correlated with the expansion intensity if the government were to respond to the increased demand by changing their higher education enrollment. We control for regional changes in GDP per capita (in 1998 prices). Similarly, we control for the growth rate in per capita disposable income at 1998 prices to eliminate potential bias from the increased demand for higher education. Lastly, if there were to be an increase in the regional provision of social security including unemployment benefits in provinces where more university spots become available, our estimates of labor market outcomes could capture effects from other social welfare policies. Thus we control for changes in the proportion of the labor force participating in unemployment insurance schemes at the regional level.

In addition, we are interested in whether the policy's effects differ by gender. Previous studies suggest that the higher education expansion policy in China produces different educational opportunities for male and female students. For example, Wu and Zhang (2010) show that women are increasingly taking advantage of expanded opportunities in higher education. A subsequent step, then, is to explore whether such opportunities can subsequently be converted to advantages in labor market outcomes. Li, Whalley and Xing (2014) also consider gender, demonstrating that the expansion policy has had a greater impact on males than on females in terms of increasing unemployment. To offer new evidence, following Bratti, Checchi and de Blasio (2008) we estimate the following equation:

$$Y_{ipt} = c_1 + \alpha_{1p} + \beta_{1t} + \gamma_1 B_i + \gamma_2 (B_i * Postreform_i) + \gamma_3 (B_i * Postreform_i * \Delta supply_p) + \gamma_4 (B_i * \Delta supply_p) + \gamma_5 (R_p * Postreform_i) + \delta_1 X_i + \varepsilon_{ipt}, \quad (2)$$ [7]

$\mathrm{B_i}$ measures the demographic background of the subgroups of interest in this study, e.g. gender. X_i here is a vector of demographic and family variables (except for dimensions specified in B_i , e.g. gender), and γ_3 in Equation (2) constitutes the coefficients of interest for comparing the impact of higher education expansion on male and female students. In addition, to assess the social returns from the expansion, we can identify the general equilibrium effects associated with changes in the aggregate number of college graduates, i.e. the effect on educational groups other than college graduates. γ_3 shows the interaction between different levels of educational attainment (i.e. middle school, high school, or college) and the post-reform and higher education supply variables.

In order to address the problem of geographical mobility, we use a restricted sample of respondents whose current hukou-registered residence coincides with their hukou-registered province at birth. One initial assumption of our analysis is that individuals are living in their birth province when decisions about their higher education are made. However, this assumption introduces a potential problem of endogenous mobility, because it is possible for some individuals to move to provinces where the supply of new university spots is greater in order to increase their probability of gaining admission to university. In this case, the effect of the higher education expansion policy would be overestimated due to positive selection by the individuals

[7] $(Postreform_i * \Delta supply_p)$ represents the effect of the excluded background category post-reform and is not explicitly shown. Similarly, $Postreform_i$ and $\Delta supply_p$ represent the effect of the excluded background category interacting with the Post-reform dummy and supply intensity, i.e. $(\mathrm{B_i} * \mathrm{Postreform_i})$ and $(\mathrm{B_i} * \Delta\mathrm{supply_p})$.

themselves. This problem can be addressed by using a restricted sample whose current hukou-registered residence coincides with their hukou-registered province at birth.

Though the problem of geographical mobility cannot be solved completely, since some individuals may have changed their hukou registration province to attend school, returned to their birth province after obtaining higher education, and changed their hukou registration back to their birth province; the chances of such a scenario are exceedingly small: first, the hukou system renders such changes implausible (Ou and Kondo, 2013); second, the higher education expansion in China happened quickly and unexpectedly; and third, individuals who migrate to access better educational resources are less likely to return to their birth provinces in search of work, as the better labor market resources in destination provinces also make them attractive places to stay after completing higher education. Another assumption of our analysis is that individuals go to universities in the province of their hukou registration.[8] It is worth noting that in China, individuals typically do attend a university located in the province of their hukou registration. This is due principally to university admissions policies, which dedicate a larger quota of admissions (generally over 80%) to students registered in the province where the university is located (Qiao and Hong, 2009; Wang, 2013)[9].

[8] It is also worth noting that our assumption that students attend college in the same province in which they are born and grow up (instead of in other provinces) implies that the estimated returns (local average treatment effect of the treatment on the treated) will actually capture the returns to going to college in one's birth province, not the returns to going to college more generally.

[9] To further elucidate the likelihood of students obtaining their college education from a province other than the one of their birth as well as the likelihood of students finding jobs in a province other than the one where they went to college, we examine some statistics using Census data. In the 2005 Census, we can identify those who are age 23 and who completed 4-year-college. If they attended college in the same province as the one where they resided in 2005, we should find that they live in the current province based on their residential history record. We found that 89% of individuals went to colleges in their current residential province. These individuals should have finished schooling by June 2005, that is, they went to college in September of 2001. So we can further check their

Further, we restrict our sample to non-agricultural hukou holders only. We also excluded a few regions or provinces with a high density of ethnic minorities. High density is defined as placing in the top 90th percentile in China in terms of the proportion of ethnic minorities in the region's population (which equates to an ethnic minority share of the regional population of 37% or greater). These regions/provinces are Xinjiang, XiZang, NingXia, Qinghai, Guizhou, and Yunnan. Lastly, we include employees from those areas only when we do the wage analysis.

Table 1 summarizes the descriptive statistics of our final sample. There are 56,306 individuals in our final sample; that figure includes 43,274 employees, whose data we rely on in the wage analysis. In general, college cohorts prior to the high expansion reform (the control group, or pre-reform cohorts) have a higher labor force participation rate, a lower unemployment rate, higher hourly wages, and a lower probability of being employed in low-skilled white-collar jobs. However, the post-reform cohorts (the treatment group) have a higher level of education. Though post-reform cohorts seem to reside in provinces with a higher density of education expansion, they also seem to reside in provinces that have higher unemployment rates, and where universities charge higher tuition and fees and have higher budgeted per pupil spending rates. The t-test statistics are mostly significant, underscoring the importance of controlling for these regional variations in our regression analysis.

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residential province in 2000 (i.e. from the question "where did you reside five years ago?") to see where these students were when they were in high school in 2000. We found that 77% of students came from the same province where they currently resided. Therefore we can infer that around 77% of individuals went to college in the same province where they went to high school. Such statistics are reasonable given that the universities dedicate a larger quota (more than 80%) of admissions to students within the province where the university is located.

4.Results

4.1 Overall effects

Table 2 reports the estimates of γ_1 in Equation (1) for the seven outcome variables. First of all, there is some evidence that the reform reduced the labor force participation rate: the interaction coefficient for post-reform and supply is -0.198 (with a standard error of 0.099), which suggests that an increase of one university spot per student annually will decrease an individual's probability of entering the labor market by almost 20%. Considering that the actual national increase in university spots is 0.22 (see Appendix Table A4) per student, the total policy effect would be 4 percentage points (=-0.198×0.22). That is, the higher education expansion has reduced individuals' labor force participation rate by 4.3 percentage points. As Table 1 shows, the average labor force participation rate of the control group is about 86.2, indicating a 4.9% (=0.043/0.862) reduction in the labor force participation rate.

The analysis of employability shows almost no effect of increased university spots on individuals' probability of being unemployed, or of being employed in either highly-skilled white-collar jobs or low-skilled white-collar jobs. The statistics in the first column indicate that the policy effect on being unemployed is marginally statistically significant at the 10% level: the interaction coefficient for post-reform and supply is -0.094 (with a standard error of 0.049), which suggests that an increase of one university spot per student annually will decrease an individual's probability of being unemployed by 9%. Because the actual national increase in university spots is 0.22 per student, the total policy effect can be calculated as 2 percentage points (=0.094×0.22). It is worth noting that the policy effect varies with the density of higher education expansion at the provincial level. For instance, the policy effect for Beijing, which had

the highest increase in supply of university spots from 1998 to 2001, reaches 3.9 percentage points. We also find some evidence that, on average, the probability of being employed in a white-collar low-skilled job has decreased by 3 percent (.136×.22) for students who benefited from the higher education expansion.

For the wage analysis, we find that the reform decreased both the total log of hourly wages as well as wages in highly-skilled white-collar jobs. Column (4) in Table 2 shows that the interaction coefficient for post-reform and higher education supply is -0.321 (with a standard deviation of 0.095), implying that adding one university spot per student annually decreases hourly wages by 14% for individuals in high school graduate cohorts from 1999 to 2001. Because the actual national increase in university spots was 0.22 per student, on average, hourly wages decreased by 7 percent (.1321×.22) for students who benefited from the higher education expansion. Similarly, the policy was associated with a 9-percent (-0.407×.22) decrease in hourly wages for highly-skilled white-collar jobs. We do not find any statistically significant policy effects on hourly wages for low-skilled white-collar jobs.

4.2 Heterogeneous effects

Table 3 reports the distributive effects of an increase in university spots by individual educational attainment and by gender. The upper panel reports the estimated coefficients of interactions with individual educational attainment. The upper panel also shows a statistically significant negative effect of a supply increase on the probability of being unemployed for individuals with a high school diploma or a college degree. Multiplying the coefficients by the actual average annual increase in the number of new spots made available during the expansion,

we find a national average policy effect of 3 percentage points for those with at least a high school level education. The reduction in the probability of unemployment for high school graduates may reflect a spillover effect from increased access to higher education. It is plausible that the increased quotas at higher education institutions could motivate high school students at the margin to study harder, improving their knowledge and skills during their high school years. They would thus be more equipped for the labor market when they leave high school, regardless of whether or not they attend university.

The lower panel in Table 3 shows that the negative impact on individuals' labor force participation rate that we observed in Table 2 seems to be driven by the effect on females: the coefficient is -0.308 (with a standard error of 0.125), which suggests that an increase of one university spot per student annually would decrease an individual's probability of being unemployed by almost 31%. The total policy effect would be 6.8 percentage points (=-0.308×0.22) when we consider the actual national increase of university spots.

We continue to find similar policy effects on the probability of unemployment, with a similar magnitude for males (Lower panel in Table 3). The coefficient on interactions with male is -0.138 with a standard error of 0.058, which implies a national average policy effect of 3 percentage points in unemployment reduction for male students. The negative policy impact on the probability of being employed in a white-collar low-skilled job seems to be driven by women: the coefficient on interactions with female is -0.192 (with a standard error of 0.091). The negative wage effect, whether in general or for highly-skilled white-collar jobs, applies to both males and females. For example, females face an 9.3–percentage point (0.422×0.22) decrease in hourly wages from the expansion policy if they work in highly-skilled white-collar jobs.

4.3 Robustness checks

Both equations are also estimated in a "policy off" period as a placebo test. We consider a potential controlled experiment by comparing the labor market outcomes of two older cohorts: e.g. those aged 26 to 33 and those aged 30 to 34. That is, we use different control and treatment groups where the control group is defined as those born between September 1971 and August 1975 and the treatment group is defined as those born between September 1975 and August 1979. The impact of the policy should be small and insignificant. Results are shown in the bottom panel "placebo" in Table 4. Neither of the coefficients are comparable to our main estimates in Table 2 in terms of magnitude, statistical significance or the sign of the coefficients. This confirms the validity of treating the variation in expansion density and cohorts as a natural experiment in our estimation strategy.

As discussed earlier, because we cannot directly capture individuals' high school graduation years, there could be cohorts born before August 1979 who were exposed to the expansion policy if they graduated from high school after September 1999 (Wu and Zhao, 2010). As a robustness check, we construct the control group as those born between September 1973 and August 1977 (i.e., the 1992 college cohort to the 1996 college cohort). Results of the overall policy effects are shown in the bottom panel "robustness" in Table 4. The coefficients and statistical significance are very similar to our main estimates in Table 2. Results for distributive effects (Appendix Table A1) also show that our results are robust, especially for males, even if we use an alternative control group (i.e. "pre-reform") cohorts. Our findings are consistent with Li, Whalley and Xing (2014), who suggest that the higher education expansion policy has a larger and more significant impact on males.

We also estimate both Equation (1) and Equation (2) for the high school graduate sample as a robustness check, because the policy expansion directly affected high school graduates eligible to go to college. Table A2 in the appendix indicates that our estimates are very robust.

The validity of the estimation approach rests on the assumption that differences in the timing of the implementation of expanded higher education are unrelated to differences in labor market conditions. In other words, for this identification strategy to be valid, the timing differences cannot be policy responses to different labor market conditions and related local economic conditions (Besley and Case, 2000). Aside from controlling for provincial level differences in variables that might potentially affect or be related to labor market outcomes, we also conduct a series of validity checks by examining the trend before and after the policy in areas with higher and lower expansion densities.

4.4 Interpretation of results

First of all, we find consistent evidence that expanding college enrollment reduced the labor force participation rate among females but not among males. This finding could also partly explain why we do not observe any statistically significant impact on women's unemployment rate but a lower wage level for those who are employed. Women either do not enter the labor market and stay inactive in the labor market, or they accept a lower wage in highly-skilled white collar jobs. The observation that women reduce their labor force participation after higher education expansion may reflect gender roles in Chinese society: while women can afford to forgo work, the cost of not working is too high for men. Given the traditional division of labor in Chinese culture, with men working outside the home and women taking care of household work (“Nan zhu wai, nu zhu nei”), we are interested in whether women residing in provinces with a

higher expansion intensity marry earlier (and thus have a lower labor force participation rate). Column (1) to Column (3) in Table 5 estimate higher education expansion's effect on "age at first marriage," the probability of being married as well as the probability of staying single. Results show that the increase in higher education supply does not seem to affect the age at first marriage for men or women. However, we do find some evidence that higher education expansion affects women's marriage decisions, in that women are more likely to stay single and less likely to marry after the reform. These findings are consistent with Wu and Liu (2014), though they find that the expansion decreased marriage rates for both male and female college graduates. Further, we run regressions on the major source of living and find that the more intense the higher education expansion, the less likely women are to rely on labor income as their main source of living, instead depending more on other family members (see columns 4 and 5 in Table 5). This is probably not surprising given that we have observed the negative policy effects on women's labor force participation rate.

Why might the higher education expansion policy reduce the probability of unemployment, especially for male students and high school graduates? And why might the negative effects on wages only exist for highly-skilled white-collar jobs?[10] One response to the first question is that higher education expansion could have been followed by an increase in demand for skilled (male) workers. This would not be surprising given the rapidly growing market economy in China following its speedy recovery from the Asian Financial Crisis in 1998 and its entrance into the World Trade Organization (WTO) in 2000. In fact, other countries in the Asian-

[10] To further explore these questions, one could analyze more outcomes of college enrollment along with types of institutions as in Hou and Ou (2015). However, our paper focuses on labor market outcomes. Further, Hou and Ou (2015) utilize the China Family Panel Studies, which contain more details on educational attainment, college major, and university type than the information provided by the 2005 mini-census.

Pacific region also experienced a dramatic expansion in tertiary education from 1999 to 2012, and statistics show that China's higher education expansion intensity and speed fall behind that of Japan, South Korea, Taiwan and Hong Kong (Mak and Wu, 2015). Furthermore, despite the expansion, as of 2010, the proportion of China's labor force with at least an upper secondary education was only about 24%, much lower than other middle-income countries such as Argentina (Khor et. al, 2015).

It is worth noting that despite the substantial increase in the supply of college graduates, returns to higher education are still high[11], and demand for higher education continues to increase (Li, Walley, and Xing, 2014; Meng, Shen and Xue, 2013). In particular, two factors seem to be driving the growth. First, going to college is a major channel for obtaining higher social status and better welfare in China. Chinese students have a particularly strong desire to attend college due to the thousand-year-old cultural role of education in facilitating upward social mobility (Chung and Lu, 2003). Additionally, students who approached college age after the 1999 higher education expansion reform also fell into the cohorts affected by the one-child policy,[12] and parents' willingness to invest in their children's education has been high for these groups. These parents have shown increasing willingness and greater ability to pay for higher education in a modern society, further ensuring that their children attain college degrees (Hou and Ou, 2015).

[11] Machin and McNally (2007) review labor market consequences of expanded higher education in countries around the world and find that despite some countries experiencing declining wage premiums for college education, all countries show positive returns to higher education.

[12] The one-child policy was implemented in 1979. Therefore, the first cohort after the one-child policy began university just around the time of expansion; that is, around 1999.

Regarding the question of why a negative wage effect only affects highly-skilled white-collar workers, there are multiple possible interpretations. First, it is possible that the increased supply of workers with a college education has lowered the bargaining power of college-educated job-seekers. College graduates have had to reduce their reservation wages when entering the labor market, especially in highly-skilled white-collar jobs (He and Mai, 2015). As we discussed previously, the cost-sharing of higher education after the expansion reform has placed a larger burden on families and individuals. Given the financial burden a family must bear to pay for four years of college, with or without loans, the opportunity cost of not working after completing college is thus very high. It is plausible that students would secure a job as soon as they are able to land one in the labor market, regardless of the wage. Therefore, the bargaining power of college graduates, especially the first cohorts following the reform, has been lower following the expansion.

Secondly, it is possible that the increased supply of higher education has reduced its quality.[13] If wages truly reflect workers' productivity and a lower quality of university education has reduced the productivity of college students, the higher education expansion policy would then lower wages for these young college graduates. Similarly, it is possible that the increased access to higher education implies an increased proportion of students of lower academic ability who gain admission to the higher education system (Chevalier and Lindley, 2009). These students would lower the average quality of the skilled labor force, and employers thus would

[13] Chevalier and Lindley (2009) mention two possible channels by which expansion could lower the quality of college education post-expansion: the first is that overcrowding and other quality issues associated with cost reduction prevent students from developing skills. The second is that due to cost-sharing of higher education, universities must attract more students to their programs, lowering educational standards. As a result, many college students do not acquire adequate skills to enter the labor market upon graduation.

not want to offer competitive starting wages (He and Mai, 2015), creating a negative wage effect more generally as a function of the higher education expansion policy.

To test whether the quality of higher education has decreased or whether student quality has decreased after the expansion reform, we run regressions of Equation 1 and 2 using the probability of being enrolled in an unemployment insurance scheme as an outcome variable. If the quality of college graduates has decreased, due to lower quality college education or to a lower quality of college students at intake, and college graduates are not as capable as high school or middle school graduates in terms of their employability or skills, employers might not want to offer job opportunities to college students but to their high school or middle school substitutes. If the unemployment probability is higher for college graduates following higher education expansion, then the probability of being enrolled in unemployment insurance could be higher.

Column 6 in Table 5 shows that the interaction coefficient for post-reform and higher education supply is -.260 (with a standard deviation of .091), implying that adding one university spot per student annually decreases the probability of enrolling in an unemployment insurance scheme by 26% for individuals in high school graduation cohorts from 1999 to 2001. Because the actual national increase in university spots is 0.22 per student, on average, the likelihood of enrolling in unemployment insurance decreases by 5.7 percent (.260×.22) for students who benefited from the higher education expansion. There is also statistically significant evidence of negative effects of the higher education expansion on both men and women. Because the likelihood of having unemployment insurance could correlate with individuals' career prospects,

the more promising one's career prospects, the less likely one would be to buy unemployment insurance. Our results could reflect two possibilities: one is that, as previously discussed, the quality of college graduates did not change or decline after the expansion reform. The other is that the labor market is prospective for college graduates. Even though supply has increased, demand is greater and college graduates are not worried about their job prospects.

5. Concluding Remarks

China's 1999 higher education expansion policy has made remarkable progress by substantially increasing universities spots. In this paper we use the 1% population survey data from 2005 to evaluate the impact of this expansion on various labor market outcome indicators. We are particularly interested in the heterogeneity of the policy's effects on male and female college students. Results from the analyses will enable policymakers and stakeholders to understand the specific ways in which the policy impacts different segments of the population. Similar to previous studies, we find consistent statistically significant negative policy effects on hourly earnings. However, we do not find that higher education expansion comes at a cost of increased unemployment. On the contrary, we find robust evidence that students who were living in provinces with access to more new university spots have a lower probability of unemployment. The paper offers some possible interpretations of our results, including the reflection that there is still a large demand for educated labor in China's fast-growing economy. The findings might have implications for the trade-off between quality and quantity with regard to the expansion policies' effects on human capital accumulation. However, our analysis on the

probability of being enrolled in unemployment insurance schemes does not seem to support the post-reform quality-reduction assumption. Rather, we think that the positive policy impact in terms of reduced unemployment illustrates both the strong demand for a skilled labor force and the economic benefit of higher education. Furthermore, highly-skilled white-collar jobs with reduced hourly wages may still be attractive to many college graduates. Going to college and working in highly-skilled white-collar jobs, even at a reduced wage, is still a major channel to obtaining higher social status in China. That hypothesis might also explain the observed increased demand for higher education in China despite the increased labor market competition due to the substantial increases in university attendance since the 1999 higher education expansion policy.

Similar to other studies utilizing the 2005 mini-census (Li, Whalley and Xing, 2014; Wu and Zhao, 2010), we analyze a sample of students who graduated at the beginning of the expansion period, and the outcomes measure their early labor market experiences. We do not have detailed information on which types of institutions these individuals attended, and thus cannot test whether the negative wage effects are correlated with the types of institutions attended (for instance, centrally controlled public universities, high cost first-tier public universities or private elite universities). Nonetheless, our results suggest that policymakers and universities could facilitate young college graduates' successful transition into the labor market, for example by providing career guidance and counseling programs to help college students, especially female students, acquire the knowledge and skills needed to improve their career readiness, encouraging young women to participate in the labor market, helping college students understand career choices and determine realistic wage expectations, and establishing

connections between college curricula and local labor markets so students can acquire the skills necessary for their future work.

Lastly, the methodology and framework used in our study could also be useful in the study of the labor market consequences of higher education expansion in other developing countries with similar education financing schemes and high income inequality.

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Table 1: Summary Statistics

Variables	Control (Before reform)	Treatment (After reform)	T-statistics
Outcomes			
Labor force participation	0.862	0.785	26.35***
	(0.002)	(0.002)	
Unemployment	0.088	0.142	-20.07***
	(0.002)	(0.002)	
White-collar highly-skilled jobs	0.458	0.457	0.25
	(0.003)	(0.003)	
White-collar low-skilled jobs	0.303	0.324	-5.06***
	(0.003)	(0.003)	
Log of hourly wage	1.745	1.683	9.70***
	(0.004)	(0.005)	
Background			
High school graduate	2.222	2.263	-5.81***
	(0.005)	(0.005)	
Female	0.477	0.515	-8.45***
	(0.003)	(0.003)	
Ethnic minority	0.042	0.041	0.77
	(0.001)	(0.001)	
Age	27.737	23.845	365.65***
	(0.007)	(0.008)	
Years of education	12.549	1.623	3.39***
	(0.015)	(0.016)	
Probability of pursuing a postgraduate degree	0.129	0.118	1.24
	(0.001)	(0.001)	
Parent's highest level of education in years	9.496	10.015	-11.41***
	(0.036)	(0.028)	
Regional (changes during 1998-2001)			
ΔSupply	0.224	0.240	-13.88***
	(0.001)	(0.001)	
High school graduate	3.873	3.840	1.02
	(0.024)	(0.022)	
Unemployment	0.154	0.180	-8.15***
	(0.002)	(0.002)	
Per capita disposal income	1658.462	1779.322	-12.26***
	(6.892)	(7.051)	
Tuition and fees	1858.950	1926.886	-6.74***
	(7.321)	(6.938)	
GDP per capita	1433.845	1427.138	0.42
	(11.960)	(10.297)	
College financial aid	-55.107	-45.099	-4.43***
	(1.636)	(1.555)	
budgeted per pupil spending (Higher Ed)	-31.510	152.944	-6.90***
	(19.628)	(18.132)	
% of labor force enrolling in unemployment insurance	1.541	1.428	0.133**
	(0.040)	(0.035)	

Note: Source: China's 2005 1% Population Sample Survey. Except for the log of the hourly wage, the sample size is 56,306. The sample size for the log of the hourly wage is limited to employees and is 43,274.

Table 2: Overall Effects of Higher Education Expansion on Labor Market Outcomes

					Log of hourly wages		
	Labor Force Participation	Unemployment	White-collar Highly-skilled Jobs	White-collar Low-skilled Jobs	Total	White-collar Highly-skilled Jobs	White-collar Low-skilled Jobs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post-reform*ΔSupply	-0.198*	-0.094*	0.027	-0.136*	-0.321***	-0.407***	-0.241
	(0.099)	(0.049)	(0.087)	(0.080)	(0.095)	(0.147)	(0.177)
No. of observations	68,173	56,306	49,995	49,995	43,274	22,159	11,131

Note: Source: China's 2005 1% Population Sample Survey. Each cell represents the coefficient of the higher education supply with the post-reform dummy. Higher education supply is the average yearly increase in the number of university spots from 1998–2001 at the provincial level divided by the population of high school graduates in 1998. Models also include birth-cohort dummies, birth-province dummies, a male dummy, age when entering college, an ethnicity dummy, a high school graduate dummy, and regional controls. The sample is limited to those whose current hukou registration province is the same as the province of residence (currently, one year ago and five years ago at the survey year) and non-agricultural hukou holders. Regions with a high density of ethnic minorities are excluded: this includes Xinjiang, XiZang, NingXia, Qinghai, Guizhou, and Yunnan. Standard errors in brackets are clustered at the provincial and the college cohort level. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 3: Distributive Effects of Higher Education Expansion on Labor Market Outcomes

					Log of hourly wages		
	Labor force participation	Unemployment	White-collar, Highly-skilled Jobs	White-collar, Low-skilled Jobs	Total	White-collar, Highly-skilled Jobs	White-collar, Low-skilled Jobs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
By Educational Attainment							
Middle School and below	-0.072	0.055	0.222	-0.031	0.395	0.548	0.232
	(0.186)	(0.153)	(0.142)	(0.197)	(0.458)	(0.811)	(0.455)
High School	0.006	-0.157**	0.017	-0.129	-0.098	-0.272	0.085
	(0.115)	(0.067)	(0.103)	(0.115)	(0.166)	(0.251)	(0.226)
College and above	-0.087	-0.144**	0.1014	-0.175	-0.434**	-0.444**	-0.364
	(0.187)	(0.065)	(0.130)	(0.120)	(0.203)	(0.180)	(0.336)
By Gender							
Male	-0.089	-0.138**	-0.026	-0.072	-0.314***	-0.369**	-0.238
	(0.104)	(0.058)	(0.101)	(0.115)	(0.102)	(0.151)	(0.229)
Female	-0.308**	-0.036	0.078	-0.192*	-0.354***	-0.422**	-0.232
	(0.125)	(0.071)	(0.099)	(0.091)	(0.130)	(0.188)	(0.207)
No. of observations	68173	56306	49995	49995	43274	22159	11131

Note: Source: China's 2005 1% Population Sample Survey. Each cell in the upper panel "By Educational Attainment" are the estimated coefficients of interactions of change in higher education supply and post-reform dummy with individual educational attainment. Each cell in the lower panel "By Gender" represents the estimated coefficients of interactions of change in higher education supply and post-reform dummy with gender. For details see note in Table 2. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 4: Effects of Higher Education Expansion on Labor Market Outcomes (Robustness Checks)

					Log of hourly wages		
	Labor Force Participation	Unemployment	White-collar, Highly-skilled Jobs	White-collar, Low-skilled Jobs	Total	White-collar, Highly-skilled Jobs	White-collar, Low-skilled Jobs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Robustness							
Post-reform*ΔSupply	-0.204***	-0.059	-0.053	0.020	-0.277***	-0.265*	-0.173
	(0.096)	(0.051)	(0.083)	(0.077)	(0.092)	(0.144)	(0.211)
No. of observations	71674	59261	52921	52921	45385	22905	11483
Placebo							
Post-reform*ΔSupply	-0.058	0.124***	-0.084	0.069	0.037	0.200	0.165
	(0.040)	(0.045)	(0.071)	(0.068)	(0.089)	(0.120)	(0.187)
No. of observations	80886	69533	63716	63716	53381	26798	12578

Note: Source: China's 2005 1% Population Sample Survey. Details please see note under Table 2. The panel "robustness" uses a different definition for the post-reform dummy, where the control group cohorts include those who were born between September 1973 and August 1977. The panel "placebo" uses different control and treatment groups where the control group is defined as those who were born between September 1971 and August 1975 and the treatment group is defined as those who were born between September 1975 and August 1979. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 5: Effects of Higher Education Expansion on Demographic and Social Outcomes

	Age at first marriage	Being married	Being Single	Labor income as main source of living	Other family members' income as main source of living	Enrolled in Unemployment Insurance
	(1)	(2)	(3)	(4)	(5)	(6)
Overall effects						
Postreform*ΔSupply	-0.681	-0.194*	0.201***	-0.142	0.130	-0.260***
	(0.461)	(0.076)	(0.074)	(0.091)	(0.083)	(0.091)
By Gender						
Male	-0.489	-0.064	0.065	0.012	-0.035	-0.271***
	(0.628)	(0.113)	(0.113)	(0.108)	(0.103)	(0.104)
Female	-0.718	-0.315***	0.328***	-0.297**	0.295**	-0.250**
	(0.570)	(0.090)	(0.089)	(0.126)	(0.118)	(0.111)
No. of observations	37132	68173	68173	68173	68173	65015

Note: Source: China's 2005 1% Population Sample Survey. Each cell in the upper panel "overall effects" is the coefficient of the change in higher education supply with the post-reform dummy. Each cell in the lower panel "By Gender" represents the estimated coefficients of interactions of change in higher education supply and post-reform dummy with gender. * significant at 10%, ** significant at 5%, *** significant at 1%.

Appendix Table A1: Robustness checks: Distributive Effects of Higher Education Expansion on Labor Market Outcomes, alternative measure for pre-reform cohorts.

					Log of hourly wages		
	Labor Force Participation	Unemployment	White-collar Highly-skilled Jobs	White-collar Low-skilled Jobs	Total	White-collar Highly-skilled Jobs	White-collar Low-skilled Jobs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
By Educational Attainment							
Middle School and below	-0.112	0.121	0.196	0.069	0.399	0.839	0.407
	(0.175)	(0.148)	(0.132)	(0.175)	(0.443)	(0.756)	(0.456)
High School	-0.025	-0.092	-0.065	-0.006	0.093	-0.010	0.350
	(0.113)	(0.065)	(0.104)	(0.114)	(0.157)	(0.253)	(0.278)
College and above	-0.071	-0.126*	0.032	-0.076	-0.448**	-0.350*	-0.477
	(0.181)	(0.066)	(0.125)	(0.120)	(0.198)	(0.147)	(0.340)
By Gender							
Male	-0.112	-0.106*	-0.057	0.027	-0.349***	-0.411**	-0.119
	(0.101)	(0.060)	(0.102)	(0.117)	(0.106)	(0.160)	(0.264)
Female	-0.294**	0.005	-0.058	-0.058	-0.236**	-0.108	-0.208
	(0.119)	(0.070)	(0.101)	(0.096)	(0.114)	(0.161)	(0.242)
No. of observations	71674	59261	52921	52921	45385	22905	11483

Note: Source: China's 2005 1% Population Sample Survey. This panel uses a different definition for the post-reform dummy, where the control group cohorts include those who were born between September 1973 and August 1977. For details see note in Table 3. * significant at 10%, ** significant at 5%, *** significant at 1%.

Appendix Table A2: Overall Effects of Higher Education Expansion on Labor Market Outcomes, High School Graduates

					Log of hourly wages		
	Labor Force Participation	Unemployment	White-collar Highly-skilled Jobs	White-collar Low-skilled Jobs	Total	White-collar Highly-skilled Jobs	White-collar Low-skilled Jobs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overall effects	-0.109	-0.169***	0.072	-0.116	-0.247**	-0.387**	-0.039
	(0.093)	(0.059)	(0.107)	(0.087)	(0.110)	(0.156)	(0.214)
By Gender							
Male	0.014	-0.224***	0.038	-0.055	-0.238**	-0.382**	0.033
	(0.096)	(0.067)	(0.122)	(0.111)	(0.113)	(0.159)	(0.255)
Female	-0.231**	-0.110	0.113	-0.172*	-0.268*	-0.370*	-0.107
	(0.118)	(0.079)	(0.116)	(0.097)	(0.149)	(0.202)	(0.252)
No. of observations	51042	43786	39636	39636	36139	21078	8414

Note: Source: China's 2005 1% Population Sample Survey. For details see note in Table 5. * significant at 10%, ** significant at 5%, *** significant at 1%.

Appendix Table A4: Intensity of Higher Education Expansion by Province/Region

Region/Province	Changes in higher education supply 1998–2001
Beijing	0.43
Tianjin	0.39
Hebei	0.21
Shanxi	0.17
Inner Mongolia	0.15
Liaoning	0.21
Jilin	0.19
Heilongjiang	0.23
Shanghai	0.31
Jiangsu	0.22
Zhejiang	0.25
Anhui	0.19
Fujian	0.16
Jiangxi	0.18
Shandong	0.17
Henan	0.19
Hubei	0.21
Hunan	0.17
Guangdong	0.16
Guangxi	0.15
Hainan	0.17
Chongqing	0.32
Sichuan	0.20
Shaanxi	0.26
Gansu	0.18
National Average	0.22

Note: The column "changes in higher education supply 1998–2001" is the average yearly increase in the number of university spots from 1998 to 2001 divided by the total number of high school graduates in 1999 at the provincial level.