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Does attending elite colleges pay in China?

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ABSTRACT

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We estimate the return to attending elite colleges in China using 2010 data on fresh college graduates. We find that the gross return to attending elite colleges is as high as 26.4%, but this figure declines to 10.7% once we control for student ability, major, college location, individual characteristics, and family background. The wage premium is larger for female students and students with better-educated fathers. We also find that the human capital and experiences accumulated in elite colleges can explain almost all the wage premium. *Journal of Comparative Economics* **40** (1) (2012) 78–88. School of Economics and Management, Tsinghua University, Beijing 100084, China.

1. Introduction

The influence of college quality over the future income of college graduates in advanced countries such as the United States has been well documented, though the findings remain inconclusive. Using data from the National Longitudinal Survey of Youth, Daniel et al. (1997) find that college quality has a substantially positive impact on young men's wages. This positive impact remains in studies that control for selection bias via either the twins method (Behrman et al., 1996) or structural estimation (Brewer et al., 1999). By contrast, a recent study by Dale and Krueger (2011) finds that the return to college selectivity does not statistically differ from zero, when they compare elite college graduates to those who were admitted by but chose not to attend elite colleges.[1]

However, little is known about the return to attending elite colleges in developing countries such as China.[2] Given that educational resources are highly limited in developing countries, governments are compelled to make a tradeoff between improving college quality and expanding access to colleges. Students (and their parents) in these countries also devote considerable effort and resources to gaining entry to elite colleges.

In this paper, we estimate the return to attending elite colleges in China using data from the 2010 Chinese College Students Survey (CCSS). Defining elite colleges using the official classification of the Chinese government (i.e., colleges belonging to the "211 Program"[3]), we examine whether fresh graduates from elite colleges are offered a wage premium as they enter the labor market. Estimating the return to elite colleges in China can help us to evaluate the quality of elite education, which will be

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[1] This new study confirms their early findings in Dale and Krueger (2002).

[2] In contrast, there does exist some evidence supporting that better school quality has positive effects on students' academic performance in developing countries (Jackson, 2010a,b; MacLeod and Urquiola, 2009; Pop-Eleches and Urquiola, 2011).

[3] See detailed description of the 211 Program in the next section.

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a key determinant of innovation and China's further development. To get its labor force prepared for future development, China has aggressively expanded its higher education over the past decade, with college enrollment having increased by 293% from 1999 to 2009. However, it remains unknown whether the quality of higher education has also improved with the expansion of quantity.

We find that going to elite colleges indeed pays in China. The wage premium of attending elite colleges is as high as 26.4% in our baseline regression, which includes only a dummy variable for attending elite colleges. The wage premium drops to 20.4% after we include the total College Entrance Examination (CEE) score, which is the most important selection variable for college admission, together with major dummies and college location dummies in the regression. The wage premium decreases further to 10.7% after we control for students' individual characteristics and family backgrounds, including gender, age, father's schooling, parental income, parental political status, whether the family resides in the local province, whether students have urban *hukou* before entering college, and number of siblings. We also find that the wage premium for attending elite colleges is 21.8% points higher for female students and 8.2% points higher for students with better-educated fathers.

The detailed information on college activities in our survey also enables us to examine whether the human capital and experiences accumulated by students in elite colleges can account for the remaining wage premium. We find that elite college students have higher College English Test (CET) scores when we control for the scores of the CEE, and including this post-CEE English score in the wage equation reduces the coefficient of the elite college dummy. This result implies that elite college students develop more solid human capital attributes than do non-elite college students. When we further include other variables (such as dummies for being a Chinese Communist Party (CCP) member, a leader of student union, having a technical certificate, and having part-time work experience) that represent experiences accumulated in colleges in the wage regression, the wage premium drops to zero, suggesting that the human capital and other experiences accumulated in elite colleges can largely, if not completely, explain the wage premium.

Although our paper builds upon the literature on the return to elite education, it also differs from earlier studies in certain respects that may be unique to the specific circumstances of China. First, studies that use data from developed countries reveal mixed results. Monks (2000) and Brewer et al. (1999) find significantly positive returns to college selectivity after controlling for selection effects, but Dale and Krueger (2002, 2011) find that estimated returns to college selectivity fall to zero after the selection problem is corrected. Our findings for China show that entering elite colleges pays insofar as it applies to the specific context of a developing country. Second, our detailed data on college activities enables the examination of why attendance at elite colleges pays, a perspective that is new in literature. Finally, our identification approach builds upon the methods used in several earlier studies. Monks (2000) and Brewer et al. (1999) use students' high school scores, standardized test scores, and parental education and incomes as control variables in regressions. Dale and Krueger (2002, 2011) control for the selection problem by including a set of dummies that indicate the colleges that students apply to and those that accept or reject these applicants.[4] With respect to these studies, we control for selection bias using the CEE score and a rich set of family background variables.

The current work also extends the previous literature on estimating returns to education in China. Earlier studies (Li and Zhang, 1998; Fleisher and Wang, 2005; Yang, 2005) find that the returns to education were low in the 1980s and 1990s, but more recent investigations (e.g. Zhang et al., 2005) find that the returns to education in urban China increased dramatically by 2002. The increase in return to education is due to the rising demand for skills given the institutional reforms and technological changes that occurred in the 1990s in China (Liu et al., 2010).[5] Most recently, Fleisher et al. (2011) have estimated the returns to education by calculating the marginal productivity of workers with different educational levels. They find that an additional year of schooling raises marginal productivity by 30.1%, and that the effect varies substantially across the ownership classes of firms.

The remainder of the paper is structured as follows. Section 2 introduces China's CEE and college admissions system. Section 3 presents the empirical strategy adopted in this study. Section 4 describes the CCSS survey and data. Sections 5 provides the estimation results on the return to attending elite colleges, and Section 6 discusses whether the human capital and other experiences accumulated in elite colleges can explain the estimated wage premium. Section 7 discusses the remaining biases and Section 8 concludes.

2. Elite colleges and college admissions in China

A total of 2305 colleges were registered in 2009 in China and the quality of these colleges varies substantially.[6] A commonly accepted pool of colleges that are regarded as elite institutions in China comprise those belonging to the 211 Program.[7] In

[4] Other identification methods include the IV strategy (Behrman et al., 1996; Long, 2008), propensity score matching (Black and Smith, 2004), regression discontinuity design (Hoekstra, 2009), and using twin/sibling data (Behrman et al., 1996; Lindahl and Regner, 2005).

[5] There are some other researchers studying the cost of the Cultural Revolution in terms of education (e.g., Meng and Gregory, 2002; Zhang et al., 2007) or using the Cultural Revolution as a natural experiment to estimate the returns to education (e.g., Giles et al., 2008). Although Meng and Gregory (2002) find that the Cultural Revolution imposed huge costs to the education of cohorts affected by it, Zhang et al. (2007) find that the Cultural Revolution has not had a significantly negative effect on the returns to schooling of the cohort experiencing it. Giles et al. (2008) find that the return to a year of schooling is 7.6% using the Cultural Revolution as a natural experiment.

[6] This figure is taken from the website of the Chinese Ministry of Education (www.moe.edu.cn).

[7] This is different from previous research, which uses average college characteristics (e.g., average SAT score) to define college quality. Given that colleges in the 211 Program have higher CEE scores, using scores to define elite colleges does not change our results.

the 1990s, the Chinese government put forward a proposal to "enhance the quality of 100 colleges in the 21st century,"[8] which was later called the 211 Program. Although the proposal indicates only 100 colleges, in practice, 112 are covered by this program. The colleges covered by the Program have longer histories and offer high-quality education; more important, they also receive more financial support from the government. In 2008 for example, 85% of the highest ranked majors in China and 96% of national laboratories were reported to fall under these colleges, and the research funding received by these institutions accounted for 70% of total research funding received by all Chinese colleges.[9]

To gain admission into these elite colleges, Chinese students are required to take the national standard examination, called the CEE or *gaokao* in Mandarin. The total CEE score is the main criterion for college admissions, and the most important benchmark for evaluating the suitability of the majority of students.[10] Because the college entrance exam is fate determining, students work very hard during their 3 years in high school in an attempt to improve their exam-taking skills. Students begin exhaustive preparations for the CEE as early as junior high school or primary school. Given that performing excellently in the CEE is a primary goal and all students labor to improve their scores, the CEE scores are essentially good measures of student ability or IQ. In Chinese society, CEE scores are well accepted as direct measures of intelligence.

A distinct feature of Chinese college admissions is that colleges are categorized into different tiers and those belonging to a higher tier are afforded first priority in admitting students. In all provinces, elite colleges fall under the first tier and are therefore allowed to be the first to choose among applicants. Students fill in a form, in which they list their college preferences (4–6 in each tier) and favored majors in order of priority. The timing of turning in the preference form varies by province: it may be submitted prior to the exam, after the exam but prior to being informed of the scores, or after learning of the scores.

The admissions procedure that has prevailed in most provinces is similar to the Boston Mechanism. In the first round, each college considers only the students who list it as their first choice. An applicant with a total CEE score above its threshold score is accepted; an applicant with a score below the threshold is rejected and placed in a pool of candidates for the college that is next on his or her list of options. Only if there are remaining slots after the first round will a college consider admitting students who list it as their second or third choice. Given the shortage of high-quality institutions, students have little chance for admission by their second-choice colleges if they fail to enter the first-choice colleges. Therefore, filling in the college preference form requires certain skills and strategies, and two students with the same total CEE scores may end up in very different colleges. Once a student is admitted by a college, the selection process is terminated and his/her files will no longer be accessible to other colleges. This protocol indicates that a student obtains, at most, one admission offer. Finally, a student decides whether to attend the college that has admitted him/her; turning down an offer would mean that the student will not be going to a Chinese college that year.

3. Empirical model

The primary obstacle to estimating the labor market return to attending elite colleges is that not all of the factors that drive students to attend an elite college are observed by econometricians, and unobserved student characteristics are likely to be correlated with both college selectivity and earnings. Suppose that the equation linking earnings to student characteristics is

$$\ln W_i = \beta_0 + \beta_1 E_i + \beta_3 X_{1i} + \beta_4 X_{2i} + \varepsilon_i, \tag{1}$$

where W is the wage offered to fresh college graduates for their first jobs, E is an indicator variable for attending elite colleges, X_1 and X_2 denote two sets of student attributes that affect earnings, and ε represents an idiosyncratic error term that is uncorrelated with other explanatory variables. X_1 represents observable characteristics, such as CEE scores. X_2 represents variables that are unobservable to researchers, such as student motivation, risk preference, and private knowledge of one's potential ability (which partly determines to which college the students apply). X_1 and X_2 influence the set of colleges (and majors) that students apply to and which school they eventually attend. The parameter β_1 depicts the monetary payoff to attending an elite college.

Given that admission hinges largely on the total CEE score, we have good reason to believe that the majority of the potential selection bias stems from selection on observables, i.e., the CEE score. In an ideal case in which students with high scores always apply to better schools than do students with low scores, college admission will depend entirely on their CEE scores. Therefore, a situation characterized by "pure selection on observables" arises. In this case, we can control for selection by including a correctly specified function of the selection variable, CEE score, in X_1 of Eq. (1). Our proposed solution to the selection-on-observables problem is to include a sufficiently flexible nonlinear function (high-order polynomials, for example) of the CEE score. In our case, using a linear term of the score works similarly to employing higher order polynomials; we simply use the total CEE score in all the regressions.

[8] The Chinese government is scheduled to infuse about 3 billion yuan to these colleges in the first phase (1997–2001), about 6 billion yuan in the second phase (2002–2006), and about 10 billion yuan in the third phase (2007–2011).

[9] People's Daily Online (http://english.people.com.cn/90001/6381319.html).

[10] Applicants to some special programs are screened by additional criteria: some art departments (e.g., audition), military and police schools (political screening and physical exam), and some sports programs (tryouts).

In reality, however, we may also have selections on unobservables in the wage equation because unobserved student attributes X_2, such as motivation and risk preference, can partially influence college attendance through college applications. If at least some of the same unobserved student characteristics are rewarded in the labor market, the coefficient on attending elite colleges can still be biased.

An ideal method for addressing selections on unobservables is to implement a regression discontinuity (RD) design.[11] If every student applies to both elite and non-elite colleges, we can identify the causal effect of elite college attendance using the discontinuity of the probability of attending an elite college around the selection threshold. Unfortunately, the dataset used in the present analysis cannot sufficiently satisfy the demanding sample size requirement of a meaningful RD analysis.

We therefore resort to our well-designed survey instrument to tackle selections on unobservables. Assuming that a student's motivation, risk preference, etc., are partly determined by his or her individual characteristics and family background, we can address the selection issue by incorporating a set of highly detailed individual and family characteristics into the Mincer regression to absorb some of the effect of the unobserved X_2. This assumption is reasonable because students choosing colleges together with their parents is a common practice in China.

One caveat is that although we include a rich set of variables in the regressions, the effect of unobserved variables, such as a student's motivation and risk preference, may not be wholly absorbed. In this case, our estimates are still biased. If the unobserved variables that help students enter elite colleges also help them earn higher wages in the labor market, then our estimate of wage premium for elite college students would be an upper bound of the true wage premium.

4. Survey and data

The data that we use are derived from the first round of the CCSS, which was carried out by the China Data Center of Tsinghua University in May and June 2010. The sampling method used is stratified random sampling, with locations (Beijing, Shanghai, Tianjin, Northeastern China, Eastern China, Central China, and Western China)[12] and type of colleges (Tiers 1–7 colleges) as stratifying variables. Out of 2305 colleges in China, we randomly select 100 colleges that serve as the final sample of the CCSS. Sampling of students within a college is random.

As a pretest, the first-round survey covers 19 colleges selected from the full sample of 100, about half (10) of which are elite colleges or covered by the 211 Program (including four colleges covered by the 985 Program[13]). We intentionally oversample elite colleges to pretest our survey instruments and organizations. In each college, we randomly select around 300 students from the population of graduating classes. A total of 6059 students from graduating classes are selected, including 3167 from elite colleges and 2892 from other colleges. Among the nine non-elite colleges, six are public colleges (2201 students), two are private colleges (415 students), and one is a vocational college (276 students). The sampled colleges are located in 11 provinces, covering 6 out of the 7 geographical areas: North, Northeast, Central, East, Southwest, and Northwest.

We design the questionnaire collaboratively with experts in other disciplines such as sociology and education. The questionnaire not only collects basic information, such as individual characteristics and family backgrounds, but also contains questions about CEE scores, college activities, as well as student placement after graduation.

The survey work in each college is managed by one to three college administrators in charge of teaching or student activities. We train these survey administrators in Beijing in several days of intensive meetings. The students are asked to complete the questionnaires, after which the questionnaire forms are placed into coded envelops to guarantee anonymity. The submitted questionnaires are then collected by the survey administrators in the college. The survey is conducted with considerable care, with our survey team closely monitoring the survey in each college and data entry process.

The summary statistics reported in Table 1 show that students from elite colleges are offered higher compensation. As shown by the top panel of Table 1, about 52% of the students are from elite colleges. This figure reflects the fact that our survey oversampled elite colleges; therefore, in all the regressions shown in Sections 5 and 6, we use a weight to adjust the sample.[14]

In this paper, wage is defined as the highest offer received by a student at the time of the survey. On average, about 49% of students report having wages values, while the percentage of students that reported having wages values is lower in elite colleges than in non-elite colleges (44% vs. 54%). The difference is significant at the 5% level.[15] According to the students that reported having wage values, the wage offer for the entire sample is 2153 yuan, but the offer to students from elite colleges is 28% higher than that to students attending non-elite institutions (2427 vs. 1903). The difference is significant at the 1% level. Although this simple *t*-test is revealing, we resort to multiple regressions in the succeeding sections to examine whether the difference remains after we control for other covariates in the wage equation.

[11] Employing the regression discontinuity design, Hoekstra (2009) and Saavedra (2009) show that college selectivity has a positive effect on earnings early in people's careers.

[12] In the sampling process, we separate these three metropolises (Beijing, Shanghai, and Tianjin) from the rest of China because these cities have an extremely large concentration of colleges, especially top universities.

[13] On 4 May 1998, then-president Jiang Zemin proposed that China needed to build up world-class universities during the Peking University Centenary Celebration. Subsequently, the Chinese government launched a program to increase financial support for elite colleges. This program is typically referred to as the 985 Program. In practice, 39 colleges are covered by this program. All colleges covered by the 985 Program must also be covered by the 211 Program.

[14] The weight is constructed as the number of elite (non-elite) colleges in the population represented by the number of elite (non-elite) colleges in our sample. We use the "pweights" option in STATA syntax.

[15] This may lead to a selection problem, discussed in Section 7.

Table 1
Summary statistics (to be continued on the next page).

Variables	Whole sample	Elite colleges	Non-elite colleges	Difference
Panel A: Individual characteristics				
Ratio of elite college students	0.523			
	(0.500)			
Ratio of students having wage	0.487	0.444	0.535	−0.090
	(0.500)	(0.497)	(0.499)	(7.07)**
Wage	2153.047	2426.652	1902.792	523.861
	(1786.929)	(1951.435)	(1581.628)	(65.288)***
Female = 1	0.438	0.378	0.504	−0.126
	(0.496)	(0.485)	(0.500)	(9.92)**
Age	22.903	22.855	22.955	−0.100
	(0.986)	(0.957)	(1.015)	(3.94)**
Father's years of schooling	10.864	11.044	10.660	0.384
	(3.211)	(3.386)	(2.990)	(4.54)**
Parent is cadre = 1	0.142	0.174	0.107	0.067
	(0.349)	(0.379)	(0.309)	(7.48)**
Parental income	41281.22	42003.79	40461.93	1541.857
	(76762.8)	(67508.51)	(86066.77)	(0.74)
Residing in the local province = 1	0.571	0.457	0.697	−0.240
	(0.495)	(0.498)	(0.460)	(18.09)**
Having urban hukou before college = 1	0.451	0.476	0.424	0.052
	(0.498)	(0.500)	(0.494)	(4.02)**
Number of siblings	0.850	0.830	0.874	−0.044
	(0.929)	(0.934)	(0.923)	(1.66)
Panel B: CEE scores				
Total	0.000	0.390	−0.433	0.823
	(0.997)	(0.906)	(0.900)	(34.20)**
Chinese	0.000	0.166	−0.184	0.350
	(0.997)	(1.000)	(0.946)	(13.46)**
Mathematics	0.000	0.239	−0.266	0.504
	(0.997)	(0.992)	(0.919)	(19.72)**
English	0.000	0.245	−0.273	0.518
	(0.997)	(0.962)	(0.949)	(20.28)**
Composite test	0.000	0.294	−0.327	0.620
	(0.997)	(0.938)	(0.944)	(24.69)**
Panel C: Human capital gained in colleges				
CET scores	0.000	0.242	−0.288	0.531
	(1.000)	(0.976)	(0.951)	(19.20)**
Having technical certificate = 1	0.236	0.216	0.253	−0.038
	(0.424)	(0.411)	(0.435)	(2.90)**
Being a party member = 1	0.364	0.435	0.287	0.148
	(0.481)	(0.496)	(0.453)	(12.03)**
Being a leader for student unions = 1	0.678	0.724	0.627	0.097
	(0.467)	(0.447)	(0.484)	(7.82)**
Having part-time work experience = 1	0.734	0.722	0.748	−0.026
	(0.442)	(0.448)	(0.434)	(2.23*

Notes: Reported in parentheses are standard deviations. For the cross group differences.
* Statistical significance at the 10% level.
** Statistical significance at the 5% level.
*** Statistical significance at the 1% level.

Students of elite colleges also differ from those of non-elite colleges in terms of personal and family characteristics (Panel A of Table 1). Students from the former are less likely to be female than those from the latter (37.8% vs. 50.4%), suggesting that females continue to encounter difficulties in gaining entry into elite colleges in China. The two groups have similar ages, around 23 years. Elite college students also have better family backgrounds than do students from non-elite colleges: their fathers have obtained more schooling (11.0 vs. 10.7 years), their parents are more likely to be cadres (17.4% vs. 10.7%), they have higher family incomes (42,004 vs. 40,462), and exhibit a larger likelihood of having urban *hukou* before entering college (47.6% vs. 42.4%). However, elite college students are less likely to reside in local provinces (45.7% vs. 69.7%) and have fewer siblings (0.83 vs. 0.87).

Panel B shows the CEE scores. All the scores are normalized using the mean and standard deviation of the scores of students who take the same type of examination in the same province, with the following formula: (individual score − mean sore)/standard deviation. The average values of these scores for the sample are all zero. Columns 2–4 show that the scores of elite college students are significantly higher than those of non-elite college students, reflecting the higher threshold scores in admission to elite institutions.

Panel C reports the human capital and experiences accumulated during college, including English test scores, technical certificates, work experience in college, membership in the Chinese Communist Party (CCP), and leadership in student unions. Compared with students from non-elite colleges, those from elite colleges have significantly better English scores and are more likely to be party members and/or leaders of student unions in college. However, they are less likely to have technical certificates or part-time work experience.

5. Return to attending elite colleges

5.1. Main results

In Table 2, we report the results from estimating Eq. (1). The dependent variable is the log of monthly wage for the first job offer. For all the regressions, we report standard errors that are calculated by clustering over colleges, and as mentioned earlier, we use a weight to address the potential problem of oversampling elite colleges. For brevity, we show only the coefficient of the elite college dummy but not those of the other control variables. The complete set of coefficients is available upon request.

The pay premium associated with elite colleges is large. In column 1, we report a regression that has only one covariate: the elite college dummy. The coefficient of the elite college dummy is 0.264, which is statistically significant at the 1% level, indicating that the monthly wages of students from elite colleges are, on average, 26.4% higher than those of students from other colleges.

However, the estimated wage premium from the simple regression cannot be wholly attributed to elite colleges because elite college students may differ from non-elite college students in other aspects. For example, elite colleges may be located in provinces that have higher wage levels in general, the majors that students choose in elite colleges and non-elite colleges may also differ, and elite college students may be different from non-elite college students with respect to their abilities. To address these concerns, we control for a set of dummies for the provinces where these colleges are located, a set of dummies for student majors, and total CEE scores. Column 2 in Table 2 shows the estimated wage premium earned by elite college students. The coefficient of elite college dummy is 0.204 and significant at the 5% level.

Although total CEE scores are the most important factor that determines whether a student can enter elite colleges, other variables may possibly affect the student-college matching process, especially from the student side. In particular, student or family characteristics may influence the decision on which colleges a student applies to. One advantage of this study is that the CCSS comprises substantive information on students' family backgrounds, such as parental incomes and parental education, which are also included in previous studies (Monks, 2000; Dale and Krueger, 2002, 2011). Moreover, we collect information on parental political status, which may facilitate student entry into elite colleges and the acquisition of higher wages once the students join the labor market. Other information collected by the survey, such as the number of siblings and whether the student have urban *hukou* before entering college, may also affect student college applications.

Therefore, in column 3, we add to the regression variables of individual and household characteristics, including a female dummy, age, a dummy for having cadre parents, father's years of schooling, log value of parental incomes, a dummy for having urban *hukou* before entering college, a dummy for residing in local province, and number of siblings. The coefficient on elite college dummy decreases to 0.107, which is significant at the 10% level. It indicates that elite college students earn incomes that are 10.7% higher than those of non-elite college students in their first job, which is equivalent to the return to about one and a half years of schooling in China (Zhang et al., 2007). The coefficient shown in column 3 is our preferred estimate of wage premium earned by elite college students.

Table 2
Effects of attending elite colleges on first job wage.

	Dependent variable: log(monthly wage)		
	(1)	(2)	(3)
Elite college = 1	0.264	0.204	0.107
	(0.087)***	(0.072)**	(0.059)*
CEE total scores	NO	YES	YES
Individual and household characteristics	NO	NO	YES
Major dummy	NO	YES	YES
College location dummy	NO	YES	YES
Observations	2953	2761	1781
R-squared	0.01	0.13	0.20

Standard errors are shown in parentheses and calculated by clustering over colleges.
Note: (1) All regressions include a constant term. (2) Individual and household characteristics include a female dummy, age, a dummy for having cadre parents, father's years of schooling, log value of parental incomes, a dummy for having urban *hukou* before entering colleges, a dummy for residing in local province, and the number of siblings.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 3
Effects of attending elite colleges on first job wage by subgroups (dependent variable: Log(monthly wage)).

	(1)	(2)	(3)	(4)	(5)	(6)
	By gender		By father's schooling years		By parental income	
	Female	Male	Top half	Bottom half	Top half	Bottom half
Elite college = 1	0.257	0.039	0.158	0.076	0.120	0.141
	(0.055)***	(0.071)	(0.071)**	(0.077)	(0.066)*	(0.078)*
Observations	710	1071	940	841	847	934
R-squared	0.19	0.10	0.23	0.19	0.20	0.24

Standard errors are shown in parentheses and calculated by clustering over colleges.
Note: (1) All regressions include a constant term, CEE total scores, individual and household characteristics, major dummies and college location dummies. (2) Individual and household characteristics include a female dummy, age, a dummy for having cadre parents, father's years of schooling, log value of parental incomes, a dummy for having urban *hukou* before entering colleges, a dummy for residing in local province, and the number of siblings.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

One caveat is that although we control for a rich set of variables, some unobserved variables that are correlated with both whether a student can enter elite colleges and wage may still exist, leading to a bias in the estimated wage premium. For example, if a more aggressive student is more likely to enter elite colleges and earn higher wages in the labor market, the estimated wage premium of elite colleges is upward-biased. In this case, our estimate should be considered as an upper bound of the true wage premium.

5.2. Who benefits more from elite colleges?

In the analysis above, we assume that the return to attending elite colleges is the same for all students. However, the return may vary across individual or family characteristics such as gender, father's schooling, and parental income. In order to test these, we estimate the wage equation using samples separated by gender (female vs. male), parental income (above or below the median), and father's years of schooling (above or below the median). The results are shown in Table 3.

First, the return to attending elite colleges varies by gender, and in this study, the return leans toward girls. The coefficient of the elite college dummy in the regression that uses the female sample is 0.257, which is significant at the 1% level (column 1). The corresponding coefficient in the regression that uses the male sample is only 0.039, which is insignificant (column 2). This means that compared with the wage premium accorded to male students, that offered to female students who attend elite colleges is 21.8% points higher. A possible reason may be that female students are more motivated to perform well in elite colleges, so that they accumulate more human capital and experiences, thereby helping them earn higher wages in the labor market.[16]

Second, the return also varies with father's years of schooling. Column 3 shows the regression results using students whose fathers' years of schooling are higher than the median, while column 4 shows the regression results using students whose fathers' years of schooling are lower than the median. The coefficient of elite college dummy is 0.158, which is significant at the 5% level for students having fathers' with years of schooling higher than the median (column 3). The coefficient of elite college dummy for students having fathers' with years of schooling below the median (column 4) is 0.076 and insignificant. This suggests that compared with students with less-educated fathers, those with better-educated fathers exhibit a return to attending elite colleges that is 8.2% points higher. This finding suggests that students from well-educated families can better reap the benefits of attending an elite college.

Finally, the return to elite colleges does not vary with parental incomes. The coefficient on the elite college dummy is 0.120 for students from a rich family (column 5) and 0.141 for students from a poor family (column 6). Both of them are significant at the 10% level.

In summary, the analysis above shows that the wage premium offered to students attending elite colleges is 26.4% if we do not control for any variables. The wage premium falls to 20.4% if we control for abilities, major dummies, and college location dummies; this value falls further to 10.7% if we add student individual characteristics and family backgrounds. The wage premium is non-uniform: it is larger for female students and students whose fathers are better educated.

6. What do students obtain from elite colleges?

In this section, we investigate why elite college students enjoy a pay premium even when we hold their abilities and family backgrounds constant. One reason may be that elite college students can acquire certain human capital and experiences

[16] We estimate the same regressions, but use college English test scores, a dummy for having technical certificates, a dummy for being a party member, a dummy for being a leader of student unions, and a dummy for having part-time work experience as outcome variables. We find that female students in elite colleges have higher college English test scores and are more likely to be leaders of student unions. The results are not shown because of space constraints, but are available upon request.

that cannot be obtained in non-elite colleges. We examine to what extent this difference can explain the wage premium earned by elite college students.

6.1. Human capital and experiences in college

We first examine whether going to elite colleges helps students gain more human capital and experiences that are useful in the labor market. We analyze several areas including English skills, technical skills, political status, leadership/organizational skills, and work experience. First, with the opening of the Chinese economy, English has become a highly important skill in the job market, and college students normally spend considerable time studying it. We use the scores of a standard English test for college students in China, the CET, to measure English language skills. Second, many college students may have also obtained certain technical skills that are useful in the job market. We use a dummy variable for having technical certificates to measure this. Third, we use membership in the CCP and leadership in student unions to measure political status, leadership, and general social skills. Finally, we use part-time work experience (internship) as a measure of employment experience. In all these variables, CET scores can be considered a measure of human capital, while the other variables can be regarded as measures of other experiences gained in college. We regress these variables on the elite college dummy while controlling for other variables such as gender, age, parental cadre status, father's schooling, parental income, whether the family resides in local province, whether the students have urban *hukou* before entering college, number of siblings, total CEE score, college location dummies, and major dummies.[17]

The regressions reported in Table 4 show that these human capital and experience variables for elite and non-elite college students differ, but not as distinctly as those reported in Table 1. The elite college dummy is significant for the CET score regression (column 1), suggesting that attending elite colleges can help students reinforce their skills in English. We also find that students from elite colleges are more likely to be CCP members (column 3) and leaders of student unions (column 4), but less likely to have a technical certificate (column 2) and part-time work experience (column 5), although the effects are not precisely estimated.

6.2. Do human capital and experiences matter?

In this section, we determine how the human capital and experiences accumulated in college affects the wage premium accorded to an elite college degree. Specifically, we estimate the Mincer wage equation adding the following set of variables: CET score, a technical certificate dummy, a party membership dummy, a student union leadership dummy, and a dummy for part-time work experience. In interpreting the effects of the human capital variables on wages as reported in Table 5, we should exercise some caution. This set of variables can be endogenous because they reflect students' choices in colleges. Nonetheless, the burden of resolving endogeneity in this context is not too substantial. We are interested mainly in examining whether the correlation of these variables with the elite college dummy can explain the return to attending elite colleges.

The regression results reported in Table 5 show that most of these human capital and experience attributes are accorded importance in the job market as we include these variables individually. The first column in Table 5 is the same as that shown in the last column in Table 2, which illustrates wage premium earned by elite college students, as preferred in this study. CET scores (column 2), being a party member (column 4), and being a student union leader (column 5) have significantly positive effects on wages, but having a technical certificate (column 3) does not have a significant effect. Interestingly, having part-time work experience is disadvantageous in the job market, as indicated by the coefficient of the variable, which is negative and statistically significantly different from zero. This may explain why elite college students are less likely to have worked part-time in college, as determined above.

More important, these human capital and experience variables can explain a large proportion of the wage premium of elite colleges, as shown in column 1 in this table. Column 7 of Table 5 shows that when all human capital and experience variables are included in the regression, the coefficient of the elite college dummy decreases to 0.037, which is much smaller than that if they are not controlled for (0.107, as in the first column in this table). The coefficient also becomes statistically insignificant, which indicates that controlling for human capital and experience variables reduces the wage premium to zero, i.e., the wage premium accorded to elite college students can be explained by the human capital and other experiences they accumulate in these colleges.

7. Sample selection

Given that the sample used in the analysis above includes only the students who receive an offer or who have non-missing wage values, a potential bias can come from sample selection. If values are missing because of non-random reasons, then the results will be biased.

[17] We fit linear probability models in this paper, but the results from Probit models are similar and available upon request. It is applied to all regressions having indicators as dependent variables in the remaining part of the paper.

Table 4
Human capital accumulated in colleges.

	(1) CET scores	(2) Having technical certificate = 1	(3) Being a party member = 1	(4) Being a leader for student unions = 1	(5) Having part-time work experience = 1
Elite college = 1	0.632 (0.306)*	−0.021 (0.058)	0.081 (0.047)	0.058 (0.041)	−0.067 (0.041)
Observations	3027	2525	3537	3364	3521
R-squared	0.11	0.04	0.15	0.04	0.09

Standard errors are shown in parentheses and calculated by clustering over colleges.
Note: (1) All regressions include a constant term, CEE total scores, individual and household characteristics, major dummies and college location dummies. (2) Individual and household characteristics include a female dummy, age, a dummy for having cadre parents, father's years of schooling, log value of parental incomes, a dummy for having urban *hukou* before entering colleges, a dummy for residing in local province, and the number of siblings. (3) We also fit Probit models for regressions in columns 2–5; the results are similar and available upon request.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Table 5
Effects of attending elite college controlling for human capital.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: log(monthly wage)						
Elite college = 1	0.107 (0.059)*	0.073 (0.051)	0.113 (0.060)*	0.111 (0.060)*	0.090 (0.068)	0.088 (0.061)	0.037 (0.072)
CET scores		0.043 (0.021)*					0.040 (0.028)
Having technical certificate = 1			−0.020 (0.037)				−0.020 (0.041)
Being a party member = 1				0.098 (0.026)***			0.041 (0.032)
Being a leader For student unions = 1					0.051 (0.025)*		0.064 (0.019)***
Having part-time work experience = 1						−0.131 (0.019)***	−0.171 (0.036)***
Observations	1781	1528	1332	1776	1687	1773	1100
R-squared	0.20	0.20	0.22	0.21	0.21	0.21	0.26

Standard errors are shown in parentheses and calculated by clustering over colleges.
Note: (1) All regressions include a constant term, CEE total scores, individual and household characteristics, major dummies and college location dummies. (2) Individual and household characteristics include a female dummy, age, a dummy for having cadre parents, father's years of schooling, log value of parental incomes, a dummy for having urban *hukou* before entering colleges, a dummy for residing in local province, and the number of siblings.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

To address this concern, we first estimate the probability of having a non-missing wage value, which can help us infer the direction of potential sample selection bias. The regression results reported in column 1 of Table 6 suggest that, in general, attending elite colleges does not have an effect on whether a student has a non-missing wage value. The coefficient of the elite college dummy is −0.071 and insignificant, indicating that the probability of elite college students to have a non-missing wage value is similar to that of non-elite college students.

Although this simple analysis suggests no selection bias, it may mask the fact that the selection bias is in different directions for the elite and non-elite samples. For example, if more capable students in elite colleges choose to enter graduate schools while less capable students in non-elite colleges could not find a job,[18] then our estimate of wage premium can still be downward biased even if the probability of missing values is the same for the two samples. To further examine the selection issue, we separately estimate the probability of having non-missing wage values for elite and non-elite samples.

The regression results show that the bias caused by selection may go in either direction. The results (column 2) show that in elite colleges, female students, students whose fathers are better educated, students with higher CET scores, or students who are CCP members are less likely to have wage information. These students are likely to be those entering graduate school and they are highly likely to have higher wages if they enter the labor market. In non-elite colleges (column 3), however, students having higher parental incomes or urban *hukou* before entering college are more likely to have missing wage values. With better family backgrounds, these students are more likely to have higher reservation wages and therefore less

[18] Indeed, 36% of the missing values for elite school are from students who will go to graduate school, while this value is only 14% for non-elite college students.

Table 6
Determinants of having first job wage (dependent variable: having wage = 1).

	(1) Whole sample	(2) Elite colleges	(3) Non-elite colleges
Elite college = 1	−0.071		
	(0.057)		
CEE total scores	0.031	−0.005	0.034
	(0.015)*	(0.011)	(0.016)*
Female = 1	−0.055	−0.119	−0.052
	(0.026)*	(0.038)**	(0.028)
Age	0.031	0.065	0.029
	(0.014)**	(0.013)***	(0.014)*
Parent is a cadre = 1	−0.052	0.010	−0.054
	(0.050)	(0.027)	(0.056)
Father's years of schooling	0.002	−0.010	0.003
	(0.007)	(0.005)*	(0.007)
Log(parental income)	−0.009	−0.005	−0.010
	(0.004)**	(0.011)	(0.004)*
Residing in local province = 1	0.052	−0.035	0.054
	(0.033)	(0.031)	(0.036)
Urban *hukou* before college = 1	−0.098	−0.046	−0.101
	(0.033)***	(0.033)	(0.036)**
Number of siblings	−0.003	0.007	−0.004
	(0.025)	(0.016)	(0.027)
CET scores	−0.022	−0.068	−0.019
	(0.013)	(0.016)***	(0.014)
Having technical certificate = 1	0.119	0.059	0.120
	(0.027)***	(0.037)	(0.029)***
Being a party member = 1	−0.008	−0.119	−0.000
	(0.037)	(0.023)***	(0.042)
Being a leader for student unions = 1	0.028	0.097	0.025
	(0.022)	(0.032)**	(0.024)
Having part-time work experience = 1	0.151	0.049	0.157
	(0.044)***	(0.029)	(0.047)**
Major dummy	YES	YES	YES
College location dummy	YES	YES	YES
Constant	−0.191	−0.849	−0.342
	(0.306)	(0.389)*	(0.268)
Observations	2060	1084	976
R-squared	0.12	0.20	0.12

Robust standard errors in parentheses.
Note: (1) We also fit Probit models for regressions in columns 1–3; the results are similar and available upon request.
* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

likely to accept current job offers. Ultimately, the direction of the bias caused by selection depends on which effect is stronger, but cannot be determined based on available information.

8. Conclusion

In this paper, we investigate whether students attending elite colleges are afforded more compensation in the labor market using a newly collected sample of college graduates in China. The baseline results show that students graduating from elite colleges enjoy a wage premium of 26.4%, but that this premium declines to 10.7% after we hold student abilities, major, college locations, individual characteristics, and family background constant. We also find that female students and students with better-educated fathers gain more advantage by attending elite colleges.

We also examine what elite colleges can offer to students, and find that elite college students have more favorable human capital attributes, particularly higher English scores. Finally, after we control for the human capital attribute and other variables representing students' experiences accumulated in colleges, the estimated wage premium becomes very small and insignificant, indicating that the human capital and experiences accumulated in elite colleges can explain most of the remaining wage premium.

Since the late 1990s, China began to expand its higher education system, with college enrollment increasing by 293% from 1999 to 2009. Anecdotal evidence suggests that the overall return to college education has declined in the past decade, although there is little systematic empirical evidence to confirm this observation. The overall return to college education may have dropped; nevertheless, we find that the return to attending an elite college is reasonably high even after we control for ability and family background. That the return is a result of the human capital attributes obtained in elite colleges further

confirms that attending an elite college is a worthwhile investment. The high return to attending elite colleges serves as one justification for the huge investment that the Chinese government infuses into these colleges, as well as for the time and money spent by parents in preparing their children for the CEE. Note that the elite-college premium is likely to rise with job market experience, an issue that we will address in our follow-up surveys.

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