Access to Elite Education, Wage Premium, and Social Mobility: The Truth and Illusion of China's College Entrance Exam*

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Abstract

This paper studies the returns to elite education and their implications on elite formation and social mobility, exploiting an open elite education recruitment system – China's College Entrance Exam. We conduct annual national surveys of around 40,000 college graduates during 2010-2015 to collect their performance at the entrance exam, job outcomes, and other individual characteristics. Exploiting a discontinuity in the probability of attending elite universities around the cutoff scores, we find a sizable wage premium of elite education that stems from variation *within* occupation-industry. As a result, access to elite education does not promise one's entry into the elite class (measured by occupation, industry and other non-wage benefits). While access to elite education does improve one's income rank, it does not alter the intergenerational link between parents' status and children's status. The wage premium appears more consistent with the signaling mechanism of elite education than the role of human capital or social networks.

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1 Introduction

Access to education, especially elite education, is believed to be one of the most important channels for elite formation and social mobility in modern societies. In sociology, the works of Pierre Bourdieu emphasize how elite education contributes to the maintenance and reproduction of class inequalities, which inspire a literature on the social consequences of elite education institutions (Bourdieu and Passeron 1977, Bourdieu 1988). In economics, while there exists a burgeoning literature estimating the economic returns to elite education (e.g., Dale and Krueger 2002, 2011; Black and Smith 2004; and Hoekstra 2009; Anelli 2016),[1] little empirical investigation exists on how the access to elite education affects elite formation and social mobility. In this paper, we not only estimate the returns to elite education but also attempt to understand their implications on elite formation and social mobility using a large-scale dataset we collected ourselves in China. We also attempt to shed light on the mechanisms behind the returns to elite education.

Every year, around 10 million students in China take the National College Entrance Exam – the largest standardized test in the world – in order to get admitted by around 2,300 colleges of different tiers. The exam not only determines whether a young person will attend a Chinese university, but also which one – attending an elite university is perceived to have a crucial bearing on career prospects or to provide a ticket to the elite class (Wong 2012). This perception is not without controversy: due to the importance of family background for the labor market, some argue that it is illusion rather than reality that the exam system can provide upward mobility and change one's fate (Bregnbaek 2016).

The exam-based admission of Chinese colleges provides us a Regression Discontinuity (RD) type laboratory to understand the role of elite education. We refer to elite universities as those designated by the Chinese government as the first-tier universities across all provinces in admission. Elite universities have a cutoff score, and students just above and below the cutoff score are similar in most characteristics, but those above are eligible to apply to elite universities. Thus, we could simply compare outcomes (income and other variables) of students who are just below and above the cutoff score, which solves the typical empirical issue that students entering better universities may be different in ability, family background and other characteristics. We should note that even though the score is the main criterion, it is possible that some students with scores below the cutoff get accepted with extra points

[1] The first four studies are in the U.S. context and their findings are mixed partly due to the challenge of selection concerns. Hoxby (2009) summarizes the advantage and limitation of different strategies used by them. The last study uses a regression-discontinuity strategy to estimate the returns for one elite university in Milan and find a premium around 45%.

from minor criteria such as talents in art and sports. It is also possible that some with scores above the cutoff do not go to elite universities since the final admission decision is also affected by competition and students' preference of majors and location (see Section 2 for discussions). Hence, we have a fuzzy RD design.

Because there are no existing data we could draw on, for the purpose of our study, we self-collected systematic data on exam performance and individual outcomes. During 2010-2015, we designed and conducted annual surveys of college graduates, and collected a total sample of 40,916 students from 90 universities.[2] In our survey, we collected the students' scores of the college entrance exam, their first-job outcomes as well as detailed individual and parental characteristics. With these data, we are able to examine outcomes of students with scores close to the cutoffs for elite universities.

We find that elite education in China has a sizable return. Our baseline analysis focuses on around 10,335 individuals within a bandwidth of 20 points (out of a maximum of 750 points from four subjects) around the elite university cutoff scores, which is close to the optimal bandwidth (21) using the method by Imbens-Kalyanaraman (2011). There is indeed a clear discontinuity around the cutoff: scores above the elite university cutoffs raise the admission probability by about 16 percentage points, about 75% of the mean probability. In contrast, there is no such pattern with respect to (fake) placebo cutoffs; neither is there any discontinuity for our balance tests with all individual and family characteristics. Exam scores above the cutoffs are associated with a wage premium of 150 RMB (USD 25) per month for a fresh college graduate, which is around 6% of the median monthly wage (2,500 RMB). These estimates together imply an IV estimate of the monthly wage premium of elite education of 1,000 RMB (USD 160), or about 40% of the median monthly wage. Our results are robust to alternative bandwidths and specifications of the running function.[3]

It is worth pointing out that scoring above the cutoff not only changes the probability of attending an elite university but also other dimensions regarding admission and college life. In our context, the choices of majors and the relative ranking of students in their college classes are particularly important. Within a university, different majors also have different admission scores depending on their popularity. For example, in recent years, economics (including finance and business) and law have a higher demand and hence are more competitive in recruitment. As a result, students often face a tradeoff between universities and majors, especially for those close to the cutoff. If they choose an elite university, they are less likely to major in popular fields because, when it is their time to select, those majors may

[2]We use "college" and "university" interchangeably throughout the paper.

[3]For instance, Gelman and Imbens (2014) discuss why including higher-order polynomials might bias the estimates.

have already been all taken by higher score students. Similarly, those just above the cutoffs are likely to be the worse students within their college class. If anything, the estimated wage premium of elite education increases marginally if we control for major and relative class ranking in college.[4]

A limitation of our study is that our survey design only allows us to investigate the wage of the first job for fresh college graduates and it is unclear how important these initial wages are later in life. To partially address this concern, we supplement our survey data with job histories of around 300,000 individuals from a major recruitment platform and document the importance of the first-job for future jobs.

While the access to elite education is associated with a wage premium, we find no evidence that it promises one's entry into the elite club, defined by job characteristics. Market income is only one measure of entering China's elite class, and there are other dimensions of being in the elite class that may not be easily monetized. Many of them are associated with the provision of public goods or perks from government monopolies, such as getting into the banking industry, finding a job in a state-owned enterprise, and obtaining *hukou* (the right to live in a city and enjoy local public goods) of a well-funded municipal. By exploring which job characteristics drive the wage premium, we find that the wage premium cannot be explained by occupation, industry or job location. Instead, it mainly stems from variations *within* occupation-industry. Moreover, we find that elite education does not increase the probability of entering an elite occupation, elite industry, elite ownership (where the elite status is defined by a realization-hope ratio in the data), living in an elite city, obtaining *hukou* or any other non-marketized benefit; in contrast, parental characteristics do.

How does elite education affect social mobility? The question has two dimensions. The first is whether elite education can lift one from a low-income status to a higher-income status. Not surprisingly, access to elite education increases wages and mobility in this aspect. The second dimension regards whether elite education can change the role family background (such as parental income) plays in determining the job market success of a person.[5] In theory, the access to elite education can increase (or decrease) intergenerational mobility if the children with poorer (or richer) parents enjoy higher returns. Empirically, we find no evidence showing that the access to elite education alters intergenerational mobility, as the returns are neutral with respect to parental income (and parental income rank). Moreover,

[4]The finding on relative ranking speaks a literature on quality-fit tradeoff (Arcidiacono and Lovenheim (2016) provides a survey). However, we find a sizable wage premium despite possible mismatching. One explanation is that the signaling mechanism documented in Section 6 is important.

[5]These two dimensions are similar to the definition of absolute mobility and relative mobility in Chetty et al. (2014).

the comparison between the impact of being above the elite college cutoff score and that of having a rich parent helps us to better understand the degree of mobility created by the exam system in the first dimension. For instance, for those students from families of the top 20% income level, even if they score below the cutoff, their probability of being in the top 20% income group is still higher than those who score above the cutoff but come from less wealthy families.

Finally, we examine why elite education has a wage premium. In theory, there are typically three explanations: human capital (e.g., Becker 1993), signaling (e.g., Arrow 1973; Spence 1973) and social networks (e.g., Bourdieu and Passeron 1977). Little empirical evidence exists to disentangle them due to the challenge of measurement. Exploiting the richness of our survey data, we proxy them using as many variables as possible and find suggestive evidence for the signaling mechanism but not the other two. In particular, the existence of national-level standardized tests in China allows us to have a reasonable proxy for human capital accumulated in college, and we find no evidence supporting the importance of human capital in explaining our findings. We also examine the role of social networks in helping as student to get a job or explaining the wage premium and do not find evidence for this channel either. One caveat is that the weak ties at the time of graduation may become more important in the long run.

Our study brings new perspectives to the literature studying elite education. Besides estimating the economic returns to elite education, as has been done in the literature, (Dale and Krueger 2002, 2011; Black and Smith 2004; and Hoekstra 2009; Anelli 2016),[6] we also examine how elite education affects elite formation and social mobility, by showing whether access to elite education can help one enter the elite class in terms of income and job characteristics and whether it changes intergenerational mobility. In this sense, we add to the growing literature on intergenerational mobility in economics (e.g., Solon 1992; Chetty et al. 2014; Chen et al. 2015) and sociology (see Erikson and Goldthorpe 1992, 2002 for related studies). As explained in Erikson and Goldthorpe (2002), while economists typically focus on income or wealth as continuous variables, sociologists are more likely to be concerned with class positions (usually proxied by occupation) that are treated categorically. Our study speaks to both perspectives. Although there is a caveat that we are studying a selected group of people, in which everyone has college education, we believe our group of

[6]In the context of China, the 2010 wave of the present data has been used in Li et al. (2012), where they control for observables and also find a sizable wage premium of elite education. Our study exploits a different empirical strategy that allows us to compare students with similar ability. Our regression-discontinuity strategy is related to that used by Hoekstra (2009) and Anelli (2016) who only examine one specific university in the U.S. or Italy. In contrast, our data speak to a large group of universities across China.

focus provides a reasonable sample for the focus of whether the access to elite education alters intergenerational mobility. Finally, we also provide evidence for understanding the mechanisms behind the returns to elite education, and find evidence supporting the signaling hypothesis but not the human capital and connections hypotheses.

The College Entrance Exam is probably one of the most important institutions in China, affecting the lives of hundreds of millions of families. It is also an institution that gives hope to the Chinese people, especially those not so well-off. Unfortunately, probably due to the lack of data, there are not many studies on such an important institution. To the best of our knowledge, ours is the first to systematically study the labor market consequences of the College Entrance Exam by collecting data on exam scores and exploiting the cutoffs in recruitment. Our findings uncover the impact as well as the limitation of the exam system in promoting open access to elite education and social mobility. The score-based college admission system provides a large-scale natural experiment that is quite unique in the world. Our research design and data can potentially be used to study other social and political implications of elite education.[7]

Section 2 discusses the background and the data. Section 3 reports the results on elite university enrollment, after which Section 4 focuses on wage premium and entry into the elite class. Section 5 centers on social mobility. Section 6 presents evidence on the mechanism for the wage premium. Section 7 concludes the paper.

2 Background and Data

2.1 Elite Universities in China

A total of around 2,300 colleges were registered in 2010 in China and the quality of these colleges varies substantially.[8] All of them recruit students based on the score of the National College Entrance Exam, known as *Gaokao* in Chinese. They are categorized into four tiers based on quality and those belonging to a higher tier are afforded priority in admitting students. A university's tier can differ across province. For instance, a very top university belongs to the first-tier in all provinces whereas a middle-ranged university can be partially regarded as first-tier in certain provinces. In this paper, elite universities refer to those falling under the first tier in the recruitment process *across all provinces*. Out of all Chinese

[7]For instance, Bai and Jia (2016) study the historical exam system in China and argue that it affected the perceived mobility and political stability.

[8]See information from the Ministry of Eduction on different types of colleges: http://www.moe.edu.cn/publicfiles/business/htmlfiles/moe/s4960/201012/113594.html

universities, 96 universities belong to this category in our study period.[9]

Our definition of elite universities heavily overlaps two other definitions often used in the literature (e.g., Carnoy et al. 2013): the so-called Project-211 universities (an abbreviation of the top 100 universities in the 21st century) and the universities under the control of the central government (111 in total).[10] The advantage of using the national first-tier to define elite universities is that they have clear cutoff scores. In recent years, due to college education expansion in China, over 75% of exam-takers can get college education. However, only 5% or less of exam-takers can get into these elite universities. This ratio also varies greatly across provinces. The spatial inequality in access to elite education is an important issue but not the focus of this study, since we would like to compare individuals similar to each other in most dimensions including province of origin.

It is worth noting that most universities, including all elite universities and second-tier universities (the focus of this study) are public. Private universities are not very developed in China and the existing ones are of low quality. Related to their public nature, these universities including both elite universities and second-tier universities charge similar tuition fees, roughly RMB 5,000 a year (USD 750).[11] Thus, in our study, we do not need to worry about tuition fees. In addition, elite universities are of a similar size as non-elite universities in our comparison group.

Another special institutional feature is that the graduation rates are very high across all universities in China, with a mean over 95%.[12] The college education system in China is known for being "strict entrance, easy out". So the probability in graduating varies little between elite and non-elite universities.

What make elite universities distinct from other universities? They clearly have more resources and support from the government. For instance, the Project 211 universities account for only 5% in terms of the number of universities but 70% of all scientific research funds.[13] Naturally, they also attract very different students and teachers. We will present several university characteristics in our data.

[9]There are another 200 or so universities that are partially regarded as the first-tier in certain provinces. We do not consider them as the elite group since there are no clear cutoffs and they are of less prestige.

[10]For instance, there are 26 elite universities defined by the national first-tier criterion in our survey: 25 of them belong to the Project-211 group and 21 are under the control of the central government.

[11]The lowest-quality ones may charge a higher tuition fee for those who score low in the exam but want a college degree, but they are not the focus of this study.

[12]The Beijing-based Mycos Institute estimated in 2011 that China's college dropout rate is 3%, while the Ministry of Education said that year that the rate is 0.75%.

[13]See the information from the Ministry of Education: http://www.moe.edu.cn/moe_879/moe_207/moe_235/moe_315/tnull_1469.html.

2.2 The College Entrance Exam and Admission

The Admission Process In our study period, the admission process for most provinces is as follows. All students take the exam in early June in their residence province, which are written and graded by education authorities in their own province. Then, based on the distribution of the scores and provincial quotas assigned by the Ministry of Education, each province announces a cutoff score for each layer and each track (social or natural science). With information of the cutoff scores, and also knowing their own scores, students fill their college preferences for each layer of universities (with universities and majors). Those above the elite college cutoff scores are *eligible* to apply for elite universities. Finally, universities take turn to recruit based on scores of the applicants. In equilibrium, the admission bars (lowest admission scores) for different elite universities are different depending on their popularity among students and competition. First-tier universities do the recruiting first, and only after all first-tier universities finish, the second-tier university start. Once a student is admitted, he/she can either choose to go to this university, or decline it and give up admission to any university for the year.

There are two minor variants of this process: students in Beijing and Shanghai fill the applications before the exam takes place; students in a few provinces fill the applications after the exam but before knowing their scores. In all these cases, the cutoff point still determines the eligibility in recruitment. In addition, the admission mechanism was transferring from the Boston Mechanism to one that is similar to the serial dictatorship mechanism in this period. Again, the exam score is the primary criteria under both mechanisms and the cutoff determines the eligibility. Thus, our empirical strategy is valid despite these complexities.[14] As discussed next, we will compare students around the cutoff within a province-year-(social or natural science) track.

Features that Matter for Our Research Design The exam system has two features that are important for our research design.

(i) The scores are only comparable within province-year-track. First, during 2010-2015, 27 out of 31 provinces (except for Jiangsu, Zhejiang, Shanghai and Hainan) use a scale of 0-750 points based on four subjects,[15] while the other four provinces use different

[14]These variations can have different implications on matching quality. For example, Chen and Kesten (2016) provides an interesting theoretical analysis on the serial dictatorship mechanism. But these variants are not essential for our research question, as long as students around the cutoff are comparable for a given mechanism.

[15]For students in the natural science track, the four subjects are Chinese (with a maximum of 150 points), Mathematics (with a maximum of 150 points), a foreign language (mostly English, with a maximum of 150 points) and a combined subject of Physics, Chemistry and Biology (with a maximum of 110, 100, 90

scales. Second, the exam papers are written and graded by each province and a point in the score in different provinces means differently. Finally, and importantly, the cutoff points vary greatly across provinces, reflecting spatial inequality in access to elite education. Since we are interested in comparing individuals similar in all other dimensions except for exam scores, we will compare students within the same province. We collect the cutoff scores for each province-year-track from a website specialized for the exam: Gaokao.com. The cutoff score of elite universities for the 27 provinces using a scale of 0-750 points has a median of 540.

In our analysis, we will control for province-year-track fixed effects. This takes care of the four provinces using other exam scales. Our results are also robust to excluding them in the analysis.

(ii) Our regression-discontinuity is fuzzy. It is possible that some students with scores below the cutoff get accepted, due to extra scores from other characteristics such as being an ethnic minority, being a child of a military martyr, or having talents in sports, music and math etc. These extra scores are orthogonal to the actual scores from the exam.

It is also possible that some students with scores above the cutoff do not get into an elite university, mainly due to competitiveness of the exam cohort or personal choices. Some who apply to the first-tier may not be accepted due to competitiveness of their exam cohort and have to go to a non-elite university (that recruits after the first-tier). This is another reason we would like to compare within province-year-track, which controls for competitiveness of an exam cohort. Some who are eligible may choose not to apply due to personal choices. For instance, there is a tradeoff between major and university, especially for those around the cutoff score. Within a university, different majors also have different admission scores depending on their popularity. In recent years, economics (including finance and business), management and law are popular and hence more competitive in recruitment. If students with scores just at or slightly above the cutoff choose an elite university, they are less likely to major in popular fields because, when it is their time to select, those majors may have already been all taken by higher score students. Such argument also applies to preferences for other things such as location of the university.

We will consider these tradeoffs such as major, university location and relative ranking of students within college class in our analysis.

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respectively). For students in the social science track, the four subjects are Chinese (with a maximum of 150 points), Mathematics (with a maximum of 150 points), a foreign language (mostly English, with a maximum of 150 points) and a combined subject of Political Sciences, History and Geography (with a maximum of 100, 100, 100 respectively).

2.3 Chinese College Student Surveys (2010-2015)

The main challenge is to collect individual exam performance and link it to labor market outcomes. We designed and conducted an annual survey of college graduates for this purpose.

Survey Design and Implementation The data that we use are derived from six waves (2010-2015) of the Chinese College Student Survey (CCSS), conducted by the China Data Center of Tsinghua University directed by one of the authors. We randomly selected 100 universities out of all universities in China by stratifying it according to locations (Beijing, Shanghai, Tianjin, Northeastern China, Eastern China, Central China, and Western China) and tiers of colleges.[16] We used the number of students as weight for each college, meaning that colleges with more students are more likely to be selected. For the purpose our study, we oversampled elite colleges in order to get enough students near the elite school cutoff points.

Due to budget and management capacity, the survey was rolled out gradually with the number of selected colleges listed in Appendix Table A1. The target was to have all 100 colleges participate in 2013. In practice, 65 colleges participated that year. Due to an unexpected budgetary cut since 2014, the survey became voluntary, and only those who are willing and can afford the survey (less than 20 colleges) did it in 2014 and 2015. Across the six years of survey, 90 colleges out of the 100 participated in at least one of the years.

For each college, we trained a clerk in the student registration office, who helped us to randomly select a sample of students from the full roaster (population) of the graduating class. The survey was carried out in May and June each year during 2010-2015. In each of the participating colleges, we appointed two to three survey administrators, who normally are in charge of registration and teaching. Every year, we trained these survey administrators from all over the country in Beijing with several days of intensive meetings. The survey in each college was administered as such. The administrators gathered all sampled students in a big classroom and let them fill in our paper survey form individually and anonymously. Students were told at the beginning that these surveys are for research to understand job market for college graduates, and none of their individual information is disclosed to any party. These filled forms were then coded and mailed to our Beijing office for data entry and cleaning.

Gathering all sampled students in one location and time for each university contributes to a relatively high response rate. For the first year (2010), we targeted on selecting

[16] 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.

400 students per college and a college on average collected a sample of 319 students, and our target was cut down to 200 in 2011-2013 due to the rising cost of the survey. For the last two years in 2014 and 2015, participating colleges agreed to survey 400 students in each college.[17] Across six sounds, the response rates from elite universities are weakly lower but the difference is not significant. These six rounds of survey give us a sample of 40,916 students in their graduating year. Among them, 34,733 reported complete information on their College Entrance Exam scores and the provinces where they took the exam.

Appendix Figure A1(a) plots the spatial distribution of the 90 colleges by province. As expected, we surveyed more colleges from more developed regions such as Beijing and Shanghai where there are more colleges. Their students come from all provinces across China. Appendix Figure A1(b) plots the number of students with exam scores by the provinces where they took the exam. Note that our strategy is not affected by the selection of colleges (see discussion below on selection and measurement concerns).

We designed the questionnaire collaboratively with experts in other disciplines (sociology and education). One of our aims in the surveys is to gather systematic data on individual performance at the College Entrance Exam and link it with labor market outcomes. Thus, we have detailed information on both. We also collected information on family background and college activities.

Selection and Measurement Concerns We would like to be clear about sample selection and measurement issues in the survey. Our data on students are not a random sample of all Chinese college students for two reasons. First, we intentionally over-sampled elite colleges to capture enough students with elite education. In our sample, 26 out of the 90 universities belong to the elite tier, in contrast to 5% for the population. Second, due to the nature of voluntary participation for the survey, we do not have 100% compliance from colleges and students. Note that we do not need a random sample of all college students in our study. For our analysis, the identification assumption is that those around the cutoff scores are comparable in all dimensions before entering colleges except for their exam scores. We will check whether this is the case in the data.

Misreporting and in particular over-reporting exam scores is possible. However, this concern is unlikely to be critical for our study. Conceptually, we are focusing on exam scores close to cutoff scores for the elite universities. It is unclear why one would like to misreport performance just around the cutoff. We expect the concern of misreporting to matter more

[17] Most of these volunteering colleges intended to collect a sample that is large enough to conduct some analysis of their own colleges.

for the very low and very high scores, which are not our focus. Empirically, we also examine the density of reported exam scores and conduct placebo tests using other scores around the actual cutoffs. Misreporting of wages is also possible. We exclude 5% of the data (2.5% in both tails of the wage distribution) in our baseline. The results are robust to keeping all the data or excluding slightly different percent of the tail sample.

University Characteristics in Our Survey Appendix Table A2 presents several university characteristics in our survey. Consistent with the discussion above, elite universities are slightly smaller in terms of the number of students but the difference is not significant. Elite universities clearly have more foreign students and a much larger share of students from other provinces – consistent with the fact that they attract talents from outside their own regions.

As expected, there is a big difference in terms of students' exam scores. The median score for the elite group is 590 whereas that for the non-elite group is 491. Moreover, the median first-job wage is about 35% higher for the elite university graduates.

Data on the College Entrance Exam Scores We collected information on the total exam score and the score for each subject. Figure 1(a) plots the distribution of the difference between the reported total scores and the actual cutoffs for elite universities, where the cutoffs are defined for each province-year-track. The density is weighted by the sampling weight of universities. Among the 40 thousand graduating students in our surveys, 10,335 of them falls into the 20-point bandwidth centered at the cutoff score. We will use this 20-point bandwidth (roughly 5 points per subject), close to the optimal bandwidth from the Imbens-Kalyanaraman method (21), as our baseline bandwidth.

In Figure 1(b), we take a closer look at the sample within the 20-point bandwidth. As shown, there is no significant discontinuity in the reported scores around the cutoff values, suggesting systematic misreporting around the cutoff is not an important concern.

Table 1 presents the summary statistics for the sample with the 20-point bandwidth. 21% of them have elite college education. For consistency, the summary statistics reported on job outcomes also refer to this sample.

Data on University, Major and College Academic Performance Elite universities are designated nationally by the government and known by students. The survey also covers information on 13 majors broadly defined. We categorize them into three groups: STEM (science, engineering, agriculture, medicine and college), Economics (including finance and

business)-Law-Management, and Humanity (philosophy, literature, history, art). As shown in Table 1, they account for 65%, 24%, and 10% of the students respectively.

The survey also includes questions on the activities and performance of students in college. We will use these data to shed some light on what elite education brings to students. For example, performance at national-levels standardized tests in college provides us some information on human capital acquired in college. In addition, we also ask their perception about their relative ranking within their college class. We will also examine how it affects our finding on wage premium.

Data on Job Outcomes Our surveys are conducted in May and June, the last two months in college for the graduating class. Thus, most of them already have a plan after graduation. Around 50% of the sample report the best monthly wage offer they get (around 74% of the sample searched for jobs). The mean and median monthly wage are 2,733 and 2,500 RMB.

We ask detailed information on job location, industry, occupation, and employer ownership, which will be used to understand what drive the wage premium. Column (2) of Table A3 presents the distributions of occupation and industry. As shown, the top two occupations are professionals (49%) and clerks (28%); the top two industries are manufacturing (including construction and mining, 25%) and IT broadly defined (15%, including information, computer and software industry).

A limitation of our survey is that we cannot track an individual once he or she is on the labor market. However, the importance of the first job in lifetime earnings has been documented by recent studies using administrative data. For instance, Carr and Wiemers (2016) show a large rank-rank correlation between the first-job wage and that in the future career. No similar administrative data with job histories are available in China. We collect job histories of around 300,000 individuals with wages from a major job search platform (zhaopin.com) and examine the importance of the first-job in terms of wages and elite status of the industry, occupation and ownership.

Defining Elite Occupation/Industry/Ownership Besides estimating the impact of elite education on a continuous measure of wage income, we also attempt to examine how scoring above the cutoff affects the entry into elite occupation, industry or ownership. *Ex ante*, we could define elite occupation, industry and ownership by the general perception in China. For instance, a job in management is perceived as an elite occupation; banking is known as an elite industry; and government-related industries are commonly considered as elite industries. Other than these seemingly arbitrary definitions, our data in fact allow us

to statistically capture these perceptions.

In our survey, we not only asked the actual industry, occupation, and employer ownership of the first job offers, but also asked students to report their perceived ideal industry, occupation, and employer ownership (summarized in column (3) of Table A3). We call the ratio of the realized job over the ideal job as the realization-hope ratio, which gives us a useful measure of the elite status. For instance, if a lot of people hope to work in an industry but very few can reach it, this industry is likely to be in the elite club.

The pattern documented from our data is actually consistent with the general perception in China. For instance, occupations like managerial positions (in both public or private organizations), business owners, and military/police, have a realization-hope ratio around 0.1-0.2. In contrast, clerks and skilled workers have a realization-hope ratio above 4. We define the formal group as elite occupations.

Similarly, government-related industries have a realization-hope ratio of 0.13; the finance industry and the education-culture industry have a ratio around 0.4-0.6. In contrast, mining/manufacturing/construction industries and wholesale/retail have a ratio around 2. Thus, government-related and finance are reasonable elite industries.

As expected, state and foreign ownships are elite ownerships. They have a realization-hope ratio of 0.65, in contrast to a ratio of 2.4 for the private ownership.

Data on Parental Characteristics Our survey covers detailed personal and family characteristics including age, gender, residency, parents' economic and political status etc. We will check whether students are similar in these characteristics around the cutoffs.

With information on parents, we are also able to link parents' income and occupation (or industry and ownership) with children's income and occupation (or industry and ownership). We expect to see intergenerational links in income and occupation status. Our interest is to examine whether this intergenerational link gets altered by the exam performance (and elite education). Related to the literature on intergenerational mobility, we employ both a rank-rank strategy (examining how the parent income rank affect child wage rank) and a log-log strategy (estimating the correlation between log parental income and log child income).

3 Exam Scores and Access to Elite Education

3.1 The Impact on Access to Elite University

To examine how an individual's exam score affects elite university enrollment, we use the following specification:

$$EliteUniv_{i,p,y,tr} = \alpha_E \mathbb{1}(Score_i \geq Cut_{p,y,tr}) + \theta_1 f(Score_i - Cut_{p,y,tr}) + \theta_2 f(Score_i - Cut_{p,y,tr}) \times \mathbb{1} + \lambda_{p,y,tr} + \varepsilon_{i,p,y,tr}, \quad (1)$$

where $EliteUniv_{i,p,y,tr}$ is a dummy indicating whether individual i in province p, year y and (natural or social science) track tr attends an elite university. $Score_i$ indicates individual i's exam score. The cutoff score for elite universities ($Cut_{p,y,tr}$) varies by province-year-track.

The running variable in our analysis is ($Score_i - Cut_{p,y,tr}$), namely the distance between a student's score and the cutoff score. $f(Score_i - Cut_{p,y,tr})$ is a function to take the effect of the running variable into consideration. To make sure our results are not driven by certain functional form of f, we employ both the local linear non-parametric method and the parametric method by including the linear-interaction or quadratic-interaction terms between ($Score_i - Cut_{p,y,tr}$) and $\mathbb{1}(Score_i \geq Cut_{p,y,tr})$.

When using the parametric method, we can control for province-year-track fixed effects ($\lambda_{p,y,tr}$). All standard errors are clustered at the university level in the presented results and they are also robust to clustering standard errors at the province level or the score level.

Figure 2(a) plots the probability of attending an elite university against the running variable by each point of the score in the raw data, focusing on the range of 20 points below and above the cutoff. The figure shows a notable discontinuity around the cutoff point: below the cutoff point, the average probability of attending an elite university is around 0.04 and is fairly stable across scores; above the cutoff point, the average probability of attending an elite university ranges between 0.19 (for score at the cutoff) and 0.43 (for 20 points above the cutoff).

Since the cutoff score varies by province-year-track, the effect of one point above the cutoff in Beijing is not necessarily the same as one point above the cutoff in Shandong. To allow for such differences, Figure 2(b) controls for province-year-track fixed effects. As shown, the pattern remains similar.

In Table 2, we present the empirical estimates of the impact of being above the cutoff score on entering an elite college using different methods. Column (1) reports the

results from the local linear non-parametric method. Columns (2)-(5) report the results from the parametric method: columns (3) adds province-year-track fixed effects; column (4) also controls for a first-order polynomial and interaction terms; and column (5) adds a second-order polynomial and interaction terms. As shown, the non-parametric estimate is 0.165 while the parametric estimate is 0.159 after controlling for polynomial and interaction terms.

3.2 Balance Tests and Placebo Results

Balance Tests in Individual and Family Characteristics The underlying assumption of our strategy is that individuals around the cutoffs are comparable in individual and family characteristics. To check whether this is the case, we examine whether being above the cutoff score is correlated with a set of individual/family characteristics.

As visualized in Figure 3, which uses the same specification as in Figure 2(b), there is no discontinuity for gender, age, being in the rural area before college or family income. We also conduct the same balance test for other attributes including father's and mother's income, father's and mother's education, and whether father/mother is a Communist Party member. Results presented in appendix Table A4 show no discontinuity around the cutoff for these characteristics.

Results Using Placebo Cutoffs The sharp discontinuity at the cutoff and the smoothness at other points in Figure 2 already suggest that misreporting around the cutoff is unlikely to be critical for our findings. Instead of the actual cutoff values, we conduct placebo tests using values 5-points above and below the cutoffs. This test not only speaks to the validity of the cutoffs, but also examines the importance of measurement error: if there is a systematic bias of the reported scores, we would expect to see a similar effect with respect to these placebo levels close to the actual cutoff values.

Results presented in Table 3 suggest that these placebo cutoff points do not consistently generate discontinuity. Columns (1)-(3) present the results using the values 5-points above the actual cutoffs whereas columns (4)-(6) present the results using the values 5-points below the actual cutoffs. As shown, although the coefficient for the cutoff-plus-5 dummy is significant when we control for the linear function of the running variable, the size of the coefficient is small and it becomes negative an insignificant once we control for a quadratic function. Overall, there is no similar discontinuity as robustly estimated for all models using the actual cutoff score. These results validate our empirical strategy and also suggest that misreporting about the cutoff is unlikely to be an important concern.

3.3 The Impacts on Other Dimensions

As explained in the background, being above cutoff makes a student eligible to apply to an elite university but he or she still needs to compete with other eligible students in the admission process. As a result, a student faces tradeoffs such as the choice of university vs. major, and which province to go to college. We examine three important factors that might also affect wages.

Majors, University Location, and Perceived Ranking within College Class Those slightly above the cutoff are in the worst position for the selection of majors in the recruitment process of elite universities, while those below the cutoff are in the best position for non-elite universities. This implies that they are likely to sort into different majors. For instance, Economics-Management majors are known to be popular in recent years. Those above the cutoff but are ranked lowest among elite university applicants are be less likely to get into these majors.

On average, the probabilities of majoring in Economics-Management-Law for those above the cutoff and below the cutoff are 21% and 26% respectively. Appendix Figure A2 (a)-(c) plots the difference in the probability of majoring in Economics-Management-Law, STEM and Humanity. Columns (1)-(6) of Table 4 presents the estimation results. The figures suggest that being above the cutoff is less likely to major in Economics-Management-Law, which are the most popular majors in recent years. Columns (1)-(4) of Table 6 shows that the difference is not always precisely estimated.

Appendix Figure A2 (d) plots the difference in the probability of attending an university out of one's home province. It suggests that being above the cutoff increases the probability of attending an university out of one's home province. This pattern is confirmed by the estimations results in columns (7)-(8) of Table 4: being above the cutoff increases the probability of attending a university out of home province by 0.07, around 20% of the mean (0.34).

It is conceivable that the students who are just above the cutoff are likely to be the worst in terms of academic performance in their class, and this academic ranking might adversely affect their job outcomes. In the survey, we ask about the perceived ranking within college class by the students. There is a systematic upward bias in perception: over 46% of the students claim to be the top 20% in their class whereas only 5% claim to be the bottom 20% in their class. Even with the bias, there is a systematic difference around the cutoff: those above the cutoff are less (or more) likely to perceive themselves as the top 20% (or bottom 20%) in class (shown in Figure A2 and columns (9)-(10) of Table 4).

We will consider how these factors affect our findings on wage premium in the next Section. Conceptually, both major and class ranking are likely to bias our estimate of the return to elite university education downward. Thus, the effect of elite education is likely to be larger once we consider majors and relatively ranking. This is indeed what we find.

Response by Individual Characteristics We further check whether the response for these tradeoffs differ greatly with individual characteristics such as gender, rural residence and family income. Specifically, we examine how the interactions of $\mathbb{1}(Score_i \geq Cut_{p,y,tr})$ and individual characteristics affect the probabilities of getting into an elite university, majoring in Economics-Management-Law, going to an university out of one's home province, and being the bottom 20% in college class.

As shown in Appendix Table A.5, some individual characteristics are indeed significantly correlated with these probabilities. For instance, female students and students from higher income families are more likely to major in Economics-Management-Finance. Rural and female students are less likely to study in universities out of their home provinces. Female students are less likely to consider themselves as the bottom 20% in college class. However, there is no significant heterogeneity conditional on being above the cutoff.

In summary, once one's score is above the cutoff, the probability of getting into elite university is similar across individual characteristics.[18]

4 Elite University Wage Premium and Elite Formation

4.1 Estimating the Wage Premium

In this section, we estimate the reduced-form impact of being above the cutoff score of elite universities on the best wage offer for the first job as well as evaluate the wage premium of elite education. Then, we discuss the implications on elite formation of our finding and document the importance of the first-job for future jobs. Before presenting the results on wages, we discuss who choose to work after graduation.

Who Choose to Work? In our data, around 74% of the graduating cohorts have ever searched for a job. Among those who searched for a job, 74% got at least one offer. As a result, we have wage information for around half of our sample.

[18] As discussed in the background, the elite universities are not charging higher tuition fees. The students who are admitted by elite universities would generally try their best to make it.

How does being above the cutoff affects the choice to work? We asked the students' post-graduation plan in the survey. As shown in columns (1)-(8) of Table A6, those above the cutoff are weakly less likely to work after graduation (4% less likely). This difference is not explained by doing graduate study (with a mean of 19%) or going abroad (with a mean of 3%). Instead, it is explained by the category of "unclear plan". One explanation is that those above the cutoff may have more options or higher reservation wages.

Relatedly, column (9) shows that those above the cutoff are weakly less likely to search for a job (4% less likely). Column (10) shows that there is no significant difference in the probability of getting an offer conditional on job search.

Thus, on the extensive margin, we find that those above the cutoff are slightly less likely to search for a job. Next, we find a wage premium on the intensive margin for those above the cutoff. These results show that this intensive margin is unlikely to be driven by more search effort.

The Reduced-form and IV Estimates The reduced-form specification for wages is as follows:

$$(\ln)Wage_{i,p,y,tr} = \alpha_W \mathbb{1}(Score_i \geq Cut_{p,y,tr}) + \theta_1 f(Score_i - Cut_{p,y,tr}) + \theta_2 f(Score_i - Cut_{p,y,tr}) \times \mathbb{1} + \lambda_{p,y,tr} + \varepsilon_{i,p,y,tr}, \quad (2)$$

where the variables are defined in the same way as in equation (1).

There is indeed a discontinuity of log wage at the cutoff score. Figures 4(a) and 4(b) visualize the mean log wages by scores with and without province-year-track fixed effects. The results on wages are noisier than those for elite university recruitment. Still, we see a notable discontinuity around the cutoff values.

The graphical results are confirmed by regressions reported in panel (a) of Table 5A. Columns (1) presents the estimate from the local linear non-parametric estimate of the impact of being above the cutoff score on wage, which shows that having a score above the cutoffs raises the monthly wage by 122 RMB. When we add province-year-track fixed effects (column (2)), the first-order polynomial and interaction terms (column (3)), and the second-order polynomial and interaction terms (column (4)), the effect increases to be around 155 RMB (USD 25), around 6% of the median monthly wage (2500 RMB). This pattern is confirmed by the results using log wage as the dependent variable in columns (5)-(8).

Panel (b) presents the first-stage results within the same sample with wage information, which are comparable with the results in Table 2: being above the cutoff increases the

probability of attending an elite university by around 0.15. Algebraically, the IV estimate is simply the ratio of the reduced-form estimates and the first-stage estimates, around 1,000 RMB (USD 160) per month, 40% of the median wage. This finding is confirmed by the IV estimates reported in panel (c) of Table 5A that range from 33% to 45%.

Results by Bandwidth and by Quartiles We use a bandwidth of 20 points of the score in our main analysis. A narrower bandwidth implies that individuals are more comparable but there is more noise in estimation due to a smaller sample size. In Appendix Figure A3(a)-(b), we plot the first-stage and the reduced-form estimates using different bandwidths ranging from 5 (roughly 1.25 points per subject) to 40 points (10 points per subject), controlling for province-year-track fixed effects and a quadratic polynomial and interaction terms. As shown, the estimates are close to the baseline estimates, suggesting that our findings are not driven by the IK-optimal bandwidth used in the baseline estimations.

We further check the impacts across the wage distribution. Appendix Figure A4 plots the reduced-form results. While the estimates are lower at the tails, the impact is similar across a large part of the distribution (from the 30th to the 80th percentiles). This result shows that our finding on the wage premium is not driven by a very limited part of the wage distribution.

The Impacts of Major, University Location and Relative Ranking To see how our finding on wage premium is affected by other changes incurred by scoring above the cutoff point as discussed in Section 3.3, we include 13 major fixed effects, 26 university location-province fixed effects and five relative ranking within class fixed effects in the estimation of equation (2).

Columns (2) and (4) of Table 5B show that including the major and ranking fixed effects only marginally increases the baseline finding. This is consistent with the fact that those above the cutoff have disadvantages in the choice of major and class ranking. Column (3) shows that including university location marginally decreases the baseline finding, because elite universities are more likely to be located in better developed provinces. Column (5) further shows that our baseline findings hold even after we control for these additional variables.

The Importance of the First-job Our survey only allows us to link exam performance to first-job outcomes. However, it does not allow us to trace the students once they are on the labor market. To investigate the importance of the first-job, we collect the job histories of 304,021 individuals from a major online recruitment platform (zhaopin.com). Individuals

there report their monthly wage for each job they have ever had by five categories (1 for below 1000 RMB, 2 for 1000-2000 RMB, 3 for 2001-4000 RMB, 4 for 4001-6000 RMB, and 5 for 6000 RMB and above). With this information, we can examine the correlation between first-job wage and wages for future jobs. Since we are interested in elite education, we focus on the sample of individuals who have four-year college education or more (91,675 individuals) and investigate the correlation pattern using the following specification:

$$Wage_{j,i,u} = \alpha_F Wage_{1,i,u} + \alpha_2 Wage_{i,1,u} \times EliteUni_u + \lambda_u + \mathbf{X}_i + \varepsilon_{i,j,u}, \tag{3}$$

where $Wage_{j,i,u}$ indicates the wage category of the jth job of individual i who graduated from university u and $Wage_{1,i,u}$ is the wage category for his or her first job. We also take into consideration a few basic characteristics such as university fixed effects (λ_u) and individuals' age and gender.

Appendix Table A7 presents the results for the second, third and fourth jobs. As shown, the first-job wage is strongly correlated with the future job wages. In addition, the importance of the first job for the second job is weakly stronger for those with elite education. The difference disappears for the third and fourth jobs.

These results suggest that our findings on the first-job are also likely to impact the future. Of course, these results are merely suggestive since we do not have exogenous variation in the first job and elite education for this analysis.

4.2 Elite Formation

In the context of China, market income is only one measure of entering the elite class. There are other important dimensions of being in the elite class that may not be easily monetized, many of which are associated with the provision of public goods or perks from government monopolies, such as getting into the banking industry, finding a job in a state-owned enterprise, and obtaining *hukou* (the right to live in a city and enjoy local public goods) of a well-funded municipal.

In this section, we start by using job characteristics to explain the wage premium, and then, as a mirror exercise, we investigate whether the access to elite education affects the entry into elite occupation, industry and ownership. Finally, we check whether elite education affects non-wage benefits associated with the job.

Which Job Characteristics Explain the Wage Premium? We examine the drivers for the observed elite premium by exploring detailed information on the job characteristics

including job location, industry and occupation, ownership (the structure of industry, occupation, ownership are presented in Appendix Table A.3). To this end, we focus on the reduced-form estimates and gradually add fixed effects to examine how the wage premium and R-squared change.

Results presented in Table 6A show that the wage premium cannot be explained by variations across location, industry, occupation or ownership. In column (1), we replicate the findings in column (8) of Table 5A. Column (2) adds job location (31 provinces) fixed effects. Both the estimate and the R-squared are marginally increased, suggesting that job location cannot explain the wage premium. In columns (3)-(5) we include three ownership fixed effects, 18 industry fixed effects, and 12 industry fixed effects, which only marginally change the estimate and R-squared. Hence, industry, occupation and ownership cannot explain the wage premium either. In column (6), we add 216 industry-occupation fixed effects, the estimate is the same as that in column (1). Finally, in column (7), we add 648 industry-occupation-ownership fixed effects and the main estimate decreases marginally from 0.067 to 0.059. Thus, the premium mainly stems from variation within an industry-occupation-ownership cell.

These findings already suggest that being above the cutoff does not entail one's entry into more prestigious occupation or industry since they cannot explain the wage premium. Next, we conduct more direct analysis on whether elite education affects entry into the elite class.

Elite Occupation, Industry and Ownership As shown in Table A.3 and discussed in Section 2, elite occupations, industries and ownerships are defined by the realization-hope ratio in the data. The impacts on them are presented in Table 6B.

Columns (1)-(3) present the results for elite occupations. As shown, scoring above the cutoff does not increase the probability of entering into these occupations. Similarly for elite industries and ownership in columns (4)-(8), we find no evidence that scoring above the cutoff increases the probability of entering these industries or ownerships.

Later in Section 5 on intergenerational mobility, we show that, in stark contrast, parental elite status (defined the same way) does have a strong influence on the entry into these occupations, industries and ownerships.

Non-Wage Benefits Another measure of elite class is the non-wage benefits on the job. For instance, the *hukou* status is an important social indicator for big cities because *hukou* is associated with access to public goods such as education, health care, pension etc. Another

example is that some privileged jobs may get more housing-subsidy, which is important given the rising housing price in China.

Results reported in Appendix Table 6C show that elite education does not bring about job-related benefits. We examine whether the job provides a local *hukou* status, whether the job provides housing-subsidy and insurance, and whether the job is located in major metropolitan cities (Beijing/Tianjin/Shanghai), and we find no impact on any of these benefits.

Together with the results on occupation, industry and ownership, these findings suggest that while access to elite education (due to a better exam performance) increases wages, it does not promise more benefits in other dimensions important for the elite class. Section 5 provides more related discussion when we compare the influence of family background with that of exam performance.

5 The Impact on Social Mobility

5.1 Two Dimensions of the Question

How does access to elite education affect social mobility? This question has two dimensions. The first is whether access to elite education lifts one from a low socioeconomic status to a higher socioeconomic status. Our previous findings already suggest the answer: access to elite education increases wage income and also the rank across income distribution.

The second dimension of this question is less unclear: does access to elite education attenuate or strengthen intergenerational mobility? If one believes that access to elite education in China levels the playing field and decreases the influence of parental influence, one would expect to see an attenuation effects. Instead, the Bourdieu (1988) approach may suggest an strengthening effect where elite education is exploited to strengthen the influence of parental income.

Appendix Figure A5 illustrates the two theorectical possibilities, where the x-axis indicates parental income rank and the y-xis indicates expected child's income rank. In both cases, being above the elite college cutoff increases the intercept, indicating a positive mobility in the first dimension. The change in slopes captures the second dimension: being above the cutoff decreases the intergeenerational slope and hence increases the intergenerational mobility in case (a) and vise versa in case (b).

Below, we examine the pattern in the two dimensions in the data. We measure socioeconomic status in terms of income and other important job-related status such as

occupation, industry, and ownership. Following the literature, we use both the rank-rank (e.g., Chetty et al. 2014) and log-log specifications (e.g., Solon 1992) when examining income mobility.

5.2 Income Mobility

We first use a rank-rank approach by dividing parental income into five quintiles and rank it from 1 to 5, with 1 meaning the lowest 20% in the parental income distribution in the whole sample while 5 the top 20%. The median annual parental income for the top 20% is around 135,000 RMB, more than 10 folds of that for the bottom 20% group (around 9,000 RMB). Similarly, we divide child wage into five quintiles and rank it from 1 to 5. Then, we employ a log-log approach as an additional check.

The correlation between parental income rank and child wage rank, corr(Child Rank, Parent Rank), captures the intergenerational mobility. Comparing the correlation for students above the elite university cutoff and that below can capture the role of the access to elite education in altering intergenerational mobility.

Nonparametric Description Before presenting the estimation results, we first present in Figure 5(a) a nonparametric description for students above and below the cutoff score separately. For each value (1 to 5) of the parental rank in the x-axis, we plot the mean of child rank using the same subsample as in the wage premium estimation (i.e., a bandwidth of 20 points).

Some interesting patterns appear in Figure 5(a). First of all, as expected, there is a strong and positive correlation between parental rank and child rank for both groups. Moreover, the correlations are similar for the two groups, with a slope around 0.2 for both groups. The difference lies in the intercept: the group above the cutoff has a higher intercept (around 0.25 higher). In other words, having a score above the cutoff helps an individual to move up in the wage ladder by 0.25 quintile and this level-up effect is the same across parental income rank groups. These results suggest that the correlation between parental rank and child rank is not altered by scoring above the cutoff point of elite universities.

The importance of parental income rank relative to scoring high in affecting child wage rank also suggests that the role of the exam in promoting mobility is limited. For instance, for those from the top 20% parental income families, even if they have scores below the cutoff, their average wage rank is still higher than that of all those above the cutoff but from families in the other four income groups. To further shed light on the magnitude, we plot the average probability of getting the top 20% wage for children by parental income ranks

in Figure 5(b). It shows that being above the cutoffs increases the probability of becoming the top 20% wage earnings among college graduates across all parental ranks. However, once again, for those from the top 20% families, even if they score below the cutoff, their probability of earning the top 20% wage is higher than that of those above the cutoff but from less wealthy families.

Regression Results We can use the following specification to quantify the pattern:

$$ChildRank_{i,p,y,tr} = \beta_1 \mathbb{1}(Score_i \geq Cut_{p,y,tr}) \times ParentRank + \beta_2 ParentRank + \beta_3 \mathbb{1} \\ \theta_1 f(Score_i - Cut_{p,y,tr}) + \theta_2 f(Score_i - Cut_{p,y,tr}) \times \mathbb{1} + \lambda_{p,y,tr} + \varepsilon_{i,p,y,tr}, \quad (4)$$

where β_3 (together with β_1) captures the level effect of being above the cutoff on Child's wage rank, β_2 (together with β_1) measures the intergenerational link of income rank, and β_1 captures the difference in the correlation between parental rank and child rank.

There is indeed a strong intergenerational correlation between parental income rank and child wage rank, as shown by results reported in Table 7A. Column (1) shows that the correlation between parental rank and child rank is around 0.18. Even though the magnitude is meaningful, one cannot assume that it captures the broad intergenerational mobility in China: we are studying a selected sample where even those blow the cutoffs attended a university.

Scoring above the elite university cutoff line does not change the intergenerational correlation, as the coefficient for the interaction term of above cutoff and parental rank is not statistically significant in column (2). In addition, being above the cutoff increases the quintile rank by about 0.28. Columns (3) and (4) add further province-year-track fixed effects and quadratic polynomial interactions. As expected, the correlation between parental rank and child rank becomes smaller. The main result on being above the cutoff score remains almost unchanged.

These estimation results confirm the nonparametric pattern in Figure 5: the wage premium of scoring above the cutoff point does not vary much with respect to parental income rank; or put differently, scoring high (and receiving elite education) does not alter the intergenerational mobility measured by the correlation between parental income rank and child income rank. The magnitude of the impact of being above the cutoff is comparable to that of an increase in parental income by one quintile (around 1.5-2 folds increase in parental income). This impact is sizable but it is not large enough to lift a child from an bottom 20% family to a top 20% wage group.

In addition to the rank-rank approach, we also employ a log-log approach by replacing $ChildRank$ with $\ln Wage$, and $ParentRank$ with $\ln ParentIncome$. Once again, since we are studying a selected group, we cannot assume that this number captures the broad intergenerational mobility in China. Our interest is whether the correlation is altered by elite education.

The log-log estimation results presented in columns (5)-(8) of Table 7A are consistent with the rank-rank results discussed earlier. The correlation between log parent income and log child wage in a simple regression (column (5)) is around 0.07, and being above the cutoff is associated with a wage premium but does not change the intergenerational wage correlation (column (6)). The impact of being above the cutoff is comparable to that of one-unit increase in log parental income (around 1.7 folds increase in parental income). When we add province-year-track fixed effects and quadratic polynomial interactions in columns (7)-(8), the results are very similar except that the intergenerational correlation deceases. Thus, the results from log-log specification imply the same pattern as in the rank-rank specification.

5.3 Occupation/Industry/Ownership Mobility

We also examine the intergenerational links in terms of elite occupation, industry, and ownership status (defined in Section 2). Once again, results reported in Table 7B illustrate the importance of parental background in determining the job outcomes of children. As shown, the parental status is significantly correlated with child status in all three dimensions. The impact of parental background is large compared with mean probability: having a parent working in an elite occupation, industry, and ownership increases the probability of entering the elite occupation, industry, and ownership by around 33%, 64% and 24% respectively (columns (1),(4),(7) of Table A.4). These are larger than the mobility in terms of income found earlier.

In stark contrast to the role of parental status, scoring higher than the elite university cutoff point does not increase the chance of entering elite occupations, industries or the state-owned sector; neither does it change the intergenerational correlations in these job-related characteristics. As shown, the coefficient on the above cutoff dummy is very small and insignificant throughout Table 7B, confirming that scoring higher (and entering elite colleges) does not increase the chance of getting elite jobs. This finding is also consistent with our previous results in Section 4. Moreover, the interaction term is also insignificant throughout the table, meaning that scoring higher does not change the intergenerational mobility.

Together with the findings in Section 4, these results help us to better understand the

degree of mobility created by the exam system. Being above the cutoff does have a sizable impact on wage income, which is roughly comparable to that of an increase in parental income by one quintile (around 1.5-2 folds increase in parental income). However, no evidence suggests that it increases the probability of entering an elite occupation, elite industry, or a state-owned enterprise, living in an elite city, obtaining *hukou* or any other non-marketized benefit; in contrast, parental characteristics do.

The finding that the wage premium is neutral with respect to parental income illustrates both the limitation and the merit of the exam system. It is an illusion to assume that the influence of family background is attenuated once one scores above the elite college cutoff. However, it is also too pessimistic to think that the elite status only gets strengthened by the access to elite education. We will show below that the neutrality is related to the mechanisms behind the return to elite education.

6 Understanding the Mechanism

In this section, we explore potential mechanisms through which elite education has a wage premium. Is that elite education increases human capital or that it creates useful social networks on the job market? Or is elite education mainly a signaling mechanism? Limited by data, we do not attempt to pin down any of these channels. Instead, we only provide some suggestive answers to these questions.

Below, we use different sets of information we ask in the surveys to proxy human capital, social networks and signaling and try to understand which ones are more likely to be important for our findings.

6.1 Human Capital

It is likely that students in elite universities accumulate more or better human capital in college. An ideal measure is some tests every college student takes in college. In addition, such tests needs to be gradated across universities so that we can compare the performance across universities. If those above the cutoff accumulate more or less human capital in college, we would expect to see some difference in their performance in such tests.

One test close to being the ideal is the national College English Test (known as CET-4), which is a basic criterion for job search and is usually presented in one's resume. In our data, over 88% of the sample have taken this test. In Column (1) of Table 8, we report the estimated difference in the probability of taking the CET-4 and finds no difference around

the cutoff. Column (2) further shows that there is no significant difference in the scores as well.

We also examine other national tests that offer certain certificates to college students. One caveat is that only a selected group take such tests for certificates. Columns (3)-(6) examine certification in computer skills, expertise (e.g., Certified Public Accountant, the BAR license to practice law), vocational skills (awarded by the National Occupational Skill Testing Authority) and driving. In none of these credentials do those above the cutoffs perform better. If anything, they perform worse in terms of expertise, which is consistent with the finding on majors: those major in economics and law are more likely to have such expertise certificates.

In addition, in columns (7)-(10) of Table 8, we report the time allocation on different activities such as time in class, time studying English and others. Once again, we find systematic evidence in time allocation around the cutoff.

Therefore, we find no evidence for the difference in human capital measured by performance at the national standardized tests in college. Of course, one may argue that these tests may not necessarily reflect human capital useful for the job market. But together with the results on majors (that cannot explain our wage premium finding), little evidence supports the importance of human capital in explaining wage premium.

6.2 Social Networks

It is also likely that students in elite universities get to know other elite students and build up important connections, which in turn help them in job searching. Indeed, 26% of the students reported that they rely on connections such as friends, schoolmates and relatives in finding a job. We conduct two sets of analysis to examine the role of networks for our findings. First, we examine whether there is a discontinuity in employing networks as a job search channel around the cutoff. Second, we study how networks affect our findings for wage.

Job Searching Channels Estimation results do not support the networks argument. In Table 9A, we report the impacts on different job search channels. Students employ multiple channels: off-campus/on-campus job fairs, information from teachers, job search websites or informal social networks. As shown in column (5), there is no significant difference in employing social networks around the cutoff.

Among these channels, the significant difference lies in on-campus job fairs: those above the cutoff are more likely to make use of on-campus job fairs. This suggests that the

reputation of universities attract more employers to campus, which seems more consistent with a signaling interpretation.

The Value of Networks for Wage We also examine how schoolmates networks matter for our finding on the wage premium. We calculate the share of schoolmates with fathers being Party members or having college education. As shown columns (1) and (3) of Table 9B, it is true that that those above the cutoff have more schoolmates with better family background. We next include the interactions of the above cutoff dummy and these shares in the wage regression. As shown in columns (2) and (4), the interaction terms are close to zero and not significant, suggesting that neither share can explain our wage premium.

We should note that this finding is limited by the fact that we are examining the first job and most of these students may not have large social networks. It is possible that this kind of weak ties become more important in their future career.

6.3 Signaling

While we have some relatively good proxies for human capital and social networks, it is almost impossible to have tangible measures of signaling in observational data. The finding on job searching channels in Table 9A provides some suggestive evidence for the signaling interpretation. Here, we provide some further suggestive evidence.

Our survey questions on various types of perceived discriminations can shed light on our knowledge of the signaling mechanism. We asked in the survey yes/no questions on whether students have experienced discrimination in terms of gender, *hukou*, accent and physical appearance in job searching. Meanwhile, we also asked an open question for them to describe any type of discrimination they have encountered. Around 10% of students answered this open question. Among them, the top three types of discrimination are the university rank or type of degree (36%), major (14%), and lack of experience (6%).

We examine whether being above the cutoff score affects different types of discrimination. Columns (1)-(4) of Table 10 show that there is no significant difference in terms of gender, *hukou*, accent or physical appearance.

When coming to the answers to the open question, we have a much smaller sample and do not have precisely estimated coefficients. Nevertheless, column (6) shows that students scoring above the cutoff are much less likely to feel discriminated regarding university rank or degree. This finding is reassuring since those above the cutoff are more likely to attend better universities.

Together with the results on job search channels in Table 9A, these results show that signaling is likely to be an important channel behind the wage premium. To be sure, these findings are not to reject the importance of human capital or social networks. Instead, they show that signaling is likely to be importance in this context of comparison. These findings are closely related to the Chinese education institution that merits some reflection.

The "strict entrance, easy out" in the college entrance-graduation system mentioned in the background is important for why there is a signaling impact. Due to the strict entrance rule, it is reasonable for employers to infer information on students' unobserved characteristics based on the tier of universities. It may also partly explain our finding on the lack of human capital accumulation around the cutoff. Almost everyone in college is promised graduation. As a result, students are not strongly motivated to learn more for graduation.

While these findings are certainly specific to the Chinese context, they show that it is important to analyze education institutions to understand the mechanisms.

7 Conclusion

The College Entrance Exam in China is often considered as a test that determines the course of life. It also provides an ideal laboratory to examine the role of elite education. However, little empirical investigation exists on its social and economic consequences. In this study, we endeavor to collect data on exam performance and link it to the access to elite education as well as labor market outcomes.

We document that the exam system does play an important role in elite university recruitment: there exists a clear discontinuity in the probability of entering elite university around the cutoff scores. The discontinuity also matters for the job market outcomes in terms of wages. However, the impact of the exam system on elite formation and intergenerational mobility seems limited. We find no evidence that it entails one's entry into the elite occupation or industry. It does not alter the influence of family background either.

Our study uncovers the merit as well as the limitation of this important mobility channel that affects most Chinese families. The findings also make a useful contribution to the growing literature on elite education. Besides estimating the returns, our study contributes to understanding how the access to elite education affects elite formation and social mobility, which also opens new avenues of research on other elite education institutions.

References

[1] Anelli, Massimo (2016), "Returns to Elite College Education: a Quasi-Experimental Analysis", Bocconi University, mimeo.

[2] Arcidiacono, Peter and Mike Lovenheim (2016), "Affirmative Action and the Quality-Fit Tradeoff", *Journal of Economic Literature* 54(1), 3-51.

[3] Arrow, Kenneth (1973), "Higher Education as a Filter", *Journal of Public Economics* 2(3): 193-216.

[4] Bai, Ying, and Ruixue Jia (2016), "Elite Recruitment and Political Stability: The Impact of the Abolition of China's Civil Service Exam," *Econometrica* 84(2): 677-733.

[5] Becker, Gary (1993), *Human Capital: A Theoretical and Empirical Approach with Special References to Education*, Chicago: University of Chicago.

[6] Black, Dan A., and Jeffrey A. Smith (2004), "How Robust is the Evidence on the Effects of College Quality? Evidence from Matching," *Journal of Econometrics* 121(1): 99-124.

[7] Bourdieu, Pierre (1988), *The State Nobility: Elite Schools in the Field of Power*, Stanford University Press.

[8] Bourdieu, Pierre, and Jean-Claude Passeron (1977), *Reproduction in Education, Society and Culture*, Sage Publications.

[9] Bregnbaek, Susanne (2016), *Fragile Elite: The Dilemmas of China's Top University Students*, Stanford University Press.

[10] Carnoy, M., Loyalka, P., Dobryakova, M., Dossani, R., Froumin, I., Kuhns, K., Tilak, J. and Wang, R., (2013), *University Expansion in a Changing Global Economy: Triumph of the BRICs?* Stanford University Press.

[11] Carr, Michael and Emily E. Wiemers (2016), "The Decline in Lifetime Earnings Mobility in the U.S.: Evidence from Survey-Linked Administrative Data", Mimeo.

[12] Chen, Yan, and Onur Kesten (2016), "Chinese College Admissions and School Choice Reforms: A Theoretical Analysis," *Journal of Political Economy*, forthcoming.

[13] Chen Yuyu, Suresh Naidu, and Tinghua Yu (2015), "Intergenerational Mobility and Institutional Change in 20th Century China", *Explorations in Economic History* 58: 44-73.

[14] Chetty, Raj, Nathaniel Hendren, Patrick Kline and Emmanuel Saez (2014), "Where is the land of Opportunity? The Geography of Intergenerational Mobility in the United States," *Quarterly Journal of Economics* 129(4): 1553-1623.

[15] Dale, Stacy and Alan Krueger (2002), "Estimating the Payoff to Attending a More Selective College: An Application of Selection on Observables and Unobservables," *Quarterly Journal of Economics* 117(4): 1491-1527.

[16] Dale, Stacy and Alan Krueger (2011), "Estimating the Return to College Selectivity over the Career using Administrative Earnings Data," NBER Working Paper #17159.

[17] Erikson, Robert, and John H. Goldthorpe (1992), *The Constant Flux: A Study of Class Mobility in Industrial Societies*, Oxford University Press.

[18] Erikson, Robert, and John H. Goldthorpe (2002), "Intergenerational Inequality: A Sociological Perspective," *Journal of Economic Perspectives* 16 (3): 31-44.

[19] Gelman, Andrew. and Gudio Imbens (2014), "Why High-Order Polynomials Should Not Be Used in Regression Discontinuity Designs," NBER Working Paper #20405.

[20] Hoekstra, Mark (2009), "The Effect of Attending the Flagship State University on Earnings: A Discontinuity-Based Approach," *Review of Economics and Statistics* 91 (4): 717-724.

[21] Hoxby, Caroline (2009), "The Changing Selectivity of American Colleges", *Journal of Economic Perspectives* 23(4): 95-118.

[22] Imbens, Guido, and Karthik Kalyanaraman (2011), "Optimal Bandwidth Choice for the Regression Discontinuity Estimation," *Review of Economic Studies*: rdr043.

[23] Li, Hongbin, Lingsheng Meng, Xinzheng Shi and Binzhen Wu (2012), "Does Attending Elite Colleges Pay in China", *Journal of Comparative Economics*, 40: 78-88.

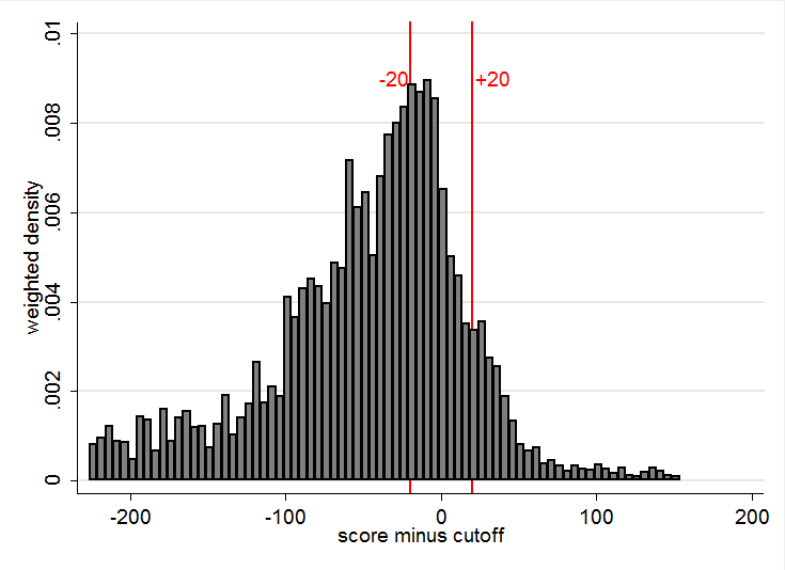
[24] Solon, Gary (1992), "Intergenerational Income Mobility in the United States," *American Economic Review* 82 (3): 393-408.

[25] Spence, Michael (1973), "Job Market Signaling," *Quarterly Journal of Economics* 87(3): 355-374.

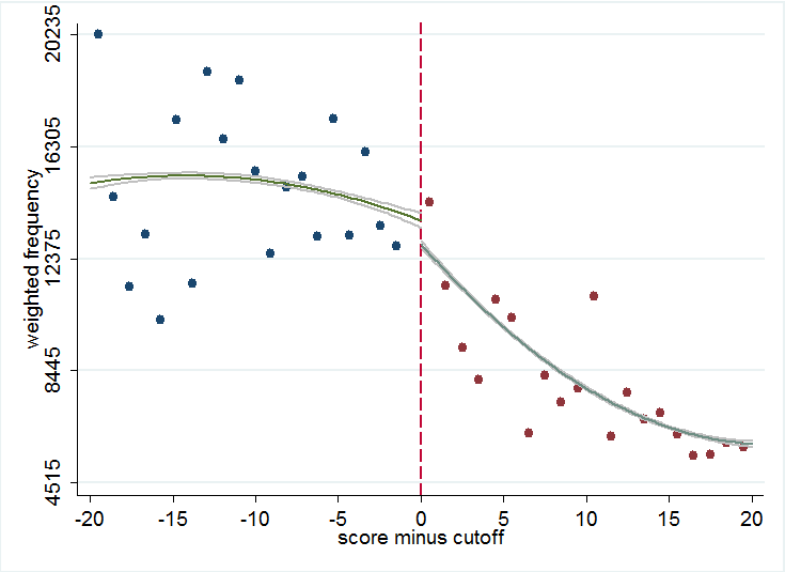
[26] Wong, Edward (2012), "Test that Can Determine the Course of Life Gets a Closer Examination", http://www.nytimes.com/2012/07/01/world/asia/burden-of-chinas-college-entrance-test-sets-off-wide-debate.html?$_r = 0$

Figure 1: The Distribution of Exam Scores in the Survey Data

(a) The Whole Sample



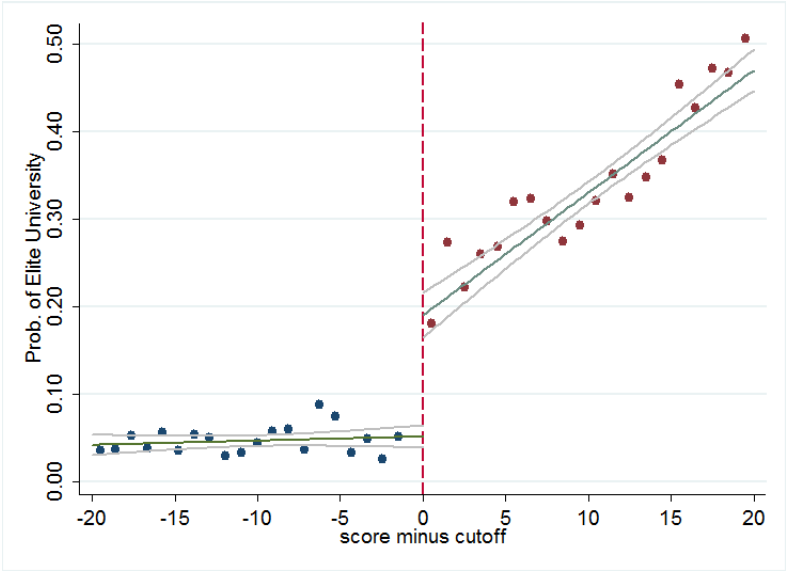
(b) Within the 20-point Bandwidth



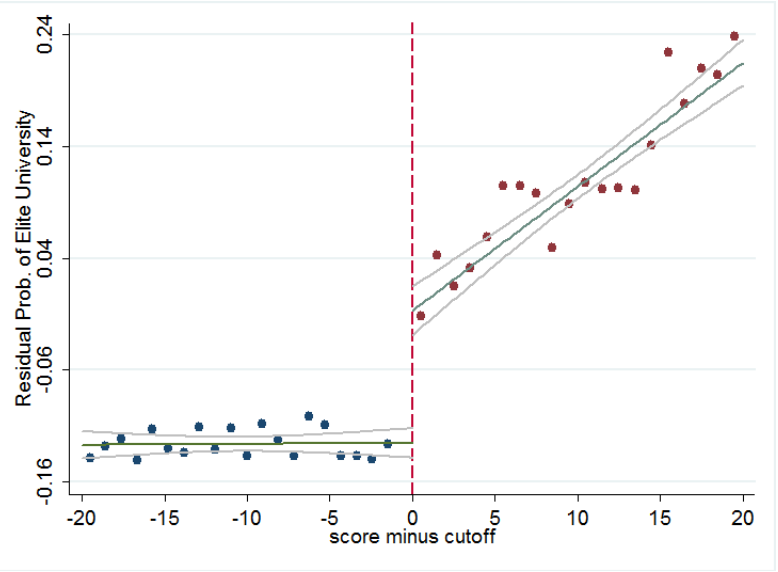
Notes: Figure (a) plots the distribution of exam scores in our survey data. Figure (b) takes a closer look at the 20-point bandwidth and shows that there is no significant discontinuity at the elite university cutoff line. Since we intentionally oversampled elite schools, the density and frequency are weighted by the sampling weight of schools. Note that the scores are not necessarily comparable across province-year-track. We make comparison within province-year-track in our analysis.

Figure 2: Exam Scores and Elite (the First-Tier) University Enrollment

(a) Pattern from the Raw Data

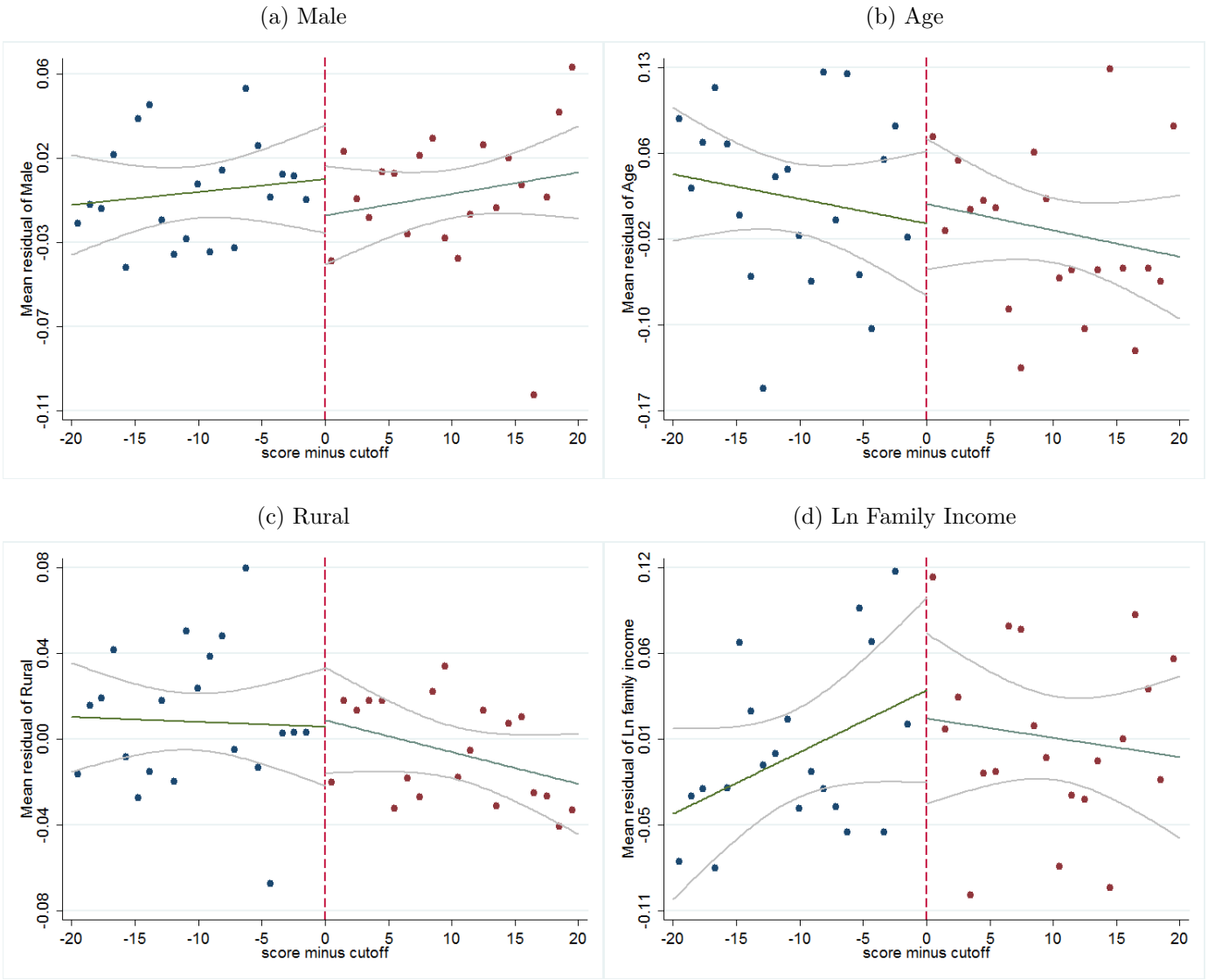


(b) Pattern after Isolating Province-Year-Track FEs



Notes: This figure plots the probability of attending an elite university by distance to the cutoff scores (that vary by province-year-track). Figure (a) is based on raw data and Figure (b) controls for province-year-track FEs. They show a notable discontinuity in the enrollment probability around the cutoff value.

Figure 3: Balance Tests of Individual and Family Characteristics (More in Appendix Table A.3)

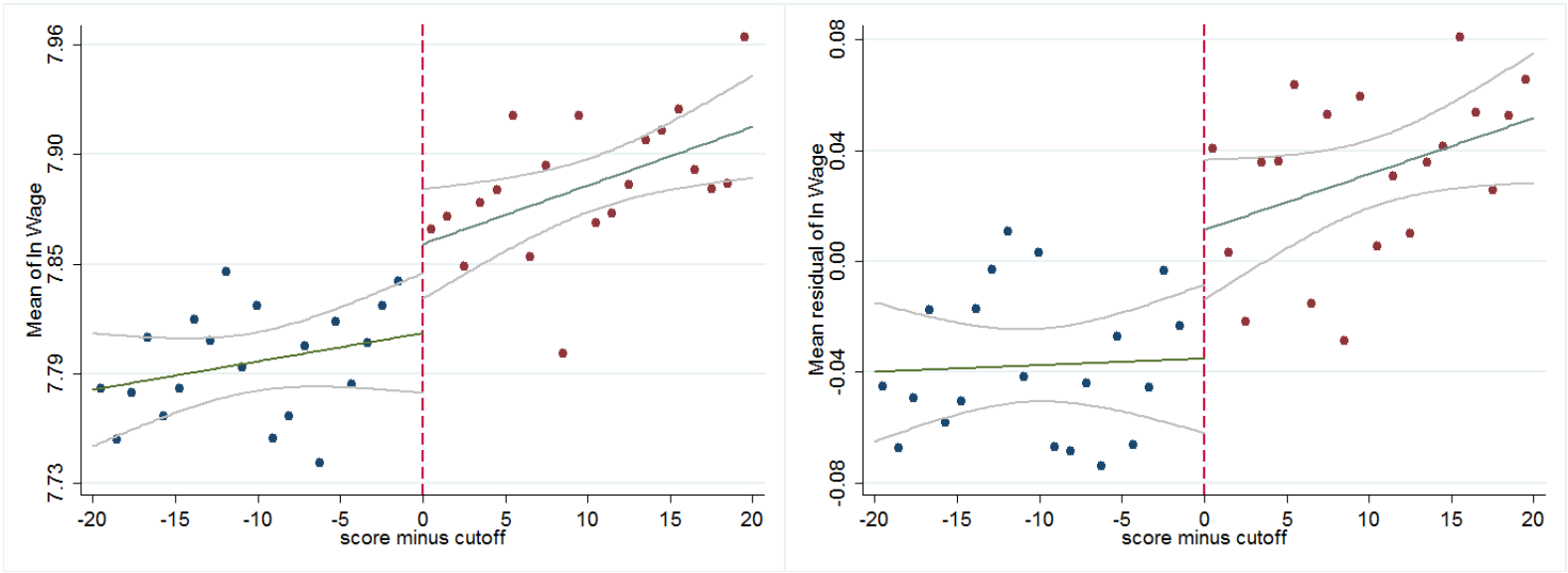


Notes: This figure shows that there is no similar discontinuity in many individual characteristics around the cutoff. Province-year-track FEs are controlled for in these figures. The patterns are similar without these FEs. Appendix A.4 presents more related results.

Figure 4: Elite Education and Wage Premium

(a) Pattern from the Raw Data

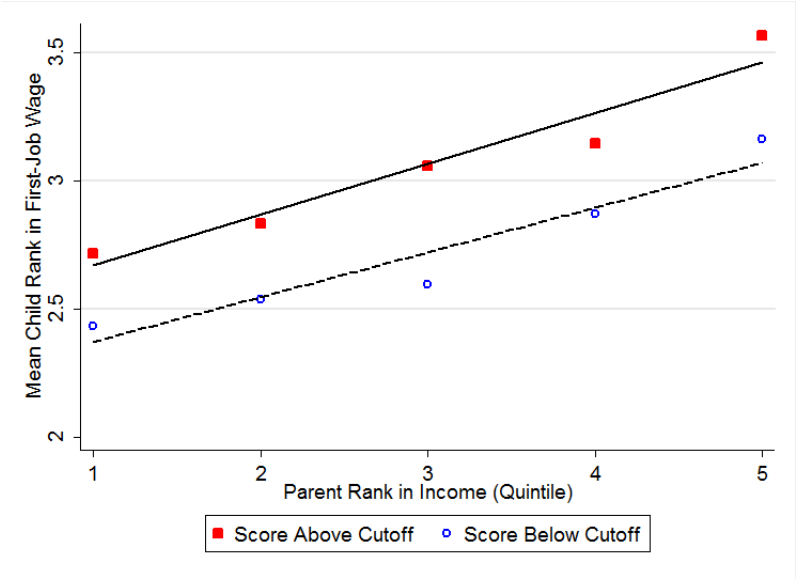
(b) Pattern after Isolating Province-Year-Track FEs



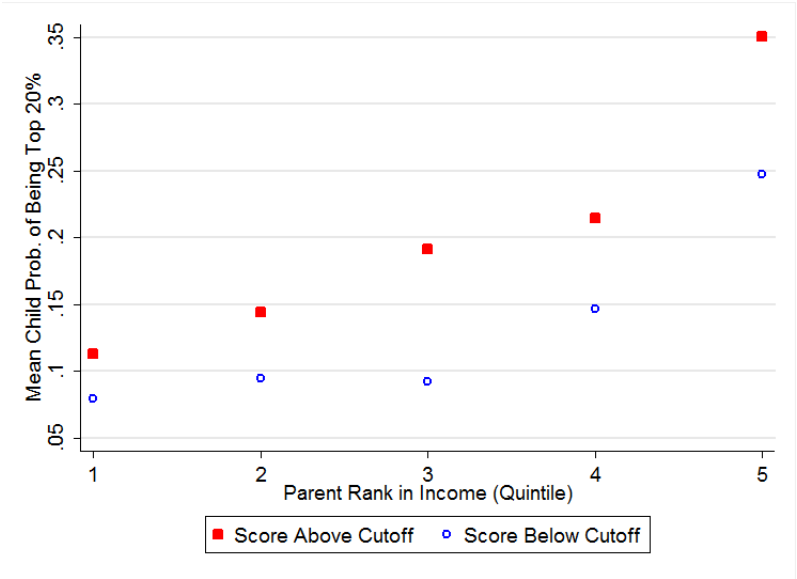
Notes: This figure plots the mean log wages by distance to the cutoff scores (that vary by province-year-track). Panel (a) is based on raw data and panel (b) controls for province-year-track FEs. They show a notable discountability around the cutoff.

Figure 5: Intergenerational Mobility By Exam Performance

(a) Child Wage Rank Against Parental Income Rank



(b) Probability of Being Top 20% by Parental Income Rank



Notes: Figure (a) presents the non-parametric binned scatter plot of the relationship between child and parent income ranks. It shows a strong and positive correlation between child and parent income ranks. An exam score above the cutoff score for elite universities raises the income rank of the child but does not change the correlation between child and parent income ranks. Using the same method, Figure (b) plots the probability of being the top 20% by parental income rank.

Table 1: Summary Statistics
(20-point bandwidth centered at the elite university cutoff)

Variable	Mean	Std. Dev.	Obs
(a) Exam Scores and Elite Education			
Elite Universities	0.21	0.41	10,335
Above Cutoff for Elite University	0.55	0.50	10,335
Scores to Cutoff	0.76	11.81	10,335
Major: STEM	0.65	0.48	10,314
Major: Econ-Business-Finance	0.24	0.43	10,314
Major: Humanity	0.10	0.30	10,314
(b) Individual and Family Characteristics			
Male	0.57	0.49	10,335
Age	23.97	1.11	10,200
Rural (before college)	0.58	0.49	10,335
Han	0.91	0.28	10,335
Father with College Edu.	0.09	0.28	9,835
Mother with College Edu.	0.06	0.23	9,821
ln Father's Income	9.89	1.11	8,674
ln Mother's Income	9.38	1.18	7,840
ln Family (Parental) Income	10.44	1.11	9,383
Father being a Party Member	0.23	0.42	9,840
Mother being a Party Member	0.08	0.28	9,822
(c) Job-related			
Ever Searched for Jobs	0.74	0.44	10,179
Best Wage Offer (for the first job)	2733	1008	5,080
ln Wage	7.85	0.37	5,080
Elite Occupation (defined in Table A4)	0.06	0.24	4,946
Elite Industry (defined in Table A4)	0.17	0.38	5,025
Elite Ownership (defined in Table A4)	0.54	0.50	5,039
Job: providing Hukou	0.39	0.49	5,026
House Subsidy	0.54	0.50	3,940
Insurance (5 types)	0.51	0.50	5,080

Notes: This table presents the summary statistics for the key variables. We focus on this sample within a bandwidth of 20 in our baseline analysis and presents results from additional bandwidths for robustness checks. The data come from six rounds of annual surveys on college graduates conducted by the authors.

Table 2: The Effect of Scoring above the Cutoff on the Prob. of Elite University Admission
Dependent Var.: Elite University=1/0 (Mean: 0.21)

	(1)	(2)	(3)	(4)	(5)
Method	Local Linear	Parametric			
Above Cutoff	0.165***	0.294***	0.283***	0.155***	0.159***
	(0.013)	(0.074)	(0.061)	(0.048)	(0.040)
Province-Year-Track FE			Y	Y	Y
Linear Interaction				Y	Y
Quadratic Interaction					Y
Observations	10,335	10,335	10,335	10,335	10,335
R-squared		0.129	0.326	0.344	0.344

Notes: This table reports the impact of exam scores on the probability of attending an elite university. Column (1) reports the results from the nonparametric method and columns (2)-(5) from the parametric method. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 3: The Prob. of Elite University Admission: Results Using Placebo Cutoffs
Dependent Var.: Elite University=1/0

	(1)	(2)	(3)	(4)	(5)	(6)
	Local Linear	Parametric		Local Linear	Parametric	
Above (Cutoff+5)	0.014	0.061**	-0.025			
	(0.018)	(0.030)	(0.026)			
Above (Cutoff-5)				-0.013	0.004	-0.037**
				(0.011)	(0.019)	(0.016)
Province-Year-Track FE		Y	Y		Y	Y
Linear Interaction		Y	Y		Y	Y
Quadratic Interaction			Y			Y
Observations	10,517	10,517	10,517	10,052	10,052	10,052
R-squared		0.367	0.371		0.304	0.306

Notes: This table shows that there is no similar discontinuity around the placebo cutoff values. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 4: The Effect of Scoring above Cutoff on Major, Univ. Location and Relative Ranking in College

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Major Econ-Manage.-Law		Major STEM		Major Humanity		University location Out of Home Province		Reported to be btm 20% in college class	
Mean	0.24		0.65		0.10		0.34		0.06	
Method	Local Linear	Parametric	Local	Parametric	Local	Parametric	Local	Parametric	Local	Parametric
Above Cutoff	-0.034*	-0.041	-0.006	0.025	0.040***	0.018	0.079***	0.071**	0.033***	0.047***
	(0.018)	(0.029)	(0.020)	(0.029)	(0.013)	(0.012)	(0.020)	(0.032)	(0.010)	(0.015)
Province-Year-Track FE		Y		Y		Y		Y		Y
Linear Interaction		Y		Y		Y		Y		Y
Quadratic Interaction		Y		Y		Y		Y		Y
Observations	10,314	10,314	10,314	10,314	10,314	10,314	10,335	10,335	10,059	10,059
R-squared		0.240		0.515		0.322		0.524		0.053

Notes: This table shows that those above the cutoff are (i) weakly less likely to major in Econ-Management-Law, (ii) more likely to attend an university out of one's home province, and (iii) are more likely to perceive themselves at the bottom 20% in college class. We will examine how these factors affect our finding on wage premium. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 5A: The Effect of Scoring above the Cutoff and Elite Education on Wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Method	Local Linear	Parametric	Parametric	Parametric	Local Linear	Parametric	Parametric	Parametric
(a) Reduced-Form								
Dependent Var.	Wage				Ln Wage			
Above Cutoff	122.2**	247.0***	146.0**	155.8**	0.053**	0.089***	0.059***	0.067**
	(60.965)	(42.358)	(56.928)	(73.176)	(0.023)	(0.015)	(0.021)	(0.027)
(b) First-Stage								
Dependent Var.	Elite University				Elite University			
Above Cutoff	0.162***	0.283***	0.155***	0.147***	0.162***	0.283***	0.155***	0.147***
	(0.018)	(0.010)	(0.019)	(0.028)	(0.018)	(0.010)	(0.019)	(0.028)
(c) IV Estimates								
Dependent Var.	Wage				Ln Wage			
Elite University	754.6**	872.6***	939.5***	1,061.5*	0.328**	0.325***	0.380***	0.456**
	(383.148)	(98.830)	(340.458)	(548.457)	(0.145)	(0.037)	(0.126)	(0.205)
Province-Year-Track FE		Y	Y	Y		Y	Y	Y
Linear Interaction			Y	Y			Y	Y
Quadratic Interaction				Y				Y
Observations	5,080	5,080	5,080	5,080	5,080	5,080	5,080	5,080

Notes: This table reports the impact on the starting monthly wage. Panel (a) presents the estimates for the reduced-form results, panel (b) for the first-stage, and panel (c) for the IV estimates of the elite education wage premium. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 5B: The Effect of Scoring above the Cutoff on Wages: Including Other Dimensions
Dependent Var.: ln Wage

	(1)	(2)	(3)	(4)	(5)
Major FEs (13)		Y			Y
Univ. Province FEs (26)			Y		Y
College Class Rank FEs (5)				Y	Y
Above Cutoff	0.067**	0.070**	0.059**	0.082***	0.075***
	(0.027)	(0.027)	(0.027)	(0.026)	(0.027)
Province-Year-Track FE	Y	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y	Y
Quadratic Interaction	Y	Y	Y	Y	Y
Observations	5,078	5,073	5,078	4,992	4,989
R-squared	0.273	0.290	0.289	0.275	0.309

Notes: This table shows that including majors and relative ranking in college marginally increases our baseline finding, consistent with the fact that those just above the cutoffs are worse compared with their peers. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 6A: The Impact of Job Characteristics on Wage Premium
Dependent Var.: ln Wage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Job Location FEs (31)							
Ownership FEs (3)		Y					
Industry FEs (18)			Y				
Occupation FEs (12)				Y			
Industry-Occ. FEs (216)					Y		
Ind-Occ-Owner FEs (648)						Y	
							Y
Above Cutoff	0.067**	0.082***	0.071**	0.071***	0.077***	0.067**	0.059*
	(0.027)	(0.027)	(0.027)	(0.026)	(0.028)	(0.028)	(0.030)
Province-Year-Track FE	Y	Y	Y	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y	Y	Y	Y
Quadratic Interaction	Y	Y	Y	Y	Y	Y	Y
Observations	5,080	4,888	5,039	5,025	4,946	4,907	4,888
R-squared	0.273	0.325	0.279	0.301	0.283	0.336	0.372

Notes: This table shows that the wage premium cannot be explained by job location, occupation, industry or ownership of the firm. Instead, it mainly stems from variation within occupation-industry-ownership cells. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 6B: Elite Formation: The Prob. of Entering Elite Occupation, Industry and Ownership

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Elite Occupation (mean: 0.06)			Elite Industry (0.17)			Elite Ownership (0.54)	
	Manager/Leader	Business Owner	Military/Police	Finance	Gov.	Edu-Culture	State-Owned	Foreign
Mean:	0.049	0.007	0.004	0.08	0.02	0.07	0.44	0.10
Above Cutoff	0.023	-0.007	-0.011	0.012	0.005	-0.044**	-0.032	0.036
	(0.022)	(0.008)	(0.008)	(0.018)	(0.009)	(0.022)	(0.044)	(0.029)
Province-Year-Track FE	Y	Y	Y	Y	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic Interaction	Y	Y	Y	Y	Y	Y	Y	Y
Observations	4,946	4,946	4,946	5,025	5,025	5,025	5,039	5,039
R-squared	0.102	0.048	0.333	0.110	0.156	0.162	0.118	0.076

Notes: This table shows that being above the cutoff does not entail one's entry into elite occupation, industry or state ownership. The elite status is defined by the scarcity (relative to the demand). See Table A4 for the specific ratios. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 6C: Elite Formation: The Probability of Enjoying Job-related Non-Wage Benefits

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Provide Hukou		Housing subsidy		5-type Insurance		Beijing/Tianjin/Shanghai	
Mean	0.39		0.54		0.51		0.19	
	Local	Parametric	Local	Parametric	Local	Parametric	Local	Parametric
Above Cutoff	-0.029	0.029	-0.025	-0.039	0.045	0.048	-0.040	-0.027
	(0.030)	(0.057)	(0.035)	(0.057)	(0.031)	(0.040)	(0.025)	(0.029)
Province-Year-Track FE		Y		Y		Y		Y
Linear Interaction		Y		Y		Y		Y
Quadratic Interaction		Y		Y		Y		Y
Observations	5,026	5,026	3,940	3,940	5,080	5,080	4,888	4,888
R-squared		0.182		0.094		0.295		0.515

Notes: This table reports the results on non-wage benefits around the cutoffs, where we find no discontinuity. This is consistent with the fact that such benefits are often associated with occupation or industry. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 7A: The Impact of Scoring above the Cutoff on Intergenerational Mobility: Income Rank and Log Income

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Child Rank (1-5)				lnWage			
Above Cutoff * Parent Rank		0.024	0.005	0.005				
		(0.035)	(0.023)	(0.023)				
Rank of Parent Income	0.184***	0.174***	0.086***	0.087***				
	(0.025)	(0.026)	(0.019)	(0.019)				
Above Cutoff * Ln Parental Income						0.001	-0.002	-0.002
						(0.012)	(0.009)	(0.009)
Ln Parental Income					0.072***	0.073***	0.037***	0.038***
					(0.010)	(0.009)	(0.008)	(0.008)
Above Cutoff		0.275**	0.297***	0.303***		0.100***	0.086***	0.085***
		(0.123)	(0.070)	(0.113)		(0.024)	(0.016)	(0.028)
Prov-Year-Track FE			Y	Y			Y	Y
Linear Interaction				Y				Y
Quadratic Interaction				Y				Y
Observations	4,696	4,696	4,696	4,696	4,696	4,696	4,696	4,696
R-squared	0.043	0.062	0.267	0.268	0.043	0.061	0.285	0.285

Notes: This table shows that (i) there is a significant correlation between parents' income with the children's income, (ii) being above the cutoff does increase the income rank, and (iii) the intergenerational link is *not* changed by exam performance around the cutoff. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 7B: The Impact of Scoring above the Cutoff on Intergenerational Mobility: Occupation, Industry and Ownership

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Elite Occuption			Elite Industry			Elite Ownership		
Mean	0.06			0.17			0.54		
Above Cutoff * Elite Parent (Occ)		-0.004	0.005						
		(0.018)	(0.018)						
Elite Parent (Occ)	0.020**	0.022	0.008						
	(0.008)	(0.014)	(0.013)						
Above Cutoff * Elite Parent (Industry)					0.019	0.003			
					(0.046)	(0.041)			
Elite Parent (Industry)				0.109***	0.099***	0.073**			
				(0.027)	(0.037)	(0.032)			
Above Cutoff * Elite Parent (Ownership)								-0.045	-0.014
								(0.037)	(0.036)
Elite Parent (Ownership)							0.130***	0.156***	0.082***
							(0.023)	(0.028)	(0.029)
Above Cutoff		-0.004	0.003		-0.023	-0.027		0.065**	0.004
		(0.008)	(0.025)		(0.022)	(0.027)		(0.030)	(0.044)
Prov-Year-Track FEs			Y			Y			Y
Linear Interaction			Y			Y			Y
Quadratic interaction			Y			Y			Y
Observations	4,946	4,946	4,946	5,025	5,025	5,025	5,039	5,039	5,039
R-squared	0.001	0.001	0.112	0.010	0.011	0.207	0.011	0.016	0.122

Notes: This table shows that (i) there is a significant correlation between parents' elite status with the children's elite status; (ii) being above the cutoff does *not* promise an elite industry, occupation or ownership, and (iii) the intergenerational link is *not* changed by exam performance around the cutoff. See Table A4 for the definition of elite status. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 8: Human Capital: the Impact of Scoring above the Cutoff on Human Capital Accumulation in College

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Certificates/Licenses from Exams Taken in College						Weekly Hours by Activity (Last Year)			
	Col. English Test Taking 0/1	CET4 Score	Computer	Field (CPA/BAR)	Vocation.	Driving	In Class	Study oneself	Study English	Sport
Mean	0.88	461	0.56	0.15	0.21	0.35	24.7	13.9	6.3	5.7
Above Cutoff	-0.014	-2.453	0.022	-0.090**	-0.003	-0.013	-0.571	1.437	-0.953	0.381
	(0.034)	(2.834)	(0.041)	(0.040)	(0.041)	(0.039)	(1.523)	(1.239)	(0.634)	(0.594)
Prov-Year-Track FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic Interaction	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	5,080	4,446	4,542	4,542	4,542	4,542	3,785	3,886	4,705	4,616
R-squared	0.099	0.277	0.193	0.130	0.107	0.139	0.097	0.110	0.131	0.083

Notes: This table shows that those above cutoff are not better in human capital proxied by national standardized tests in college. The finding in column (4) is consistent with the previous result on majors – those major in Econ-Management-Law are more likely to get certificates of CPA and BAR. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 9A: Networks I: the Impact of Scoring above the Cutoff on Job Search Channels

	(1) Off-campus fairs	(2) Teacher	(3) On-campus fairs	(4) Website	(5) Friends/Relatives/ Schoolmates
Mean	0.41	0.57	0.77	0.57	0.26
Above Cutoff	0.022	0.041	0.061**	0.032	-0.019
	(0.051)	(0.045)	(0.025)	(0.043)	(0.040)
Prov-Year-Track FEs	Y	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y	Y
Quadratic Interaction	Y	Y	Y	Y	Y
Observations	5,063	5,063	5,063	5,065	5,063
R-squared	0.096	0.080	0.148	0.117	0.078

Notes: This table presents the difference in the channels of job search around the cutoffs. There is no evidence that they employ the networks channel more. We also find that those above the cutoff are more likely to get information from on campus job affairs, consistent with the interpretation that the reputation of colleges attract employers. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table 9B: Networks II: the Value of Networks for Wages

	(1) % schoolmates w. father in the Party	(2) ln Wage	(3) % schoolmates w. father with college	(4) ln Wage
Mean	23		9.5	
Above Cutoff * % schoolmates w. father in the Party		-0.001		
		(0.002)		
Above Cutoff * % schoolmates w. father with college				-0.003
				(0.003)
Above Cutoff	0.751*	0.083	0.989**	0.083**
	(0.411)	(0.056)	(0.382)	(0.033)
% schoolmates w. father in the Party		0.010***		
		(0.002)		
% schoolmates w. father with College				0.015***
				(0.003)
Prov-Year-Track FEs	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y
Quadratic Interaction	Y	Y	Y	Y
Observations	4,877	4,877	4,874	4,874
R-squared	0.600	0.287	0.565	0.292

Notes: This table shows that those above cutoff do have better connected schoolmates, however, this fact does not explain our finding on wage premium. It is possible that such networks matter more in the long run. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.A

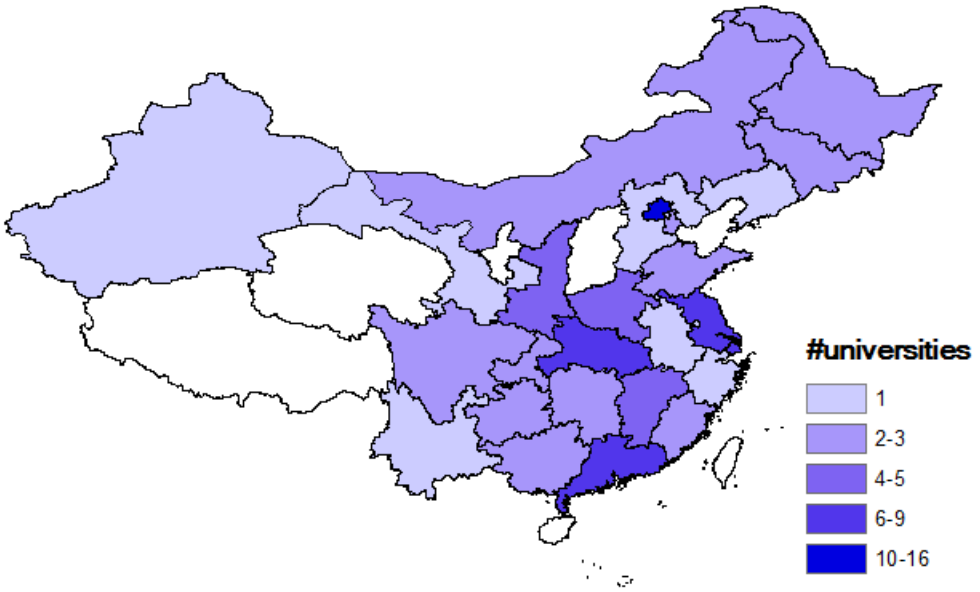
Table 10: Signaling: the Impact of Scoring above the Cutoff on Discrimination in Job Search

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Yes/No Question					Open Question		
Discrimination	Gender	Look	Accent	Rural	Hukou	University	Major	Experience
Mean	0.25	0.15	0.08	0.08	0.26	0.36	0.14	0.06
Above Cutoff	0.018	-0.021	-0.005	0.003	-0.029	-0.279	-0.045	0.054
	(0.038)	(0.029)	(0.028)	(0.027)	(0.034)	(0.184)	(0.126)	(0.072)
Prov-Year-Track FEs	Y	Y	Y	Y	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic Interaction	Y	Y	Y	Y	Y	Y	Y	Y
Observations	4,593	4,410	4,260	4,250	4,519	388	388	388
R-squared	0.109	0.111	0.096	0.089	0.129	0.481	0.399	0.554

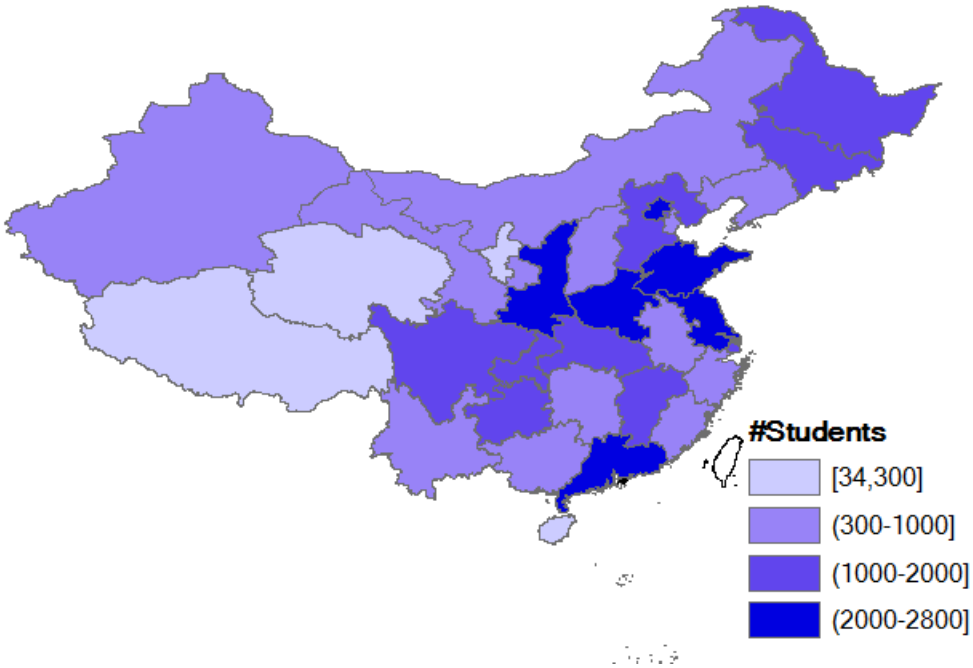
Notes: This table presents the results on reported discrimination in job searching around the cutoff. The place that exhibits a large (but not very precisely estimated) discontinuity is discrimination of universities, which is also consistent with the signaling effect of elite universities. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Appendix

Figure A.1: The Distribution of Universities and Students in Our Survey



(a) Distribution of the 90 Universities

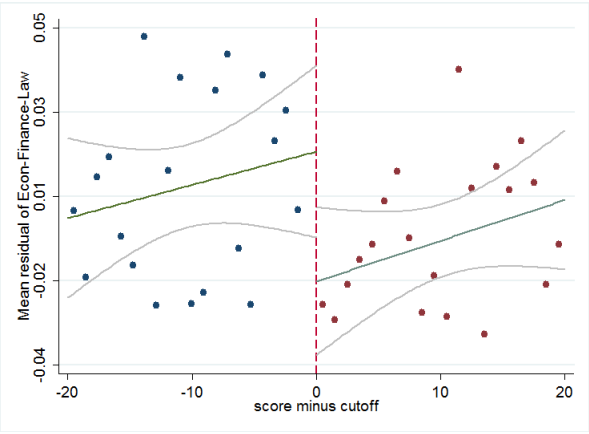


(b) Number of Students by Province of Exam

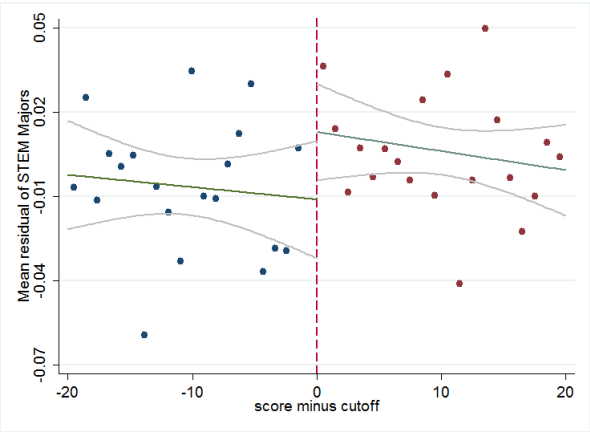
Notes: Figure (a) plots the distribution of the 90 universities in our survey by provinces. Their students come from all provinces across China. Figure (b) plots the number of students by the province of origin (where they took the exam).

Figure A.2: The Impacts on Major, Location and Relative Rank in College

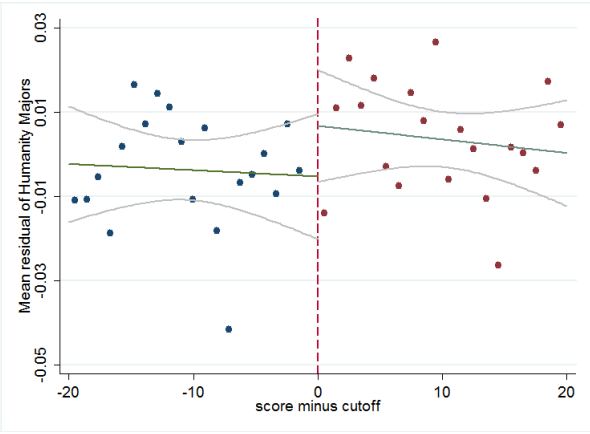
(a) Major: Econ-Mangement-Law



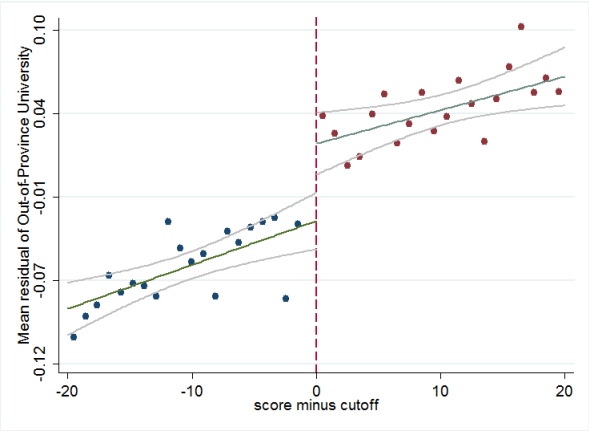
(b) Major: STEM



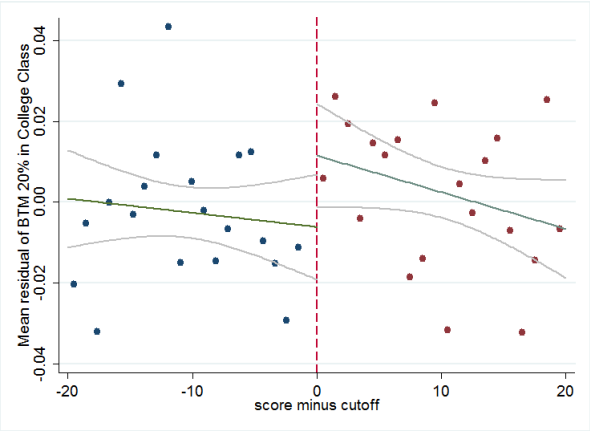
(c) Major: Humanity



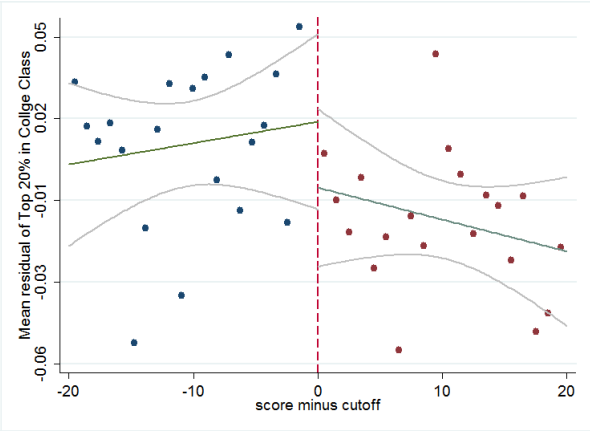
(d) University Out of Home Province



(e) Perceived Ranking in College Class: btm 20



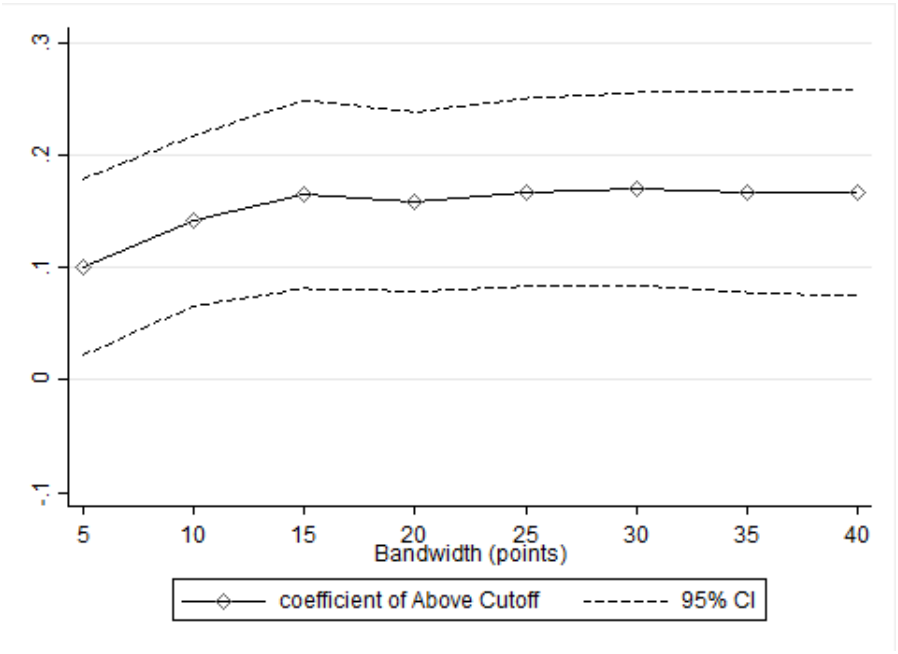
(f) Perceived Ranking in College Class: top 20



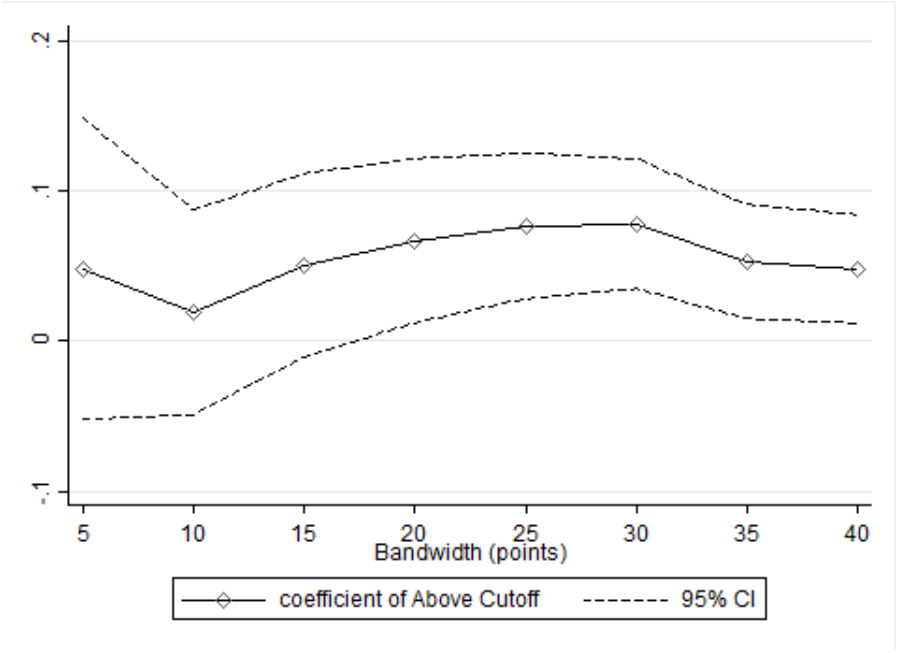
Notes: This figure plots the discountability pattern for major, university location and ranking in college class. The estimation results are presented in Table 4.

Figure A.3: Results with Different Bandwidths

(a) First Stage – Scores and Elite Education

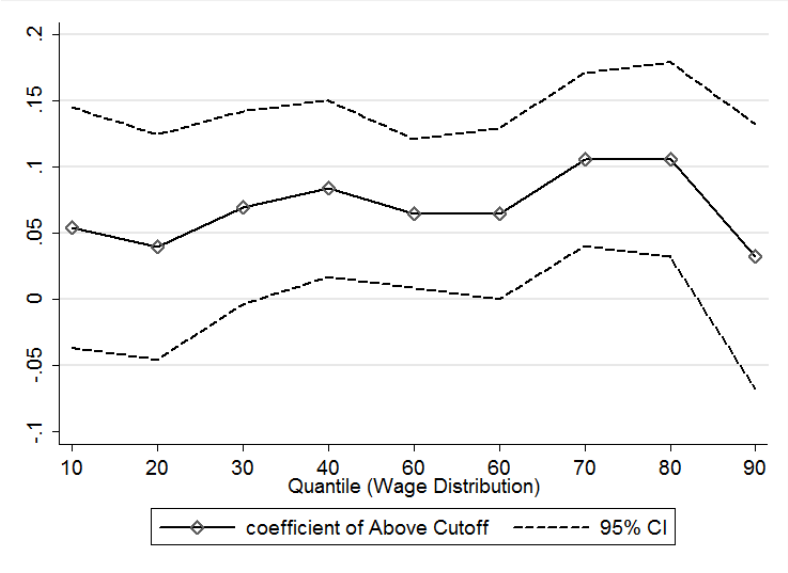


(b) Reduced Form – Scores and Wage Premium



Notes: This figure plots the estimates using different bandwidths of scores while controlling for province-year-track FEs and a second-order polynomial and interaction. Panel (a) is for the first-stage results on elite university and panel (b) for the reduced-form estimates on wage premium.

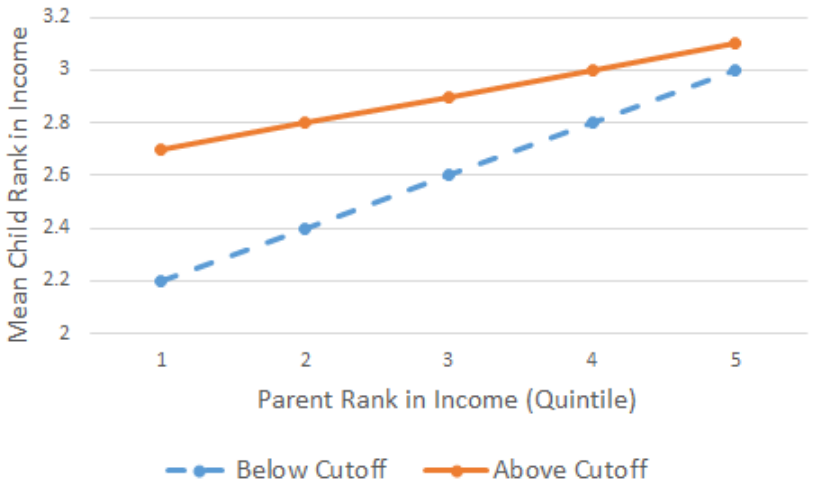
Figure A.4: The Impacts of Scoring Above Cutoff on Wage across Wage Distribution



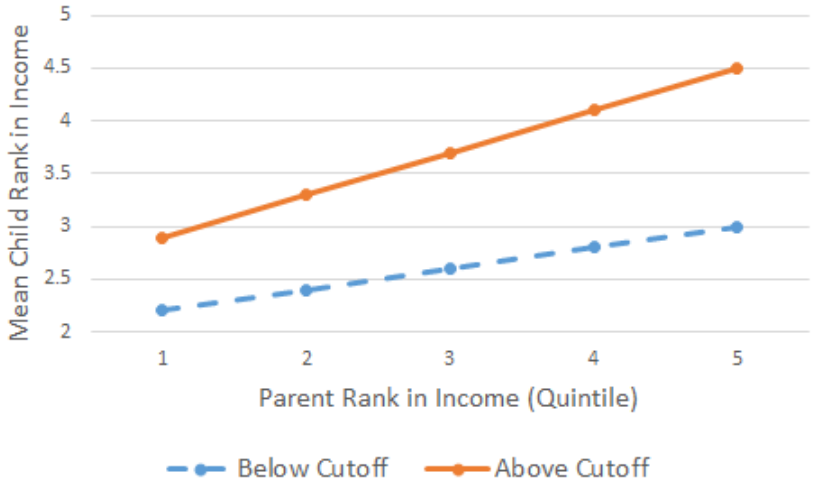
Notes: This figure plots the reduced-form estimates across wage distribution (while controlling for province-year-track FEs and a second-order polynomial and interaction). They show that the baseline is not restricted to a very specific segment of the wage distribution.

Figure A.5: Two Hypothetical Scenarios on Intergenerational Mobility

(a) An Attenuation Effect



(b) An Strengthening Effect



Notes: This figure plots two hypothetical scenarios. In both cases, access to elite education increases one's wage rank. However, it increases the intergenerational mobility in case (a) but decreases the intergenerational mobility in case (b).

Table A.1: Roll-out of Surveys 2010-15

	#Universities	#Students Per University	Total #Students
2010	19	319	6,060
2011	50	164	8,176
2012	50	173	8,650
2013	65	164	10,679
2014	17	212	3,607
2015	13	288	3,744
Total	90		40,916

Notes: This table reports the number of universities and the number of students in survey year. The selection of schools, however, is unlikely to affect our strategy exploring individual-level information on exam performance.

Table A.2: University Characteristics in Our Survey

	(1) 26 elite universities	(2) 64 non-elites	(3) Difference
# All students (Median)	19,380	18,655	724
	(9,712)	(14,632)	(3,270)
# Graduate students (Median)	4,733	4,598	135
	(2,418)	(3,392)	(769)
# Foreign students (Median)	590	182	408***
	(653)	(344)	(114)
Median Tuition	5,020	6,196	-1,176*
	(443)	(3,444)	(680)
Share of Students from Other Provinces	0.64	0.31	0.33***
	(0.24)	(0.24)	(0.05)
Median Exam Score	590	491	98***
	(26.3)	(71.6)	(14.5)
Median Wage	3,271	2,423	848***
	(818.6)	(636.9)	(161.8)

Notes: This table shows the difference between elite universities and non-elite universities in our survey. As discussed in Section 2, the elite universities are public in China. They are not small in scale and do not charge higher tuition fees. But they do have very different students.

Table A.3: Defining Elite Occupation, Industry, Ownership

	(1) Share(%) realized job	(2) Share (%) hoping to get a job in:	(3) Realized/Hope
(a) Occupation			
1 Mid-senior management personnel	3.65	22.08	0.17
2 Junior management personnel	1.24	11.83	0.10
3 Clerks	28.43	7.07	4.02
4 Professional	49.26	37.21	1.32
5 Technical staff	2.36	1.67	1.41
6 Foreman / group leader in factories	0.98		
7 Service personnel	4.08	1.53	2.67
8 Business Owner/Self-Employed	1.36	13.94	0.10
9 Skilled workers	6.65	1.51	4.40
10 Manual workers	0.44	0.4	1.10
11 Military / Police	0.4	2.3	0.17
12 Others	1.14	0.48	2.38
(b) Industry			
1 Ag, forestry, husbandry and fishery	2.51	2.23	1.13
2 Mining / Manufacturing / Construction	24.89	10.18	2.44
3 Electricity, gas and whose production and supply	5.08	4.32	1.18
4. Transport, storage and postal	3.99	2.11	1.89
5 Information, computer and software industry	15.45	11.35	1.36
6 Wholesale and retail trade	5.35	2.76	1.94
7 Accommodation and catering industry	1.98	2.25	0.88
8 Financial industry	9.17	14.08	0.65
9 Real estate	4.24	3.55	1.19
10 Rental and business services	1.85	1.07	1.73
11 Education	5.2	8.5	0.61
12 Health industry	5.27	3.62	1.46
13 Cultural, sports and entertainment	3.41	7.64	0.45
14 Scientific and technical services	4.97	6.56	0.76
15 Public Facilities Management	1.91	1.97	0.97
16 Residents and other services	1.75	1.9	0.92
17 Governments / public organizations	1.99	14.83	0.13
18 Others	0.99	1.09	0.91
(c) Ownership			
State-owned	41.67	63.85	0.65
Foreign-owned	10.78	16.26	0.66
Private-owned	47.55	19.89	2.39

Notes: This table lists the occupation, industry and ownership in our survey. Those underscored are those occupation/industry/ownership in which many people hope to work but few manage to, which indicates the elite status. These categories are also consistent with common understanding of China. We examine how they are affected by exam scores in our analysis.

Table A.4: More Results from Balance Tests

	(1) Male	(2) Age	(3) Rural (pre)	(4) Ln(Father Income)	(5) Ln(Mother Income)	(6) Ln(Family Income)	(7) Father College Edu.	(8) Mother College Edu.	(9) Father Party Mem.	(10) Mother Party Mem.
Above Cutoff	-0.007	0.001	0.014	0.031	0.038	0.023	-0.027	-0.003	-0.006	0.013
	(0.029)	(0.076)	(0.026)	(0.067)	(0.083)	(0.060)	(0.019)	(0.013)	(0.024)	(0.015)
Prov-Year-Track FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic Interaction	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	10,335	10,200	10,335	8,674	7,840	9,383	9,835	9,837	9,845	9,827
R-squared	0.150	0.109	0.145	0.204	0.229	0.206	0.069	0.072	0.055	0.060

Notes: This table reports more results from balance tests. There is no notable discontinuity in terms of observed individual characteristics and family background. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table A.5: Response by Individual Characteristics

Dependent Var.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Elite University			Major: Econ-Manage-Law			Out of Home Province Uni.			Reported: bottom 20% in college		
Above Cutoff*Rural	-0.018			0.014			0.015			0.001		
	(0.033)			(0.023)			(0.019)			(0.009)		
Above Cut*Female		0.021			0.024			0.023			-0.010	
		(0.024)			(0.021)			(0.021)			(0.009)	
Above*ln HH Income			0.009			-0.005			-0.001			-0.004
			(0.017)			(0.009)			(0.009)			(0.003)
Above Cutoff	0.169***	0.130**	0.158***	-0.049	-0.077*	-0.031	0.063**	0.037	0.070**	0.047***	0.062***	0.049***
	(0.038)	(0.053)	(0.040)	(0.034)	(0.045)	(0.026)	(0.031)	(0.048)	(0.032)	(0.016)	(0.021)	(0.014)
Rural	-0.019			-0.015			-0.043***			-0.000		
	(0.017)			(0.015)			(0.016)			(0.007)		
Female		-0.014			0.036**			-0.035**			-0.059***	
		(0.012)			(0.017)			(0.015)			(0.007)	
ln HH Income			0.011			0.026***			0.009			0.003
			(0.009)			(0.006)			(0.007)			(0.003)
Prov-Year-Track FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Linear Interaction	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic Interact.	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	10,335	10,307	9,383	10,314	10,286	9,363	10,335	10,307	9,383	10,059	10,033	9,154
R-squared	0.345	0.344	0.340	0.240	0.243	0.244	0.525	0.525	0.527	0.053	0.069	0.058

Notes: This table shows there is no significant heterogeneity in choices once one is above the cutoff. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table A.6: Post-graduate Plan and Job Searching

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Post-Graduate Plan								Job Search/Offer			
	Work in China		Graduate Study		Abroad		Unclear		Searched for Jobs		Offer after search	
Mean	0.70		0.19		0.03		0.05		0.74		0.74	
Method	Local	Parametric	Local	Parametric	Local	Parametric	Local	Parametric	Local	Parametric	Local	Parametric
Above Cutoff	-0.028	-0.050*	-0.001	0.007	0.004	0.005	0.020**	0.028**	-0.034*	-0.055	-0.035	-0.042
	(0.019)	(0.026)	(0.017)	(0.021)	(0.007)	(0.007)	(0.009)	(0.014)	(0.019)	(0.034)	(0.022)	(0.033)
Prov-Year-Track FE		Y		Y		Y		Y		Y		Y
Linear Interaction		Y		Y		Y		Y		Y		Y
Quadratic Interact.		Y		Y		Y		Y		Y		Y
Observations	10,335	10,335	10,335	10,335	10,335	10,335	10,335	10,335	10,179	10,179	7,265	7,265
R-squared		0.080		0.095		0.051		0.050		0.084		0.080

Notes: This table reports the results on the post-graduate plan and whether one has searched for a job. It suggests that the wage premium in our baseline results is unlikely due to different search effort of students around the cutoffs. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.

Table A.7: The Correlation between Wages for the First Job and the Future Jobs

Wage Category	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2nd Job			3rd Job			4th Job		
First-Job Wage Category	0.566***	0.536***	0.520***	0.442***	0.415***	0.438***	0.395***	0.391***	0.315***
	(0.015)	(0.015)	(0.019)	(0.034)	(0.033)	(0.042)	(0.094)	(0.094)	(0.113)
First-Job Wage*Elite University			0.049*			-0.062			0.187
			(0.030)			(0.067)			(0.188)
Age, Gender		Y	Y		Y	Y		Y	Y
University FE			Y			Y			Y
Observations	13,696	13,696	13,696	4,061	4,061	4,061	968	968	968
R-squared	0.389	0.410	0.410	0.424	0.448	0.448	0.588	0.624	0.626

Notes: This table shows that there is a strong correlation between wages for the first job and the future jobs. In addition, this correlation seems to be similar for graduates from elite universities and those from non-elite universities. The data come from a major online job search platform. Wages are reported in categories: 1 for below 1000 RMB, 2 for 1000-2000 RMB, 3 for 2001-4000 RMB, 4 for 4001-6000 RMB, and 5 for 6000 RMB and above. Standard errors are clustered at the university level. Significance levels: *** 1%, ** 5%, **** 10%.