Entrepreneurial Reluctance: Academic Talent and Firm Creation in China*

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Abstract

A growing literature has documented that entrepreneurial ability matters for firm productivity and economic growth. Yet, it remains unclear whether talented individuals more or less likely to create firms. We study this issue by linking administrative data on college admission for 1.8 million individuals with information on firm registration records in China and examining who had established firms by their mid-30s as well as the success of the firms. We document that within colleges, (i) individuals with higher college entrance exam scores – the most important human capital measure in this context – are *less likely* to create firms, and (ii) this negative relationship between scores and firm creation is even stronger for men, urban individuals, and those from better high schools. We allow for different interpretations of these findings in a conceptual framework and investigate their empirical relevance by studying firm success, examining wages from surveys we conducted, and considering risk preferences. The empirical patterns are most consistent with the interpretation that higher-score individuals have *higher entrepreneurial ability* but they are attracted away by non-entrepreneur sectors.

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1 Introduction

In recent years, a growing literature in economics has shown that entrepreneurial talent has important influences on both firm-level productivity and aggregate-level economic growth (e.g., Bertrand and Schoar 2003; Bloom and Van Reenen 2007; Syverson 2011; Gennaioli et al. 2013). However, it remains unclear whether talented individuals in a society are more or less likely to become entrepreneurs. On the one hand, a literature on the determinants of entrepreneurship argues that talent facilitates entrepreneurship especially in terms of incorporated business (as opposed to self-employment, e.g., Levine and Rubinstein 2017, 2019). On the other hand, a different literature on talent allocation emphasizes that talents are often attracted to non-entrepreneurial sectors in many societies which can lead to misallocation of talent (e.g., Murphy, Shleifer and Vishny 1991; Baumol, Litan and Schramm 2007).

In this paper, we examine how talent affects firm creation using administrative data in China. We focus on a special talent, academic talent, which is likely to be highly correlated with the general talent. Specifically, we link college admission records in 1999-2003 with the universe of Chinese firms and their owners (available from the 1980s to 2015), and use a random sample of 20% of the linked administrative data (over 1.8 million college graduates who had created around 170,000 firms by 2015) to examine who had created firms by 2015 and how their firms had performed.

Our setting allows us to address a few challenges in existing literature.[1] First, existing literature often faces the challenge of measuring individual-level ability. Our measure of talent is one's score in the National College Entrance Exam (known as *"gaokao"*), which is analogous to the SAT score in the U.S. context.[2] However, the *gaokao* score plays an even more important role in the Chinese society than SAT scores in the U.S., as it is the criterion in the centralized college admission system and is popularly believed to determine the course of one's life. The importance of this measure motivates us to study the implications of this human capital proxy. Second, it is usually difficult to separate the role of individual-level characteristics from that of education. Our context allows us to compare individuals from the same college and thus get a better understanding of individual choices.

[1] Entrepreneurship is a multiple discipline topic. We do not give an overview of the extensive literature here. See Parker (2018) for many related studies in economics, finance, and other fields.

[2] We are not aware of existing studies that link individual-level SAT score to firm creation and firm success in the U.S. or other countries. That said, there exist studies examining SAT scores and mutual fund performance (e.g., Chevalier and Ellison 1999). However, such a measure refers to average SAT scores for colleges rather than individual-level scores and thus likely combines both college effect and individual effect.

Third, a recent literature points out the importance of differing big firms from small business as the former is more likely to be transformational entrepreneurship (e.g., Schoar 2010). Our data allows us to paint a comprehensive picture of the creation and performance for both small and very large firms.

With these advantages, our measure does face two natural challenges. The first is that the score not only measures innate ability or talent but also captures student's family background. On this issue, we will show that the link between economic status measures and firm creation is usually *opposite* to that between scores and firm creation. The other is that one may imagine that the relationship between scores and entrepreneurial ability is zero or even negative. This is one of the key issues we will investigate.

We find that higher score students are less likely to become entrepreneurs. First of all, there is an overall negative correlation between firm creation and the *gaokao* score.[3] Most importantly, after removing the college fixed effects, we still find a strong negative association of firm creation and score within a college: a one standard deviation higher score is associated with a 10% lower probability of creating a firm. Note that this association has nothing to do with time/effort allocation in college as the score is determined prior to entering college. Within colleges, this negative sore-firm creation relationship holds even when we focus on the creations of more successful (larger) firms, compare students within college-field, and examine colleges by tier.

We also investigate how the negative link between scores and firm creation varies by personal background. We find that the negative score-firm creation link is stronger for men, for urban students and for those from better-quality higher schools. This means that the negative link appears even stronger for the relatively more advantaged groups, because we also find that students who are male, urban and from better high schools are more likely to create firms than their counterparts. The slope difference is economically large across gender and high-school quality. For instance, the negative score-firm creation slope for men (and those from above-median high schools) is 67% (and 50%) higher than women (and those from below-median high schools).

We then attempt to explain the negative link between exam scores and firm creation by formalizing three hypotheses in a simple conceptual framework built on earlier work (e.g., Evans and Jovanovic 1989; Levine and Rubinstein 2019). Specific to our context, we allow exam scores to map to the entrepreneurial ability and wage-job ability differently. The first hypothesis is the *"lower entrepreneurial ability"* hypothesis, which asserts a negative correlation between exam scores and

[3]However, this relationship becomes nonlinear when focusing on large firms, which is affected by both college effect and individual effect. See Section 3.1 for discussion.

entrepreneurial ability. For instance, one can assume that those with higher scores are the opposite type of Jack-of-all-trades (e.g., Lazear 2004) or that the exam-focused Chinese education system deters entrepreneurship. The second is the *"opportunity cost"* hypothesis. In this case, scores are positively correlated with both entrepreneurial and wage-job abilities, and the talent gets attracted away by the waged jobs. The final hypothesis is the *"risk attitude"* hypothesis, which argues that higher-score students are more risk-averse than their lower-score peers in a college.

The empirical results fit the opportunity cost hypothesis better than the other two. We test the entrepreneurial ability hypothesis by studying firm success and find that firms created by higher-score students are larger, more likely to expand and even more likely to become publicly listed. These patterns are robust to using peer composition – whether one happened to have more peers from more entrepreneurial provinces in the same cohort within a college – as an instrument to correct potential selection bias of firm creation. A survival analysis further shows that the hazard ratio of exit is lower for firms founded by higher-score students. All the patterns reveal that a higher score indicates higher entrepreneurial ability rather than the opposite.

To test the opportunity cost hypothesis, we supplement the administrative data with our own survey of Chinese college graduates we conducted during 2010-2015, covering detailed information on their first job outcomes. We document a positive link between scores and first-job wages within colleges, suggesting the opportunity cost of starting up own businesses increases with scores. Moreover, we find that the positive score-wage link is also stronger for men, urban students, and those from better high schools, which mirrors the pattern of firm creation in the administrative data. When further separating waged jobs in the state sector (state-owned enterprise and government jobs) and the private sector, we find that both are relevant as alternative opportunities but the state sector plays a relatively larger role in attracting the talents.

Finally, we do not find evidence for the risk aversion hypothesis. Empirical patterns on risk attitudes in our supplementary survey data confirm the intuition that women are more risk averse than men. In contrast, they reveal no strong correlation between risk aversion and scores in a college. The heterogenous score-risk patterns are not consistent with the score-firm patterns either. To be clear, this finding is not to belittle the important role of risk preferences in firm creation but to show that it is difficult to use risk preferences to explain our findings on score-firm relationships.

Overall, our findings imply that academic talent in a college measured by entrance exam scores, the most important human capital measure in the Chinese education system, is positively associated with both entrepreneurial ability and wage ability. When it comes to talent allocation across occupations, we find more evidence for the argument that higher-score students are more

likely to be attracted away by non-entrepreneurial sectors than their lower-score college peers, which provides evidence for earlier theoretical conjectures on talent allocation (e.g., Murphy, Shleifer and Vishny 1991; Baumol, Litan and Schramm 2007).

Our study has at least two caveats. Firstly, despite the richness of administrative information, our data cannot paint a complete picture for who becomes an entrepreneur in China, the answer of which is certainly multifaceted. For instance, the talent measured by the exam scores may work together with other types of ability to shape entrepreneurship, which we cannot observe. Instead, our focus is understanding the relationship between exam scores – a human capital measure the whole society is obsessed with – and firm creation, and we can shed light on the drivers for this relationship. Secondly, on average, it takes six years after college graduation for a college graduate to create a firm. We do not observe job history, which limits our ability to speak to interesting issues like the role of capital accumulation in firm creation. We do find that firm creation propensity differs greatly by gender and other measures of socioeconomic status, indicating the importance of other determinants of entrepreneurship such as access to capital and risk attitudes.

Section 2 describes the background and data. Section 3 presents our main findings on the negative link between exam scores and firm creation within colleges, and Section 4 presents a conceptual framework that accommodates different interpretations. Finally, Section 5 brings more evidence for or against different interpretations to data, and Section 6 concludes.

2 Background and Data

2.1 *Gaokao* and Firm Owner Data

All 2,000 or so colleges in China admit students via a centralized system that is based on the college entrance exam (i.e., *gaokao*), normally taken in early June every year. The exam, written and graded by provincial education authorities, determines the college, if any, a student will attend. In the first or second year in high school, students are divided into natural sciences (with exam subjects being Chinese, English, math and sciences) and social sciences (with exam subjects being Chinese, English, advanced math and social sciences) tracks. After the third year, they take the exam in one track. Thus, these exam scores are comparable only for students from the same province-year-track (social or natural sciences).

We employ administrative data covering the whole universe of all participants in *gaokao* from 1999-2003 and their college admission outcomes across 2,056 colleges. Out of the 23 million

records, including those who failed to go to any college, 14.2 million were accepted by some college, which is the data we use. The data provide detailed information on students' exam performance including total scores and each subject score, names of colleges and majors (if admitted), and students' biographical information such as gender, *Hukou* (i.e., rural or urban residency), birth year and high school names.[4]

To track firm creation and performance, we use administrative data of all firms ever registered in China by February 2015.[5] This data include 28 million firms, 11 million of which had been de-registered by 2015. The administrative registration records provide information on the owners (known as shareholders), which can be individuals and firms. We call individual owners firm creators or entrepreneurs. We also know if a firm invested in another firm as an owner, which we call an "expansion". The data also include some basic firm information such as industry, firm location and registered capital size. In addition, we observe when a firm deregistered, which we use as a proxy for exit.

The college entrance exam and admission data are linked to the firm owner data by an encrypted national identity number in both datasets. Matching of the two data is not perfect because of missing (3.9 million) or invalid identifying numbers (0.8 million). Out of the 14.2 million records, we succeed in linking 9.5 million records with 9.1 unique individuals. The extra records are for repeated exam takers, for whom we focus on the last-time score because it determined the college outcome.[6] For the purpose of de-identification, we randomly sampled 20% of the college students (i.e., 1.8 million individuals) in the linked administrative data for our analyses. Below, we describe the key variables and present their summary statistics in Table 1.

2.2 College Graduates Survey 2010-15

We cannot link the data with any administrative data on wages. Instead, we employ large scale surveys of college graduates we conducted during the graduation months (May and June) in 2010-15, which cover around 30,000 students from 90 colleges, 14,600 of whom reported their first-job

[4]It should be noted that the college dropout rate is very low in China and thus is not an important issue in our context. In fact, the college education system in China is known for being "strict entrance, easy out". The overall graduation rate for Chinese colleges is above 95%.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%.

[5]For small business, an individual may face a trade-off between staying self-employed (not studied in this paper) and registering a firm. Putting aside that fact that certain industries require registration for doing business, an important benefit of registering a firm is limited liability. On the other hand, staying self-employed without registering a firm may have implications on tax evasion. We consider both small and big firms, registration is a must for the latter.

[6]We examine how missing data due to linking and repeated exam takers affect our results.

wages. We designed the surveys to evaluate elite college premium and intentionally asked about their *gaokao* scores (see Jia and Li (2019) for a detailed description of these surveys and where we also show that the first job has a strong persistent effect on future jobs).

These surveys cover differ student cohorts (who were admitted to colleges from 2006-2011), for a limited number of colleges, and only provide information on the first jobs. However, since our main interest is within-college comparison, we employ data from these surveys to provide information on the relationship between exam scores and first-job wages within colleges. We examine employer ownership to shed light on whether the talents are attracted to the state or private sector.

Moreover, the surveys include rich information on student performance and behaviors in college, which we use to depict the differences among higher-score and lower-score students with a college.

2.3 Variables and Summary Statistics

Within-College Variations in Exam Scores Exam scores are positively correlated with college quality but also vary greatly within colleges. To see the pattern, we plot the distribution of exam scores (after controlling for province-year-track fixed effects) by eight college groups (top 10, 11-20, 21-50...) in Figure 1(a). It shows that on average, better colleges accepted higher-score students. In addition, the scores overlap across different batches of colleges, as we expect to be due to the institutional features in the college admission system discussed above.

To measure the variation, we report in Panel A of Table 1 the mean and standard deviation of the exam scores: 443.8 and 101.5. Once controlling for province-year-tracks fixed effects, the standard deviation of the exam scores is 87.7. Since our main interest is the within-college comparison, we also report the residual scores after isolating college fixed effects: the standard deviation is reduced 65 points. If we add 12 major fixed effects, the standard deviation changes to be 63.1 points. Figure 1(b) plots the density distribution of these variables.

The large within-college variation of scores is due to a few institutional reasons. First, college application and admission are a very uncertain process. In our study period, students in most provinces applied for colleges before they knew their exam scores. Each exam taker needed to fill a college preference sheet by pencil and bubble sheet for up to three colleges (and three majors in each college) within a few days. Each student could be accepted by only one college, and priority was given to the first choice in the bubble sheet (second and third choices were almost useless). As a result, the matching between score and college was far from being ideal.[7] Second, scores

[7]Such uncertainty gets marginally mitigated only in recent years when the admission system was reformed to be a parallel system which allows students to apply for a few more colleges thanks to computer technologies.

for each college varies greatly across provinces due to the uneven distribution of admission quota. Each province is assigned a quota for each college by the central government. Due to political and historical considerations, major metropolitans such as Beijing, Shanghai, and minority provinces such as Tibet, Xinjiang and Yunnan typically get a larger quota, especially for elite colleges. Finally, there is also a college-major tradeoff. Some students may choose a lower-ranked college for a popular major. For example, within any college, admission scores for popular majors such as economics, finance, law and STEM are normally higher than those in humanity.

Personal Background We report summary statistics of personal attributes in Panel A of Table 1 and their correlations with *gaokao* scores in Table A.1. The median birth year for these cohorts is 1982, i.e., the median age is 33 in 2015 (the final year of the firm registration records we examine). As shown by Table 1, 54% of the colleges students are male, slightly higher than the male share in the population (51.3% in 2001). 53% of the student have urban *Hukou*, much higher than the urban share in the population (37% in 2001), consistent with the fact that fewer rural students can make it to high schools. As shown in Table A.1, within college, females and males do not differ in the *gaokao* score, though men do better across colleges. Rural students have higher scores, both across and within colleges, probably because only the better rural students could attend high schools and participate in the exam.

Because we do not observe family socioeconomic status, we use high school quality as a proxy. Richer families are more likely to afford more elite high schools whose quality is determined at the local level. For instance, Ye (2015) shows that the parents of those in better high schools are better educated and have better-paying jobs. We measure high school quality using the share of students admitted by the top 100 colleges in China[8] for each high school. As reported in Table 1, the bottom 25% and top 25% high schools have 4.8% and 19.4% of their students admitted by the top 100 colleges, indicating wide variations across high schools. In addition, we use one's birth county's GDP per capita in 2001 as another indirect measure of one's family economic status. Not surprisingly, students from better high schools and richer counties tend to have higher scores, both across and within colleges, as shown in Table A.1.

Firm Creation and Success We present firm-level variables in Panels B and C of Table 1. By 2015, our sampled 1.8 million college graduates had established 170,087 firms, and the probability of creating any firm is 7.2%. In light of a recent literature emphasizing the importance of large

[8]These are designated by the government as the Project-211 colleges – the top 100 colleges in the 21^{st} century.

firms with transformative entrepreneurship, it is important to consider firm size. We use registered capital as a proxy for firm size,[9] which is the maximum liability a firm has and hence matters for doing business. After a firm is registered, the owners can choose to update their registered capital size, but we can only observe the most current number. In our analysis, we use registered capital in 2015 to measure firm size. If a firm exited before 2015, its registered capital size refers to the most recent information before exit, which we also observe in 2015. Using registered capital as a measure of firm size, we find that 1.6% of the individuals had established firms with registered capital above RMB 2 million, and only 0.78% and 0.4% of the individuals had established firms with registered capital above RMB 8 million and 15 million.

The median firm was established in 2010, or around six years after one graduated from colleges, showing that it takes time to create a firm. The top five industries are wholesale and retail (30.9%), leasing and business services (20.2%), scientific research and technology services (14%), manufacturing (8.5%), and information technology and services (6.8%). The other 15 industries together account for the remaining 20%.

We also use a few alternative measures of firm success. The first measure is registered capital size mentioned above, with the 25th and 75th percentiles being RMB 200,000 and 2 million. The second proxy is whether the firm was registered out of one's home province. It has been well recognized that provincial governments tend to protect local firms from the competition of other firms (e.g., Young 2000). Thus, being able to found a firm out of one's home province also indicates success. In our sample, less than half (or 39%) of the firms were registered outside one's home province, suggesting that it is not easy to establish a firm beyond one's home province due to local protection. The third is expansion, which is defined as one firm listed as the owner of another firm. In our sample, 5% of the firms expanded this way. The fourth proxy is whether a firm became publicly listed. This measure can be considered as a proxy for extreme success as it is a rare event with a chance of 3.6 per 10,000 firms. Finally, we use deregistration information to proxy firm exit. The exit probability varies greatly by firm age: 90% survived beyond 3 years but only 60% survived beyond 10 years.

[9]Unfortunately, the firm registration data does not report employment.

3 Academic Talent and Firm Creation

3.1 Descriptive Patterns

We first describe the patterns on firm creation by scores in the administrative data. Then, using our survey data, we compare observable characteristics of higher-score students with their lower-score college peers, which is useful to illustrate what scores capture.

Scores and Firm Creation cross and within Colleges We first examine the link between college entrance exam score and firm creation unconditional on the colleges students go to, recognizing that such a relationship reflects both the within- and between-college effects. We have four different definitions of a firm by its capital size, i.e, any firm, a firm with the registered capital no less than RMB 2 million, RMB 8 million, or 15 million. We isolate province-year-track fixed effects so that the scores are comparable.

Descriptive results suggest that the correlation between firm creation and exam scores is generally negative, but even more so when we control for the college fixe effects. As shown in Figure 2(a), the score-firm correlation is strongly negative when all firms count, but it becomes nonlinear and more positive as we examine the creation of larger firms. The patterns are rather different after we control for college fixed effects. As in Figure 2(b), within colleges, we find that regardless of how we define firms, higher-score students are less likely to create them.

Although it is not our focus, we show that underlying the difference between Figure 2(a) and (b) is the role of the college one attends on firm creation. To see this, we plot the correlation between college selectivity (measured by the median score of admitted students) in Appendix Figure B.1, which is generally positively associated with firm creation, especially for large firms.

Our focus is to understand the relationship between individual-level ability and firm creation. Thus, we focus on within-college pattern and leave the task to investigate the college selectivity effects for the future work. We are interested in the following questions: How large is the negative association? Is the negative link different by personal background such as gender? Finally, why do higher-score students avoid entrepreneurship in a college?

The Profile of Higher-score Students in College To illustrate what the exam score measures, we leverage the information on personal characteristics in our college graduate surveys and describe how higher-score students differ from their lower-score peers. As reported in Appendix Table B.3, we find that within a college, higher-score students better performance, indicated by a significantly

higher GPA, a lower probability to fail any subject, a higher likelihood to get university-level awards. They are also more likely to hold positions in student unions and more likely to be a Party member.

Together, these results suggest that the entrance exam score is positively associated with general ability. Yet, its relationship with entrepreneurial ability remains to be studied next.

3.2 Estimation Results within Colleges

Baseline Results To estimate the link between academic talent and firm creation within colleges, we employ the following specification at the individual level:

$$Firm_{i,pyt,c} = \beta Score_{i,pyt,c} + \alpha X_i + \lambda_{pyt} + \theta_c + \epsilon_{i,pyt,c}, \quad (1)$$

where $Firm_{i,pyt,c}$ a dummy variable indicates whether an individual i of province-year-track (pyt) in college (c) created a firm. On the left side of the equation, we use four definitions of a firm by its registered capital size. The key independent variable of our interest is the exam score ($Score_{i,pyt,c}$). Since $Score_{i,pyt,c}$ is only comparable within province-year-track, we always control for province-year-track fixed effects (λ_{pyt}) in our analysis. θ_c indicates college fixed effects. We report standard errors are clustered at the college level.

X_i indicates one's personal characteristics that include gender, *Hukou* (rural vs. urban), high school quality, birth county's GDP per capita, and age fixed effects. While we do not have measures like parental income, it is reasonable to assume that those from better high schools and richer counties enjoy more socioeconomic advantages than their counterparts. We also control for the major fixed effects in X_i for certain specifications.

Regression results reported in Table 2 show that firm creation is negatively correlated with firm creation. To make interpretations of results easier, we report the coefficient for 1σ (standard deviation) difference in the exam score (i.e., 65 points in a college). As shown by Columns (1), within a college, 1σ higher exam score decreases the probability of creating any firm by 0.77 percentage points or over 10% of the mean (7.12). The estimates remain stable when we control for all personal characteristics in columns (2) and add 12-major fixed effects in columns (3). If we define firms as those with registered capital no less than RMB 2 million or 15 million, the magnitudes are actually very similar as reported in columns (4)-(9): 1σ more in the exam score within a college decreases the probabilities of creating these two type of firms by around 10% of the mean.

In addition, we find personal attributes matter for firm creation. The gender difference is large: women are only half as likely to create a firm as men, probably because female students are more risk averse or face discrimination in access to capital. Students from urban areas and better high schools

are more likely to create firms than their counterparts, albeit the difference is less striking than the gender difference, suggesting that students with advantageous social and economic background also have an advantage of creating firms.

Patterns by Majors and College Ranks Within a college, the opportunity cost of creating a firm may differ across other attributes such as major. We controlled for major dummies in the above analysis and find firm creation-score correlation holds. We now go a step further to allow the effect of scores on firm creation to vary across major. To make analysis tractable, we categorize the twelve majors into three groups: STEM, Economics-Finance-Law, and Humanity. As shown in columns (1)-(3) of Table B.4, STEM majors account for 51% of college students, consistent with the fact that Chinese higher education encourages a large number of students to enter STEM fields. Economics, Finance and Law majors account for 27% of the students and humanity majors for the rest 21%.

The reported correlations between exam scores and majors confirm that, within a college, students in STEM and Econ-Finance-Law majors have higher scores than those in Humanity majors The estimated coefficients suggest that 1σ higher exam score within a college is associated with an increased probability of majoring in STEM and Economics-Finance-Law by 3.6 and 2 percentages points, which stems from a reduction in the probability of majoring in Humanity.

The relationship between exam scores and firm creation within each broad major (in columns (4)-(12)) is similar to the overall effect reported above. First of all, as shown by the mean firm creation probabilities, students in Econ-Finance-Law majors have a higher propensity of firm creation, consistent with the conjecture that the choice of these majors indicates preferences toward entrepreneurship. Most importantly, the negative relationship between scores and firm creation holds within each major. For instance, based on the broadest definition of a firm, 1σ higher exam score within a college decreases the probabilities of creating firms by 10% for those who majored in STEM, 7.6% for those in Economics-Finance-Law majors, 12% for those in Humanity.

The relationship between scores and firm creation may also differ by college quality, if the opportunity cost of firm creation differs greatly across colleges of different quality. To test this, we divide colleges into three groups: the top 10, those ranked 11-100, and the rest. As reported in Appendix Table B.5, the negative link between scores and firm creation hold for each group. Thus, our main finding is not driven by a small set of majors or colleges. Instead, it seems to be a general pattern that holds across fields and college tiers.

Potential Data Issues We check a number of data issues. First, one issue is that we lose 33% observations while matching the firm data to the admission data due to missing identifications. To check whether this matters for our finding, we restrict our analysis to the province-years with missing probabilities lower than 5% and 1%. As reported in panels A and B of Appendix Table B.6, the patterns remain very similar to those in Table 2, suggesting that the missing identification may not have been a critical issue in our case.

Second, we include in the above analysis those college students who were repeated exam takers. They may cause a problem if repeated exam takers are different from one-time takers in that they alter the correlation between firm creation and score. As a robustness check, we exclude them from our analysis. Again, we obtain estimates very similar to those from our baseline estimations (reported in Appendix Table B.7).

Third, we deal with the issue of students on the two tails, whose characteristics may be special. For instance, risk attitudes are likely to be more important for students on the tails. As indicated in Figure 1, there are a small number of students with scores on the tails of the score distribution within a college. Our finding on the negative relationship between scores and firm creation is not driven by these students on the tails, as already suggested by the pattern in Figure 2(b). Nonetheless, as another test, we focus on students with scores between 10th and 90th percentile within a college. As shown in Appendix Table B.8, we find that the estimates become even stronger if we exclude those with scores on the two tails.

3.3 Heterogeneous Patterns by Personal Characteristics

We further examine how the link between scores and firm creation varies by personal characteristics, which will reveal possible explanations for the negative relationship. Specifically, we examine the score-firm creation link across gender, *Hukou* (rural vs. urban), and high school quality using the following specification:

$$Firm_{i,pyt,c} = \beta_1 Score_{i,pyt,c} + \beta_2 Score_{i,pyt,c} \times \mathrm{X}_i + \lambda_{pyt} + \theta_c \times \mathrm{X}_i + \epsilon_{i,pyt,c}, \quad (2)$$

where X_i indicates being female, rural or from below-median high schools. We also allow college effects to differ for these groups by including $\theta_c \times \mathrm{X}_i$ as controls.

Similar to Figure 2(b), Figures 3(a)-(c) plot the within-college correlations between scores and firm creation by gender, *Hukou* and high schools based on college enrollment outcomes. As shown, the negative score-firm creation link is stronger for men than women, for the urban individuals than the rural individuals, and for those from better high schools than those from lower-quality high

schools. For simplicity, we focus on firms with registered capital no less than RMB 15 million in these figures and report similar patterns by firm size in Table 3.

The differences across personal background are clear. For instance, the estimates in column (1) of Table 3 show that 1σ higher score within a college decreases the probability of creating any firm by 0.96 for male but 0.58 for female, implying that the score-firm slope for men is 65% higher than that for women. The negative score-firm link is also stronger for urban than rural, though the difference is less striking (column (2)). The difference across high schools is also large: the magnitude of the negative effect for students from above-median high schools is about 50% larger than that from below-median high schools. These differences remain similar when we examine all types of heterogeneity together (column (4)) and restrict firms to be the larger ones (columns (5)-(12)).

3.4 Discussion

There are three potential hypotheses for our finding that higher-score students within a colleges are less likely to create a firm. The first is that higher-score students in college have lower entrepreneurial ability than their lower-score counterpart, which we call the *"lower entrepreneurial ability"* hypothesis. While we are not aware of any evidence for such a argument, there does exist a perception that the Chinese education system hinters creativity and entrepreneurial ability.[10] The second hypothesis is the opposite: higher-score students in college have higher entrepreneurial ability but they also have higher wage ability. If the return to their wage ability rises faster than that to their entrepreneurial ability, we expect a negative relationship between scores and firm creation. We term this the *"opportunity cost"* hypothesis. The third hypothesis is that scores reflect other personal traits. In particular, because risk attitudes are an important factor in entrepreneurship. One may wonder whether higher-score students in a college are more risk averse than their lower-score peers. We call this the *"risk attitude"* hypothesis. We formalize all three hypotheses in Section 4. While they can work together in theory, our aim is to bring them to data to understand t heir empirical relevance.

[10]There exits a Chinese phrase to describe this perception, *gaofen dineng*, meaning "high score but lower ability". Zhao (2009) identifies this as a problem with the Chinese educational system. However, we are not aware of any empirical investigation to prove the plausibility of this perception.

4 A Conceptual Framework

In this section, we present a simple yet flexible conceptual framework on the choice of a college student between creating a firm and becoming a wage worker. Building on earlier work (e.g., Evans and Jovanovic 1989; Levine and Rubinstein 2019), we let the academic ability of a college student to feed into both the entrepreneurial ability and the ability for wage work (wage ability). We also we allow the mapping from academic ability to entrepreneurial ability to differ from the mapping to wage ability. Specific in our empirical context, we use the exam score as the indicator of academic ability. Our aim is to derive three alternative hypotheses for the negative link between scores and firm creation.

Setup An individual i with score S (we ignore the subscript i to simplify notations) and personal background X (e.g., gender and *Hukou*) in a college chooses to establish a firm or become a worker. We differ entrepreneurial ability (A_E) and wage ability (A_W) and allow for a flexible mapping between scores and these abilities using the following specifications:

$$A_E = e^{aS} \text{ and } A_W = e^{bS}, \tag{3}$$

where a can have any sign, reflecting the correlations between exam scores and entrepreneurial ability can be positive, negative or zero. In theory, we could allow b to have any sign, but for empirical relevance, we assume $b > 0$ (on which we later present evidence).

If one chooses to start a firm, then the entrepreneurial ability (A_E) and physical capital K are used to produce Y:

$$Y = A_E^{\beta(X)} K^{\alpha},$$

where β captures the return to entrepreneurial ability, which is allowed to be affected by personal background (X) in a flexible way.

A firm owner's problem is to maximize the following expected returns by choosing the optimal size of capital K:

$$R = A_E^{\beta(X)} K^{\alpha} - r(X)K,$$

where the price of capital $r(X)$ can also depend on personal background.

The optimal amount of capital is

$$K^* = \left(\frac{\alpha A_E^{\beta(X)}}{r(X)} \right)^{\frac{1}{1-\alpha}}. \tag{4}$$

Given that $A_E = e^{aS}$, we obtain the expected returns as

$$\begin{aligned} \ln R^* &= \tfrac{1}{1-\alpha} \ln A_E \beta(X) - \tfrac{\alpha}{1-\alpha} \ln r(X) + \ln \Gamma \\ &= \tfrac{1}{1-\alpha} aS\beta(X) - \tfrac{\alpha}{1-\alpha} \ln r(X) + \ln \Gamma, \end{aligned} \tag{5}$$

where $\Gamma = \alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}$.

Alternatively, if one chooses to become a wage worker, then wage is a function of wage ability A_W or

$$W = A_W^{\mu(X)},$$

where μ captures the return to wage ability, which is also allowed to be affected by personal background (X) in a flexible way.

Similar to the existing literature, we capture personal preferences such as risk aversion in occupation choice in a reduced-form way. Specifically, we assume the utility function includes an element $\delta(X, S)$, where δ refers to the extra utility of being a waged worker (or utility of avoiding risks of firm creation). Thus, the utility of being a worker can be written as

$$V = A_W^{\mu(X)} e^{\delta(X,S)},$$

and the expected returns from being waged worker is

$$\begin{aligned} \ln V &= \mu(X) \ln A_W + \delta(X, S) \\ &= bS\mu(X) + \delta(X, S). \end{aligned} \tag{6}$$

We also allow individual-level idiosyncratic shocks (ε) to affect occupation choice where ε follows a distribution of c.d.f $\mathbb{G}(\varepsilon)$.

Choosing to Create a Firm An individual will choose to create a firm iff $lnR^* \geq lnV + \varepsilon$, which gives the following condition:

$$\frac{1}{1-\alpha} aS\beta(X) - \frac{\alpha}{1-\alpha} \ln r(X) + \ln \Gamma \geq bS\mu(X_i) + \delta(X, S) + \varepsilon. \tag{7}$$

Thus, the probability of creating a firm becomes:

$$\mathbb{P}(Firm) = \mathbb{G}\left\{ \left[\frac{1}{1-\alpha} a\beta(X) - b\mu(X) \right] S - \delta(X, S) - \frac{\alpha}{1-\alpha} \ln r(X) + \ln \Gamma \right\} \tag{8}$$

From equation (8), we can see the negative link between scores and firm creation (dP/dS) could be due to three different channels summarized by

$$\frac{1}{1-\alpha} a\beta(X) - b\mu(X) - \delta_s(X, S) < 0 \tag{9}$$

From this, we can see that the negative link between scores and firm creation ($d\mathbb{P}/dS$) could be

due to one, two or all three of the following channels:

(1) the *"lower entrepreneurial ability"* hypothesis assumes that $a < 0$;

(2) the *"opportunity cost"* hypothesis refers to $b > 0$;

(3) the *"risk attitudes"* hypothesis refers to $\delta_s(X, S) > 0$.

Testable Implications We can derive a few empirical tests of the three hypotheses based on (4) and (9). Some or all of the three hypotheses could be at work to drive the negative correlation between creating a firm and score S. In the following, we derive a few testable conditions that make (9) more likely to hold. Note that individually, these tests results are neither necessary nor sufficient conditions for (9) to be true.

First, we can test the *"lower entrepreneurial ability"* hypotheses by estimating the sign of a. Empirically, we do so by estimating the effect of score on the optimal size of capital, which is derived from Equation (4),

$$\ln K^* = \frac{1}{1-\alpha}\left[aS\beta(X) + \ln\alpha - \ln r\right]. \tag{10}$$

The estimated sign of dK/dS is the same as a, given that $\beta > 0$. If the estimated sign is negative (score is negatively correlated with the size of capital), then $a < 0$, which means that we cannot reject the *"lower entrepreneurial ability"* hypothesis. Otherwise, this hypothesis is rejected. We can further extend this argument by exploiting other measures on the success of the firms.

Second, we can test the *"opportunity cost"* by estimating the sign of b, the wage ability. Particularly, we estimate a wage equation with score as a key explanatory variable, exploring our college graduate survey. Finding a positive correlation ($b > 0$) would provide supports of the *"opportunity cost"* hypothesis.

Third, we can directly test the *"risk attitude"* hypothesis by directly estimating the correlation between risk attitude and score using survey data with both score and risk attitude information (the sign of $\delta_s(X, S)$). Empirically, we do so by directly estimating a risk attitude equation with score as the key explanatory variables.

Fourth, we can also go a step further to test how personal characteristics (X) affects the marginal effect $d\mathbb{P}/dS$, or estimating the sign of the cross derivative $\frac{d^2\mathbb{P}}{dSdX}$. For example, if we find that the score-risk relationship does not change with X but the score-wage relationship changes with X, then it supports the *"opportunity cost"* hypothesis.

Finally, there is an interesting situation in our empirical work. In particular, we find in the next section that both the *"lower entrepreneurial ability"* hypothesis and the *"risk attitudes"* hypothesis

are rejected (specifically, we find that $a > 0$ and $\delta_s(X, S) = 0$). In contrast, we find support for the *"opportunity cost"* hypothesis ($b > 0$). These findings together suggest that the return to score is positive for both entrepreneurial activities and wage work, and that $b\mu(X) > \frac{1}{1-\alpha} a\beta(X)$ must be true. The later means that the relative return to creating a firm is larger than that of wage work. Unfortunately we do not have data to directly estimate the relative returns.

5 Testing the Hypotheses

We present evidence for and against each hypotheses in this section. In theory, all three hypotheses can work together. However, as we will show, empirical patterns appear to be consistent with the opportunity cost hypothesis but go against the other two.

5.1 Lower Entrepreneurial Ability Hypothesis

Estimation Strategy We test the *lower entrepreneurial ability* hypothesis by recovering the sign of a, which is the same as dK/dS as shown in the last section. Specially, we estimate equation (10) using the following specification,

$$\ln K_{f,i,pyt,c} = \gamma Score_{f,i,pyt,c} + \alpha X_i + \lambda_{pyt} + \theta_c + \epsilon_{i,pyt,c}, \tag{11}$$

where $K_{f,i,pyt,c}$ refers to registered capital of firm f created by individual i. Recall that firms can update their registered capital and we use the most updated amount observed in 2015 as a measure of firm success.

One concern is selection bias. Success is conditional on entry, which might be correlated with unobservables that also affect success. For instance, we assume that individual-level shocks in the decision to create a firm (inequality (7)) are not correlated with academic talent in our conceptual framework but we cannot empirically observe these shocks. If they vary systematically with academic ability, the estimation of equation (11) is biased.

To deal with this potential selection bias, we employ the Heckman two-stage estimation to correct potential bias caused by entry (Heckman 1976). In the first stage, we estimate the probability of entry, which is

$$Pr(Firm = 1|Z_{i,pyt,c}) = \Phi(Z_{i,pyt,c}) \tag{12}$$

where $Z_{i,pyt,c}$ includes X_i, λ_{pyt}, θ_c in equation (11) as well as an instrument variable (IV). We then estimate the second-stage firm success equation correcting for (entry) selection by using the inverse mills ratio estimated from the first stage.

We argue that the origin composition of peers within the same college-cohort (indicated by peer origin$_{c,t}$) provides a reasonable instrument to predict firm entry. Essentially, we exploit two sources of variation: the variation in entrepreneurship across provinces and the composition of one's peers within a college. Intuitively, higher-score students may select into colleges with higher or lower propensity to create firms. But within a college, the composition of students' origin has some randomness which creates the variation in entrepreneurship exposure.

Specifically, we define the instrument as

$$\text{peer-origin}_{c,t}=\left(\frac{\sum_{j\neq i} EntrepreneurProp_{j,prov}}{n-1}\right)_{,c,t}$$

where $EntrepreneurProp_{j,prov}$ is calculated as the number of entrepreneurs who had established firms before 1999 divided by the adult population in a province. We use this historical information of entrepreneurial propensity to further minimize any concern of the reflection problem. n refers the number of students in a college-cohort.

A good IV should be close to being randomly assigned and thus not correlated with personal characteristics. This is indeed the case within colleges. In Table 4, we show that across colleges, one's score is positively correlated with peer-origin$_c$ (column (1)), indicating the existence of sorting; however, within a college, the correlation between peer-origin$_{c,t}$ and score is close to zero (columns (2)). This is also true for other personal characteristics, as reported in Appendix Table C.1.

A good IV should be highly correlated with firm creation (selection). We indeed find that, within a college, peer-origin$_{c,t}$ is a strong predictor for firm creations (column (3)) of Table 4. In terms of the marginal effect, 1σ increase in $peer_{c,t}$ is associated with a 2.4 percentage points higher probability of firm creation, or 25% of the mean.

Results on Success Using capital sizes as success measures, we find evidence that success of an entrepreneur increases with scores. Since it is more reasonable to compare capital within industries, we employ demeaned (log) capital size by industry mean as the outcomes. As shown by success in columns (4) and (5) of Table 4, there are positive associations between scores and registered capital. The estimated coefficients suggest that 1σ increase in within-college scores is associated with RMB 220,000 larger registered capital within an industry. These coefficients are relatively small (around 0.5-3% of the mean). As discussed above, registered capital size is likely to be a noisy measure as some firms may not update their registered capital.

The positive links are stronger when we use alternative measures of firm success. One alternative is based on the location of the firm. In particular, a firm being located outside one's home province indicates that the entrepreneur is able to overcome typical barriers in local protection, which

serves as a possible success measure. Another measure is firm expansion: if a firm invests in another firm as an owner, we are able to observe this behavior in the firm data. Finally, becoming a publicly listed firm is a rare event that indicates extreme success. For these three alternative measures, we find positive and sizable correlations between exam scores and firm success: 1σ increase in the within-college exam score increases the probabilities of investing out of home province and expansion by around 10% (i.e., 0.039/0.394 and 0.005/0.049). When it comes to the rare event of becoming listed, the estimate is less precise but the increase is even larger in magnitude, around 17% (0.063/0.359) of the mean.

As a comparison, we also report simple OLS estimates (conditional on entry) without correcting for selection. Results reported in panel B of Table 4 and visualized in Appendix Figure C.2 show that the OLS estimates are similar to the Heckman estimates, suggesting that the selection bias is not quantitatively important, conditional on that we have a valid IV.

Exclusion Restriction We discuss the exclusion restrictions or the quality of our IV in this section. A good IV should only affect entry but not success other than through entry. *Ex ante*, it is not obvious that our instrument, historical entrepreneurial propensity by peer's origin, matters for a firm's success via channels beyond firm creation. The results in column Table 4 and Appendix Table C.1 suggest that conditional on the college fixed effects, there are no strong correlations between our instrument and observables (scores and other personal characteristics), which gives us confidence that the IV is also unlikely to be highly correlated with unobservables.

As another exclusion restriction test, we create two IVs by the origin of peers, those from the same versus different regions (region means northern or southern China). If unobservables are important, then we should expect to see a larger two-step estimate when using peer exposure from the same region as the IV because these peers are more likely to be exposed to the same environments that affect success. Our results in Appendix Table C.3 show that the magnitudes of the estimates are very similar when using the two IVs, suggesting that the effect of unobservables are not quantitatively large.[11]

A Survival Analysis As an additional success (or failure) measure, we conduct a survival analysis to study how within-college scores correlate with firm exit (deregistration in our data). We plot the

[11] Another similar exercise to divide peers by their success, assuming that less successful peers are less likely to help one's own firm. We find similar patterns using more or less successful peers to predict entry. We did not present these results because this criterion is based on ex post measure, which is less ideal than our current measure based on ex ante proxy, i.e., province of origin.

firm survival probabilities for owners with within-college scores in the top 20% versus those in the bottom 20%.[12] As shown in Appendix Figure C.4, firms founded by those with higher scores are more likely to survive, and the advantage rises over time. In a Cox regression, the estimated hazard ratio with respect to 1σ within-college exam scores is around 0.975, with a standard error of 0.006. The small-than-1 ratio is consistent with the graphical illustration that firms created by higher-score students are less likely to exit.

Summary The empirical evidence seems to reject the *lower entrepreneurial ability* hypothesis. In other words, we find students with higher scores are more likely to create successful firms, or they have higher entrepreneurial ability.

5.2 Opportunity Cost Hypothesis

First-job Wage Returns to Scores We test the *opportunity cost* hypothesis by estimating the wage equation using our college graduates survey data, and find that opportunity cost indeed increases with scores. We use the same specifications as equation (1) for our survey data. As reported in columns (1)-(2) of Table 5, within a college, 1σ increase in the score is associated with 3.5% higher first-job wages.[13] This positive score and wage link supports that $b > 0$ in our conceptual framework.

One possible opportunity cost is work in the state sector. As described by Cook et al. (2020), college graduates in China are attracted to the state sector. We further examine the probabilities of working for the state sector (governments and state-owned-enterprises) and in a private firm and indeed find the state sector plays a larger part in attracting higher-score students. In our survey, 46% of the graduates work in the state sector, 48% in private firms, and 5.7% becoming self-employed (including creating firms). Using self-employment as the reference group, we report how scores affect the relative risk of working in the other two sectors in Appendix Table C.5. As shown, the relative risk of working in the state sector (and private firms) for students with 1σ higher score is 1.38 (and 1.25) times higher respectively. Therefore, both the state and the private sectors are relevant, while the state sector plays a relatively larger role in absorbing the talents.[14]

[12] Specifically, we obtain within-college score distribution (by isolating province-year-track fixed effects and year fixed effects), and divide the scores into five quartiles.

[13] All the results on wages have considered college sampling weight, i.e., weighted by the inverse of college sampling weight in our surveys.

[14] The score-wage result holds if we further control for dummies indicating the state sector and the private firms, with a coefficient of 0.036, close to that in column (2) of Table 5.

Wage Returns by Personal Background We further examine how the opportunity costs vary with personal characteristics. In Section 3, we find that the probability of firm creation is higher for those who are male, urban and from higher-quality high schools, suggesting that $\frac{d^2\mathbb{P}}{dSdX} < 0$ for these characteristics (X). We could further test whether these cross effects are through the opportunity cost channel. If the opportunity cost plays a critical role in explaining our main findings, we also expect to see heterogenous patterns by personal background corresponding to what we have found on firm creation. Specifically, since the negative link between scores and firm creation is stronger for men, the urban and those from better high schools, we expect to see the positive score-wage link stronger for these groups. We indeed find those who are male, urban and from higher-quality high schools have a large correlation between wages and score as in Figures 3(a)-(c). Despite the limited size of survey data, the differences in the links between score and first-job wages are large across gender and high school types: the score-wage slope for women is 22% that for men and the slope for non-key high school graduates is 39% that for key high school graduates. The difference is less striking between urban and rural individuals but still sizable: the slope for the rural is 59% that for the urban. We report these results in columns (3)-(9) of Table 5.

Summary Therefore, the *opportunity cost* hypothesis is consistent with the patterns we document on scores and firm creations. In addition, we find suggestive evidence that the state sector plays a larger role than the private sector among the alternative opportunities.

5.3 Risk Attitudes Hypothesis

Our survey data also provide an opportunity to examine the *risk attitudes* hypothesis. In the 2011 wave of our College Graduate Surveys, we asked two questions on risk attitudes. The first is "do you prefer to get RMB 1,000 with certainty or get 0 and 2,000 with equal chance?". If the answer is no, we code it as a proxy for risk aversion. The second is "do you agree with the statement that ensuring certain returns to investment is more important than taking more risks to gain higher returns?" We use the 1 (indicating strongly disagree) to 5 (indicating strongly agree) scale to measure risk aversion. The two measures are positively correlated, with a correlational coefficient of 0.21.

We do not find any strong correlation between scores and risk aversion within colleges. As shown in columns (1) and (3) of Table 6, there exist no significant correlations between exam scores and these risk aversion measures. In addition, we also report the score-risk correlations by personal background (columns (2) and (4) of Table 6). Again, we do not find consistent patterns that would support our finding on firm creation by personal background. For instance, to be consistent with the

fact that the negative relationship between scores and firm creation is stronger men, the score-risk aversion relationship should be weaker for women. We find no such evidence. Is it possible that our risk measures are not precise enough? To this question, it is reassuring to observe that women are indeed strongly more risk averse in both measures in columns (2) and (4).

To be clear, our findings do not belittle the importance of risk aversion and other personal traits in determining entrepreneurship. In fact, based on patterns regarding the control variables, personal traits play important roles in firm creation. In particular, *ceteris paribus*, we find that women, rural individuals and those from lower-quality high schools are less likely to create a firm in columns (3), (6), (9) of Table 2. Note that these differences cannot be explained by wage differences. If anything, we find that women, rural individuals and low-quality high schools earn lower first-job wages in Table 5. This suggests that risk aversion and other personal preferences play an important role in explaining the level differences across personal background. For instance, women may be more risk averse or may face disadvantages in accessing to credit to start a firm (similar to the role of $r(X)$). However, our focus in this paper is to understand the talent-firm relationship.

5.4 Hypothesis Supported

Together, all the empirical patterns fit better with the *"opportunity cost"* interpretation. The *"lower entrepreneurial ability"* hypothesis or the *"risk attitudes"* hypothesis have difficulties to explain. In addition, two useful insights emerge from the empirical patterns: (i) firms created by higher-score individuals are more successful, implying a positive correlation between scores and entrepreneurial ability, and (ii) among the alternative opportunities, the state sector appears to be relatively more important than the private firms in absorbing the talents.

6 Conclusion

Despite a rich literature on entrepreneurship, evidence on the role of individual talent in firm creation is still scarce. By focusing on arguably the most important talent measure in the Chinese society, we document that within colleges, individuals with higher college entrance exam scores are *less likely* to create firms. This negative link is even stronger for the relatively more advantaged groups: men, urban students, and those from better high schools.

However, the negative relationship between scores and firm creation is unlikely because higher-score individuals have lower entrepreneurial ability. On the contrary, firms created by higher-score individuals are larger and more successful. The opposite patterns for *ex ante* firm creation and *ex*

post firm success are more consistent with the hypothesis that scores are positively correlated with entrepreneurial ability but higher-score students are attracted away by non-entrepreneur sectors. Our study provides a depiction of the choice of academic talent in China, which contributes to a literature on talent allocation.

We focus on within-college patterns in the current paper, partly to avoid the confounding roles of colleges. The cost of doing so is that we obscure interesting aspects of college effects. In our future work, we attempt to better understand the roles of colleges in firm creation. Meanwhile, we also find that women, the rural individuals and those studied from in lower-quality high schools are less likely to create firm, and our results suggest that the entrepreneurial reluctance of these groups are is unlikely to be due to better outside options. We believe it will be useful to uncover the factors underlying entrepreneurial reluctance by gender and other personal characteristics in the future work.

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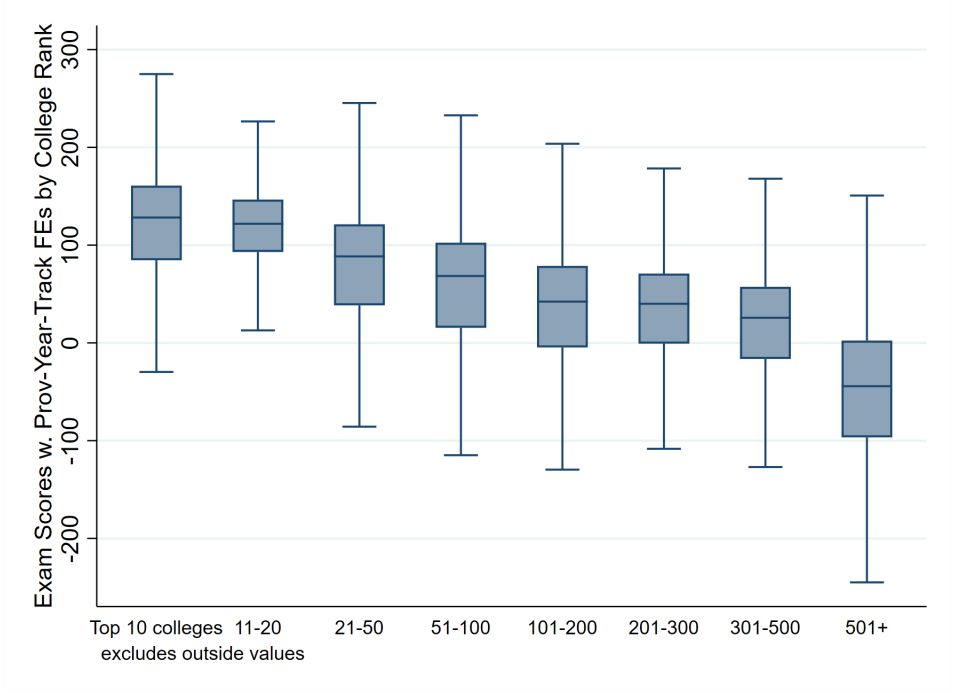
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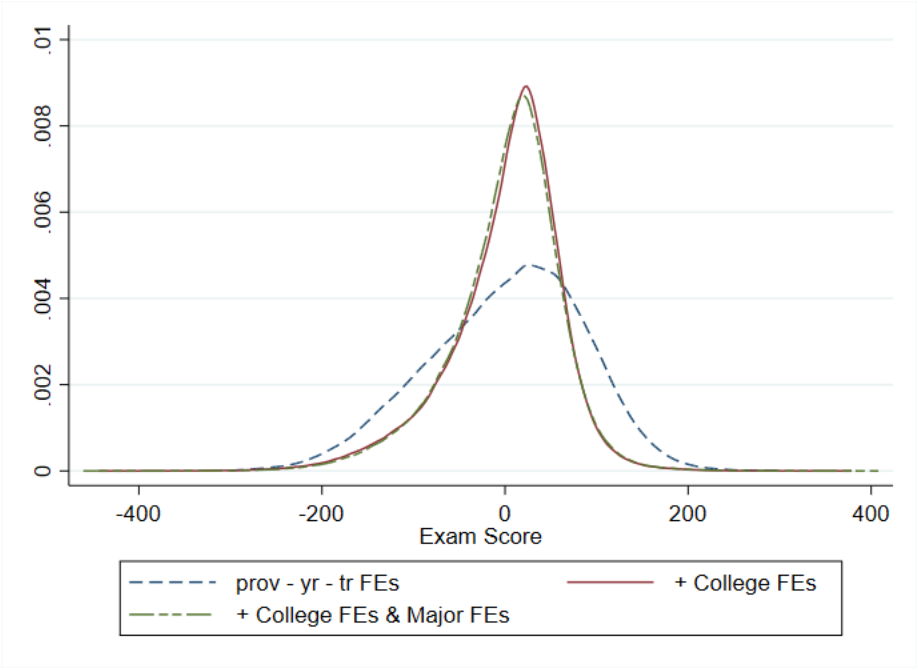
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Figure 1: Exam Scores Distribution across and within Colleges

(a) Exam Scores by College Ranks



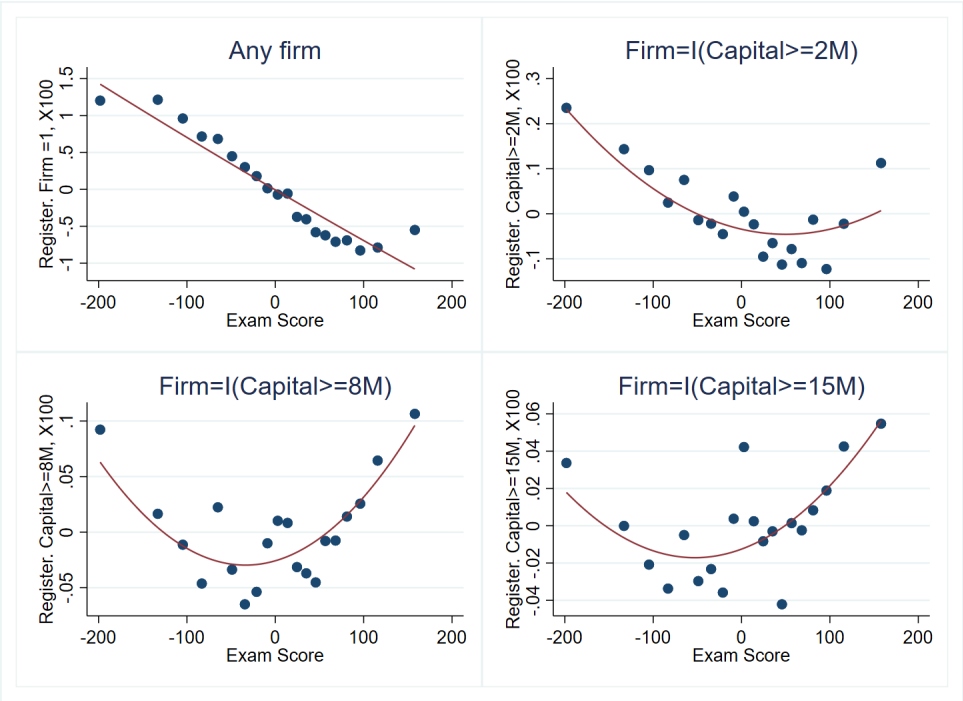
(b) Exam Score Distributions



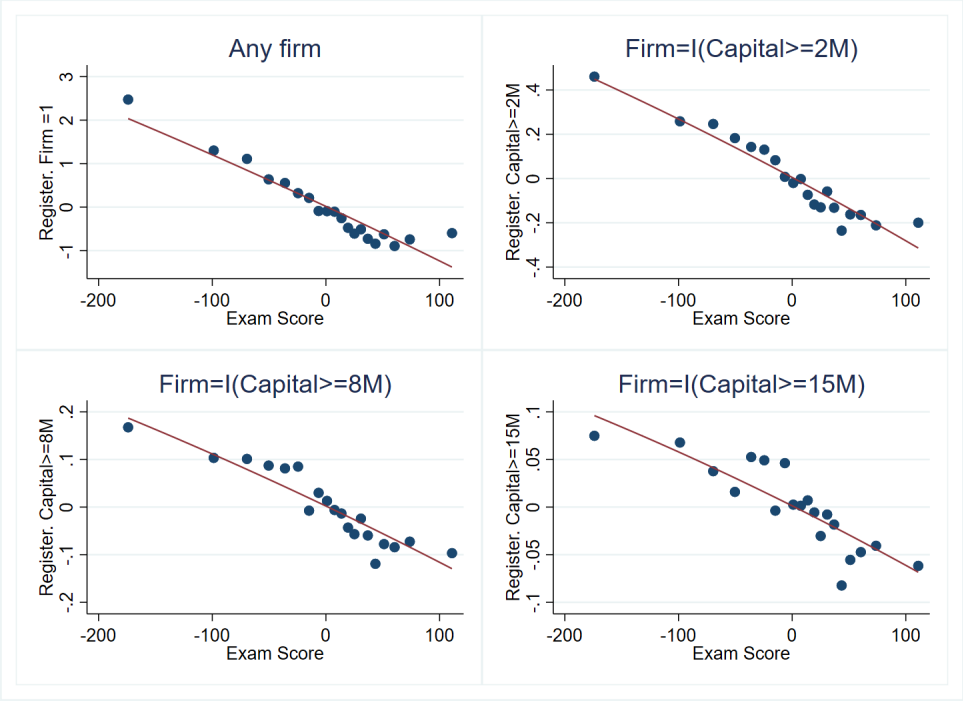
Notes: Figure (a) shows that better colleges have higher-score students on average. Meanwhile, score distributions overlap across different batches of colleges. Figure (b) confirms the wide variation within colleges.

Figure 2: College Entrance Exam Scores vs. Firm Creation

(a) Without College FEs



(b) With College FEs



Notes: Figure (a) shows nonlinear patterns between scores and firm creation across colleges; Figure (b) shows negative correlations. The difference is because college selectivity is positively correlated with firm creations, as presented in Online Appendix B.1. Province-year-track FEs are controlled in all figures.

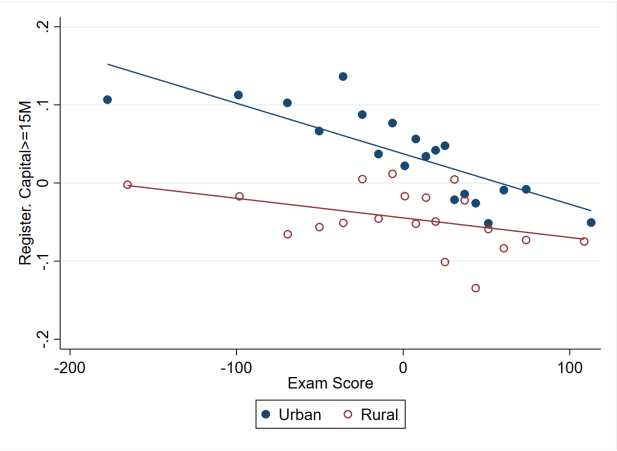
Firm=I(Capital≥2M/8M/15M) refers to defining a firm only if it is large, i.e., its registered capital no less than RMB 2 million/8 million/15 million.

Figure 3: Academic Talent and Firm Creation (Within Colleges), by Personal Background

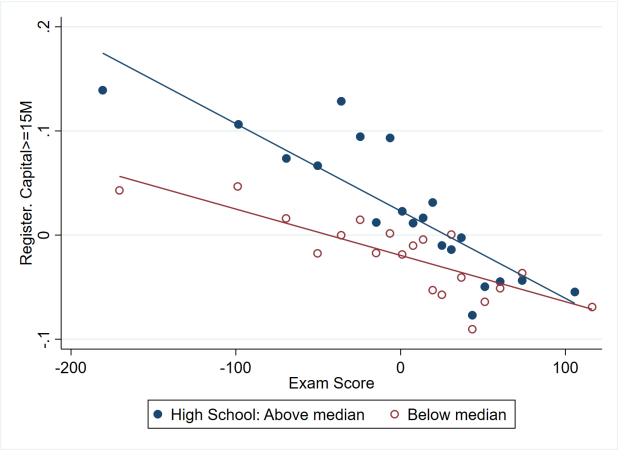
(a) Male vs. Female



(b) Urban vs. Rural



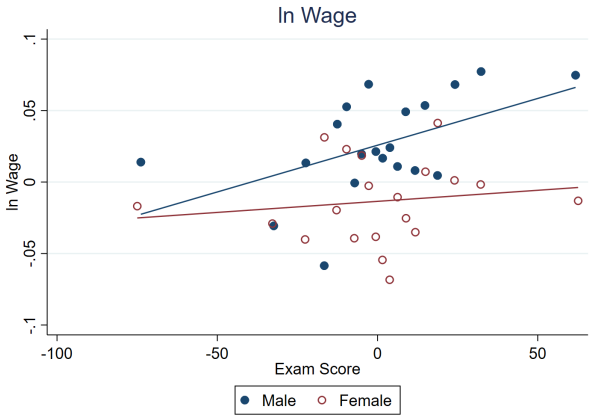
(c) Better vs. Worse High Schools



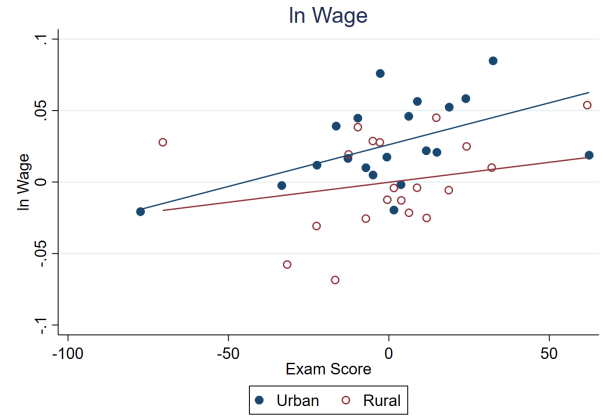
Notes: This figure shows that the negative relationship between scores and firm creation is even stronger for male, urban individuals, and those from better high schools. Province-year-track FEs and college FEs are controlled in all figures.
We focus on large firms (those with registered capital no less than RMB 15 million) in these figures and show similar patterns when varying firm definition in Table 3.

Figure 4: Academic Talent and First-Job Wages (Within Colleges), by Personal Background

(a) Male vs. Female



(b) Urban vs. Rural



(c) Better vs. Worse High Schools



Notes: This figure shows that the positive score-wage link is stronger for male, urban individuals, and those from better high schools. Province-year-track FEs and college FEs are controlled in all figures. This data comes from the College Student Survey we conducted during 2010-2015 (see Jia and Li 2019 for more discussion). The wage refers to the first job wages.

Table 1: Summary Statistics

A. Information on Individuals	Mean	Std Dev	p25	p75	Obs.
Prob of Creating a Firm (*100)					
Any Firm	7.21	25.87			1,814,547
Firms w. Capital>=RMB 2 Million	1.65	12.73			1,814,547
Firms w. Capital>=RMB 8 Million	0.78	8.82			1,814,547
Firms w. Capital>=RMB 15 Million	0.40	6.29			1,814,547
College Entrance Exam (*Gaokao*) Score	443.8	101.5	377	515	1,814,547
Exam Score (w. prov-yr-tr FEs)		87.7			
Exam Score (w. prov-yr-tr FEs+college FEs)		65.0			
Exam Score (w. prov-yr-tr FEs+college FEs + major FEs)		63.1			
Birth Year	1982.7	1.7	1982	1984	1,814,547
Male	0.54	0.50			1,814,547
Urban	0.53	0.50			1,814,547
High School (Sh. Stud. in Top 100 Colleges)	0.14	0.13	0.048	0.194	1,814,547
ln GDP Per Capita (birth county, 2001)	8.69	0.81	8.206	9.206	1,814,547
B. Information on Firms	Mean	Std Dev	p25	p75	Obs.
Registered Capital	632	6042	20	200	170,087
ln Registered Capital	4.28	1.74	3.04	5.30	170,087
Out of Home Province	0.39	0.49			170,087
Expanding (Investing in Other Firms)	0.05	0.22			170,087
Becoming Listed (*1000)	0.36	18.94			170,087
Establishment Year	2010.6	3.69	2009	2013	169,668
C. Firms by Industry	Percent				
Wholesale and Retail	30.91				
Leasing and business services	20.19				
Scientific research and tech services	13.96				
Manufacturing	8.54				
Info. Trans, software and i.t. services	6.84				
the other 15 industries	19.56				

Table 2: Exam Scores and Firm Creation, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Any Firm			Firm=I(Capital≥2M)			Firm=I(Capital≥15M)	
mean		7.12			1.64			0.40	
Exam score (sd)	-0.774	-0.802	-0.762	-0.172	-0.180	-0.180	-0.037	-0.039	-0.043
	(0.033)	(0.034)	(0.033)	(0.011)	(0.012)	(0.012)	(0.005)	(0.005)	(0.005)
Female		-3.403	-3.535		-0.850	-0.865		-0.184	-0.184
		(0.063)	(0.064)		(0.024)	(0.025)		(0.011)	(0.011)
Rural		-0.254	-0.196		-0.235	-0.221		-0.092	-0.085
		(0.049)	(0.049)		(0.022)	(0.022)		(0.011)	(0.011)
High school quality (sd)		0.265	0.279		0.132	0.130		0.045	0.045
		(0.032)	(0.032)		(0.014)	(0.014)		(0.007)	(0.007)
ln GDP per capita		0.095	0.090		0.039	0.038		0.012	0.011
(birth county, 2001)		(0.031)	(0.030)		(0.014)	(0.014)		(0.006)	(0.006)
prov-track-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
age FE		Y	Y		Y	Y		Y	Y
major FE			Y			Y			Y
Obs. (excl singletons)	1,814,534	1,814,498	1,799,656	1,814,534	1,814,498	1,799,656	1,814,534	1,814,498	1,799,656

Notes: Conditional on colleges, one's exam score is strongly and negatively associated with firm creation. This finding is robust to defining firms by size and considering personal background and major fixed effects.
Firm=I(Capital≥2M/15M) refers to defining a firm only if it is large, i.e., its registered capital no less than RMB 2 million/15 million. Standard errors in the paraphrases are clustered at the college level.

Table 3: Exam Scores and Firm Creation by Personal Background, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Any Firm (mean 7.12)				Firm=I(Capital≥2M) (mean 1.65)				Firm=I(Capital≥15M) (mean 0.40)			
Exam score (sd)	-0.957	-0.800	-0.982	-1.163	-0.199	-0.181	-0.216	-0.241	-0.048	-0.039	-0.051	-0.060
	(0.044)	(0.036)	(0.045)	(0.056)	(0.017)	(0.014)	(0.018)	(0.024)	(0.007)	(0.007)	(0.008)	(0.010)
Female×Score	0.382			0.375	0.054			0.053	0.019			0.019
	(0.039)			(0.039)	(0.018)			(0.018)	(0.008)			(0.008)
Rural×Score		0.102		0.073		0.055		0.048		0.017		0.015
		(0.042)		(0.043)		(0.020)		(0.020)		(0.009)		(0.009)
Below-med Highsch×Score			0.321	0.298			0.059	0.049			0.018	0.015
			(0.045)	(0.045)			(0.021)	(0.020)			(0.009)	(0.009)
prov-track-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Female×college FE	Y			Y	Y			Y	Y			Y
Rural×college FE		Y		Y		Y		Y		Y		Y
Below-med Highsch×col FE			Y	Y			Y	Y			Y	Y
Obs. (excl singletons)	1,814,500	1,814,464	1,814,502	1,814,406	1,814,500	1,814,464	1,814,502	1,814,406	1,814,500	1,814,464	1,814,502	1,814,406

Notes: This table shows that the negative score-firm creation link is stronger for men, urban individuals, and those from better high schools. These patterns are robust to defining firms by capital size. Firm=I(Capital≥2M/15M) refers to defining a firm only if it is large, i.e., its registered capital no less than RMB 2 million/15 million. Standard errors in the paraphrases are clustered at the college level.

Table 4: Exam Scores and Firm Success, within Colleges
Administrative Data, Firm-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Validity of the instrument		**Selection**	**A. Heckman two-step estimates**				
Dependent Var.	peer origin$_{c,t}$	(sd)	firm creation	ln Reg Capital within ind	Reg Capital within ind	Out of Home Prov	Expand	Listed (*1000)
mean dependent var				4.281	632	0.394	0.049	0.359
Exam score (sd)	0.0275	0.0006		0.0048	22.79	0.0392	0.0050	0.0625
	(0.0048)	(0.0004)		(0.0039)	(13.22)	(0.0010)	(0.0005)	(0.0446)
peer$_{c,t}$ (sd)			0.0239					
			(0.0044)					
λ (inverse mills ratio)				0.0937	332.3	-0.0025	-0.0744	-3.6286
				(0.2620)	(895.4)	(0.0706)	(0.0348)	(3.0387)
prov-track-year FE	Y	Y	Y	Y	Y	Y	Y	Y
age FE	Y	Y	Y	Y	Y	Y	Y	Y
other personal controls	Y	Y	Y	Y	Y	Y	Y	Y
college FE		Y	Y	Y	Y	Y	Y	Y
Obs. (excl singletons)	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053
				B. Estimates conditional on entry				
				ln Reg Capital within ind	Reg Capital within ind	Out of Home Prov	Expand	Listed (*1000)
Exam score (sd)				0.0056	22.94	0.0405	0.0051	0.0651
				(0.0046)	(12.74)	(0.0017)	(0.0005)	(0.0378)
prov-track-year FE				Y	Y	Y	Y	Y
age FE				Y	Y	Y	Y	Y
other personal controls				Y	Y	Y	Y	Y
college FE				Y	Y	Y	Y	Y
Obs. (excl singletons)				169,341	169,341	169,358	169,358	169,358

Notes: The table shows that one's score is positively associated with firm success. To address the concern of endogenous entry, we employ the entrepreneurial propensity across provincial origins of one's peers within the same college as an instrument. Columns (1)-(2) show that while one's own score is correlated with the instrument, it is not the case any more within a college-cohort. Column (3) shows that the instrument is indeed a strong predictor for firm creation. Panel A reports the Heckman two-step estimates and Panel B the estimates conditional on entry.
Other personal controls include gender, rural status, higher school types and log GDP per capita of one's birth county. Standard errors in the paraphrases in Panel B are clustered at the college level.

Table 5: Exam Scores and First-job Wages by Personal Background, within Colleges
Survey Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	ln Wage		ln Wage						
Exam score (sd)	0.029	0.035	0.045	0.046	0.034	0.034	0.053	0.054	0.057
	(0.011)	(0.011)	(0.014)	(0.014)	(0.011)	(0.011)	(0.015)	(0.015)	(0.019)
Female×Score			-0.037	-0.036					-0.033
			(0.020)	(0.020)					(0.032)
Rural×Score					-0.015	-0.014			0.018
					(0.017)	(0.018)			(0.026)
Non-key Highsch×Score							-0.032	-0.033	-0.04
							(0.019)	(0.020)	(0.018)
Female			-0.041						
			(0.012)						
Rural					-0.024				
					(0.008)				
Non-key High School							-0.017		
							(0.011)		
prov-track-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
other personal controls		Y							Y
Female×college FE				Y					Y
Rural×college FE						Y			Y
Non-key Highsch×col FE								Y	Y
Obs. (excl singletons)	14,697	11,149	14,674	14,674	14,140	14,140	11,534	11,534	11,145

Notes: This table shows that scores are positively associated with first-job wages, and the positive score-wage link is stronger for male, urban individuals, and those from better high schools. This data comes from the College Student Survey we conducted during 2010-2015. Standard errors in the paraphrases are clustered at the college level.

Table 6: Exam Scores and Risk Aversion, within Colleges
Survey Data, Individual-level Analysis

	(1)	(2)	(3)	(4)
	Not taking the lottery option 0/1		Importance to ensure certain return 1-5	
	0.64		3.09	
Exam score (sd)	0.017	-0.008	0.012	0.074
	(0.013)	(0.032)	(0.037)	(0.060)
Female×Score		0.030		-0.074
		(0.028)		(0.078)
Rural×Score		0.017		-0.103
		(0.043)		(0.083)
Non-key High Sch×Score		0.025		0.081
		(0.041)		(0.061)
Female		0.075		0.087
		(0.016)		(0.034)
Rural		-0.042		-0.061
		(0.015)		(0.037)
Non-key High school		0.008		0.058
		(0.011)		(0.034)
prov-track-year FE	Y	Y	Y	Y
college FE	Y	Y	Y	Y
age FE	Y	Y	Y	Y
Observations	6,249	5,971	6,058	5,793

Notes: Notes: This table shows that there is no strong relationship between scores and risk aversion.
This data comes from the College Student Survey we conducted in 2011. We did not cover risk questions in the other years. Standard errors in the paraphrases are clustered at the college level.

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A Background and Data: More Results

A.1 Correlations between Scores and Personal Characteristics

As discussed, exam scores capture both ability and family background. We examine the correlations between one's score and his or her personal characteristics in Table A.1. Within college, females and males do not differ in the *gaokao* score, though men do better across colleges. Rural students have higher scores, both across and within colleges, probably because only the better rural students could attend high schools and participate in the exam. Perhaps not surprisingly, students from better high schools and richer counties tend to have higher scores, both across and within colleges.

Table A.1: Exam Scores and Personal Characteristics, across and within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)
	Exam Score	
Mean	443.8	
Female	-4.490	-0.033
	(0.676)	(0.339)
Rural	22.689	20.566
	(0.687)	(0.502)
High school quality (sd)	38.609	15.225
	(0.829)	(0.546)
ln GDP per capita	1.011	0.817
(birth county, 2001)	(0.271)	(0.165)
prov-track-year FE	Y	Y
age FE	Y	Y
college FE		Y
Obs. (excl singletons)	1,814,511	1,814,498

Notes: Standard errors in the paraphrases are clustered at the college level.

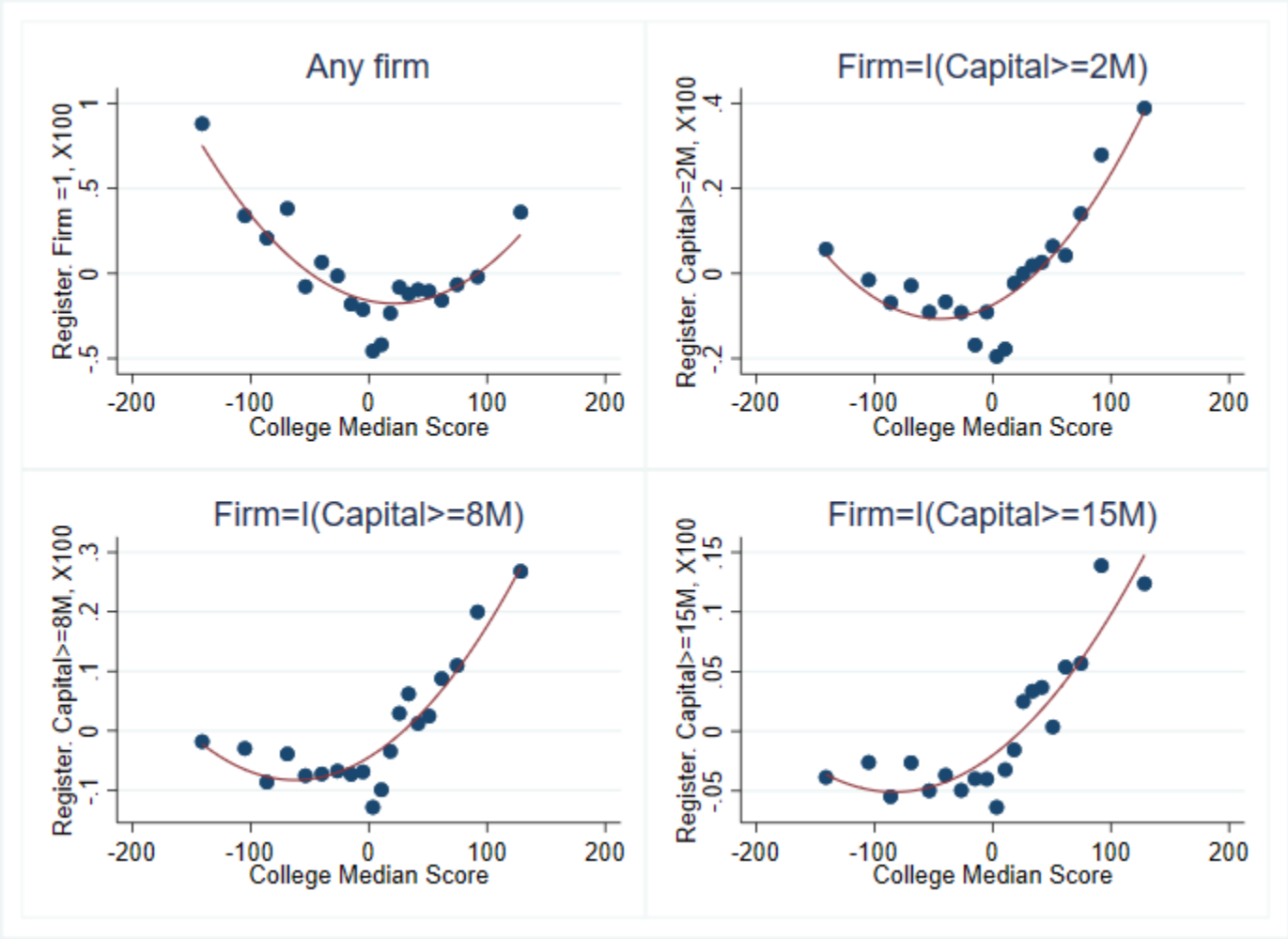
B Score-Firm Creation: Additional Results

B.1 College Selectivity

Figure B.1 shows that college selectivity is positively correlated with firm creation, especially for large firms. These patterns explain the difference between Figures 2(a) and (b): the nonlinear

patterns across colleges come from two facts: a negative within-college relationship and a nonlinearly positive relationship between college selectivity and firm creation.

Figure B.1: College Selectivity and Firm Creation



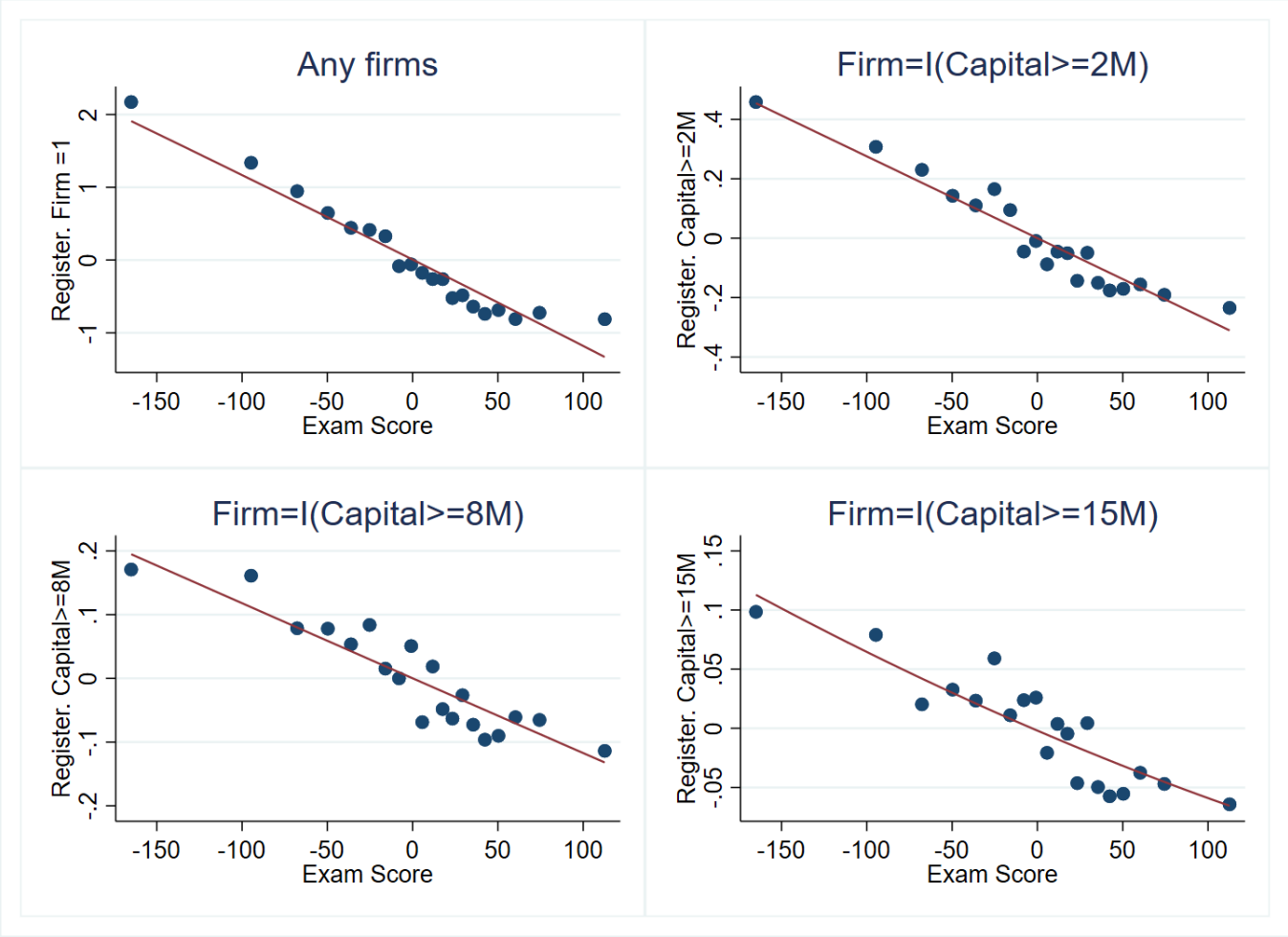
We do not study why college selectivity matters in this paper, which is likely to be a multifaceted issue: social networks, peer effects and the reputation impact of colleges could work together. We leave the investigation of the roles of colleges in our future work.

B.2 Including Major Fixed Effects

Figure B.2 shows that the negative link between exam scores and firm creation within colleges hold after controlling for 12-major fixed effects. Because major choices reflect one's own preferences, we focus on with-college comparison and report results without and with major fixed effects.

Figure B.2: Exam Scores and Firm Creation: With College FEs and Major FEs

(a) With College FEs and Major FEs



We report the relationship between exam scores and firm creation by majors in Table B.4.

B.3 The Profile of Higher-scores Students

Using survey data, we find that within a college, higher-score students better performance, indicated by a significantly higher GPA, a lower probability to fail any subject, a higher likelihood to get university-level awards. They are also more likely to hold positions in student unions and more likely to be a Party member.

Table B.3: Scores vs. Other Characteristics in College

	(1)	(2)	(3)	(4)	(5)
	GPA (std)	Failed a subject in college	Univ.-level award	Positions in the student union	Party member
Mean		0.394	0.076	0.322	0.264
Exam Score (std)	0.280	-0.108	0.034	0.019	0.038
	(0.037)	(0.011)	(0.006)	(0.009)	(0.011)
age FE, gender, Hukou, highsch type	Y	Y	Y	Y	Y
prov-track-year FE	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y
Observations	25,994	30,471	30,471	30,471	30,471
R-squared	0.216	0.158	0.049	0.09	0.148

Notes: Standard errors in the paraphrases are clustered at the college level.

B.4 Results by Majors

Our baseline finding holds when examining the pattern by major, as shown by Table B.4.

Table B.4: Exam Scores and Firm Creation by Majors, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)		(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent var.	STEM	Econ-Fin-Law	Humanity		Any firm			Firm=I(capital≥2M)			Firm=I(capital≥15M)		
				Field	STEM	Econ-Fin-Law	Humanity	STEM	Econ-Fin-Law	Humanity	STEM	Econ-Fin-Law	Humanity
Mean Dependent var.	0.51	0.27	0.21		6.50	8.21	7.52	1.52	2.02	1.41	0.35	0.55	0.28
Exam score (sd)	0.036	0.020	-0.049		-0.630	-0.622	-0.908	-0.171	-0.221	-0.165	-0.052	-0.053	-0.027
	(0.002)	(0.002)	(0.002)		(0.043)	(0.059)	(0.054)	(0.017)	(0.026)	(0.018)	(0.008)	(0.012)	(0.009)
college FE	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
prov-track-year FE	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
age FE	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
other personal controls	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs. (excl singletons)	1,813,282	1,813,282	1,813,282		928,355	498,328	371,761	928,355	498,328	371,761	928,355	498,328	371,761

Notes: Other personal controls include gender, rural status, higher school types and log GDP per capita of one's birth county. Standard errors in the paraphrases are clustered at the college level.

B.5 Results By College Ranks

Our baseline finding holds when examining the pattern by college rank, as reported in Table B.5.

Table B.5: Exam Scores and Firm Creation by College Rank, with Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Any Firm			Firm=I(Capital≥2M)			Firm=I(Capital≥15M)	
mean	8.33	7.69	7.1	2.27	1.98	1.57	0.6	0.49	0.38
college rank	Top 10	11-100	100+	Top 10	11-100	100+	Top 10	11-100	100+
Exam score (sd)	-0.768	-1.351	-0.643	-0.192	-0.321	-0.153	-0.044	-0.071	-0.033
	(0.209)	(0.090)	(0.033)	(0.076)	(0.032)	(0.012)	(0.035)	(0.017)	(0.005)
prov-track-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
other personal controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs. (excl singletons)	34,762	266,666	1,500,371	34,762	266,666	1,513,061	34,762	266,666	1,513,061

Notes: Other personal controls include gender, rural status, higher school types and log GDP per capita of one's birth county. Standard errors in the paraphrases are clustered at the college level.

B.6 Results Excluding Province-Years with Missing IDs

Our findings remain very similar if we restrict data to individuals in province-years whose id missing rates are lower than 5% (Panel A of Table B.6) or even 1% (Panel B of Table B.6.)

Table B.6: Province-Years with Little Missing Info., within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	Any Firm		Firm=I(Capital≥2M)		Firm=I(Capital≥15M)	
prov-track-year FE	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y
age FE and other personal controls		Y		Y		Y
			A. sample: missing id < 5%			
Exam score (sd)	-0.782	-0.806	-0.167	-0.174	-0.034	-0.035
	(0.046)	(0.046)	(0.016)	(0.016)	(0.007)	(0.007)
Obs. (excl singletons)	943,355	942,405	943,355	942,405	943,355	942,405
			B. sample missing id < 1%			
Exam score (sd)	-0.951	-0.939	-0.219	-0.211	-0.041	-0.038
	(0.086)	(0.098)	(0.038)	(0.038)	(0.024)	(0.023)
Obs. (excl singletons)	428,416	428,407	428,416	428,407	428,416	428,407

Notes: Other personal controls include gender, rural status, higher school types and log GDP per capita of one's birth county. Standard errors in the paraphrases are clustered at the college level.

B.7 Results Excluding Repeated Exam Takers

Our findings remain similar after excluding repeated exam takers, as shown in Table B.7.

Table B.7: Excluding Repeated Exam Takers, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	Any Firm		Firm=I(Capital≥2M)		Firm=I(Capital≥15M)	
Exam score (sd)	-0.715	-0.739	-0.164	-0.173	-0.035	-0.039
	(0.033)	(0.034)	(0.012)	(0.013)	(0.006)	(0.006)
Female		-3.451		-0.861		-0.185
		(0.067)		(0.028)		(0.013)
Rural		-0.270		-0.255		-0.100
		(0.058)		(0.025)		(0.013)
High school quality (sd)		0.287		0.140		0.050
		(0.034)		(0.016)		(0.008)
ln GDP per capita		0.101		0.047		0.017
(birth county, 2001)		(0.034)		(0.016)		(0.007)
prov-track-year FE	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y
age FE		Y		Y		Y
Obs. (excl singletons)	1,310,535	1,310,502	1,310,535	1,310,502	1,310,535	1,310,502

Notes: Standard errors in the paraphrases are clustered at the college level.

B.8 Results Excluding Students with Scores on the Tails

Our baseline finding holds if we restrict data to individuals with scores between 10th-90th percentiles on the score distribution within a college. As shown in Table B.8, the estimates become even stronger if we exclude the students on the tails.

Table B.8: Excluding Students with Scores on the Tails, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	Any Firm		Firm=I(Capital≥2M)		Firm=I(Capital≥15M)	
Exam score (sd)	-0.926	-0.995	-0.211	-0.231	-0.048	-0.054
	(0.052)	(0.054)	(0.020)	(0.021)	(0.009)	(0.009)
Female		-3.286		-0.834		-0.184
		(0.066)		(0.026)		(0.012)
Rural		-0.210		-0.207		-0.082
		(0.053)		(0.024)		(0.011)
High school quality (sd)		0.336		0.146		0.050
		(0.033)		(0.015)		(0.008)
ln GDP per capita		0.079		0.043		0.011
(birth county, 2001)		(0.035)		(0.015)		(0.007)
prov-track-year FE	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y
age FE		Y		Y		Y
Obs. (excl singletons)	1,468,125	1,468,097	1,468,125	1,468,097	1,468,125	1,468,097

Notes: Standard errors in the paraphrases are clustered at the college level.

C Interpretations: Additional Results

C.1 More Results on IV Validity

If our instrument is valid, we should see no strong correlations between our instrument and scores and other personal characteristics. This is true within colleges. As reported in column (1) of Table C.1, without controlling for college sorting, personal characteristics are correlated with our peer exposure measure. But such correlations are close to zero within colleges (column (2)).

Table C.1: Validity Checks of the Instrument

	(1)	(2)
	$\text{peer}_{c,t}$ (sd)	
Exam score (sd)	0.0275	0.0006
	(0.0048)	(0.0004)
Female	-0.0039	0.0004
	(0.0038)	(0.0003)
Rural	-0.0603	0.0002
	(0.0046)	(0.0003)
High school quality (sd)	0.0103	-0.0013
	(0.0051)	(0.0003)
ln GDP per capita	0.0066	-0.0005
(birth county, 2001)	(0.0014)	(0.0002)
prov-track-year FE	Y	Y
age FE	Y	Y
college FE		Y
Observations	1,853,012	1,853,012

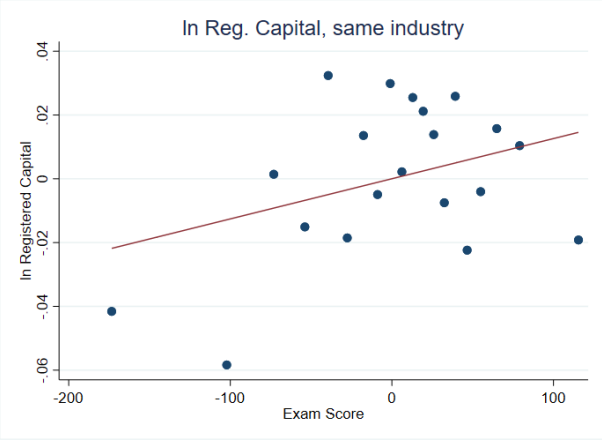
Notes: Standard errors in the paraphrases are clustered at the college level.

C.2 Visualization: Score-Firm Success Conditional on Entry

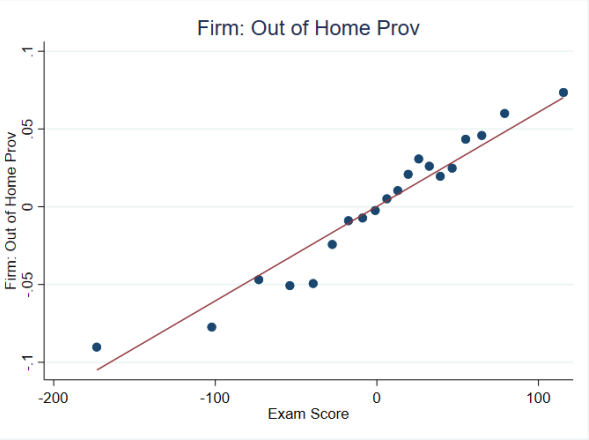
Given entry, exam scores (within colleges) appear positively associated with multiple measures of firm success, including (a) registered capital (demeaned by industry mean), (b) the propensity of creating a firm outside one's home province, (c) the propensity of investing in other firms as a shareholder, and (d) the propensity of becoming publicly listed. Figure C.2 visualizes these correlations.

Figure C.2: Firm Capital Size and Other Success Measures (given entry)

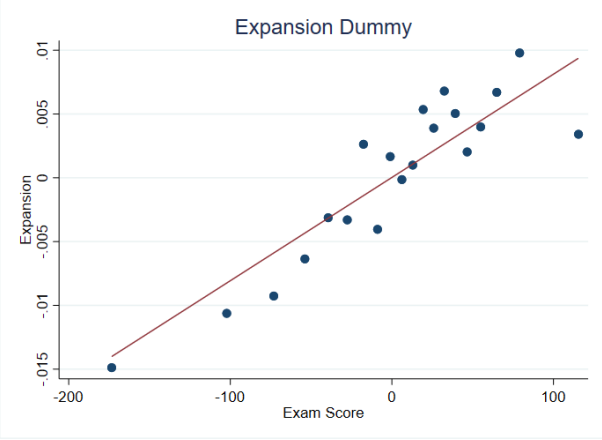
(a) log Registered Capital



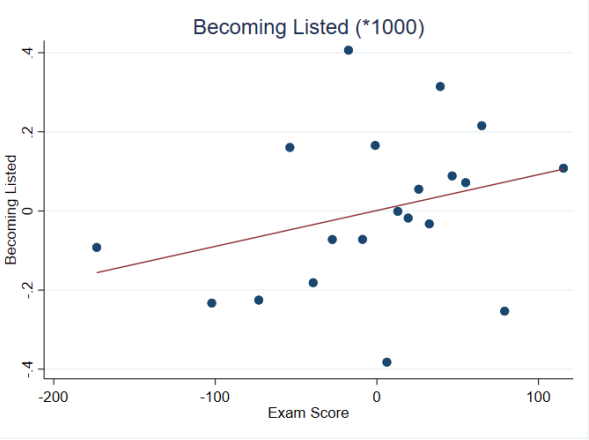
(b) Firms Created Out of Home Provinces



(c) Expansion



(d) Becoming Listed



However, we need to deal with the challenge of selection into entry when evaluating how scores affect firm. As discussed in the paper, we exploit peer composition across cohorts within colleges as an instrument to predict firm entry and use the Heckman two-step method to correct possible selection bias.

C.3 Checking Exclusion Restriction

We exploit peer composition to predict firm entry. To check whether it is a concern that peer composition also matters for firm success, we separate the peers into two groups. Specifically, we divide students' home provinces into Northern China and Southern China. Then, we use peer compositions from both the same part and the other part of China to predict entry. If peer composition matters for success, we would to see a larger impact on success when using the former as an instrument because it is more likely to help with firm success. This is not the case, as presented in Table C.3.

Table C.3: Exam Scores and Firm Success, within Colleges
Administrative Data, Firm-level Analysis

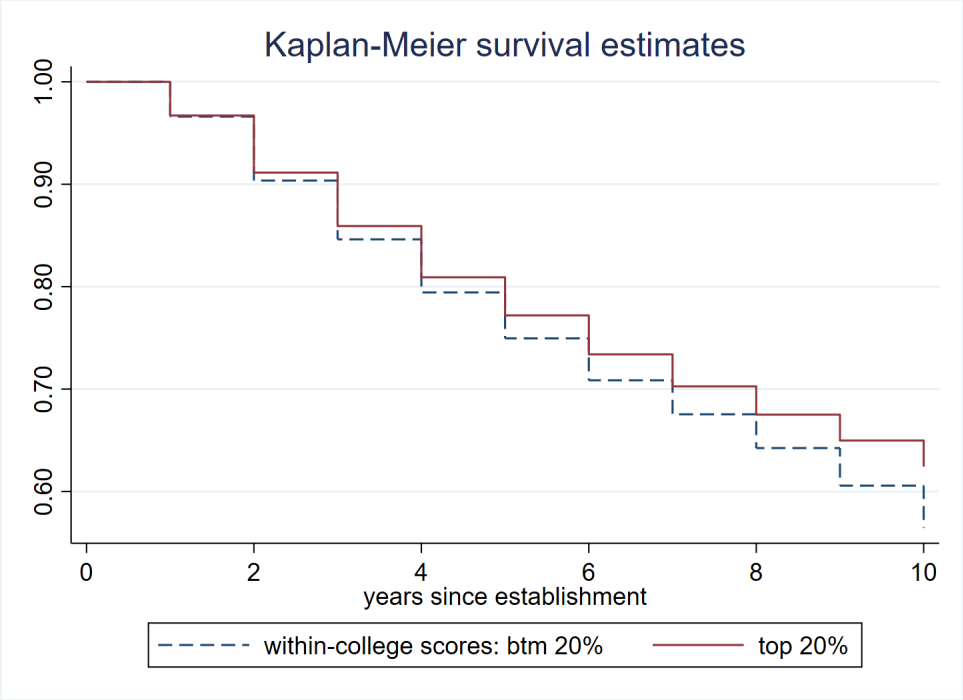
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Var.	ln Reg Capital within industry		Reg Capital within industry		Out of Home Prov		Expand		Listed (*1000)	
peer composition	North-on-North	North-on-South	N-on-N	N-on-S	N-on-N	N-on-S	N-on-N	N-on-S	N-on-N	N-on-S
(instrument)	South-on-South	South-on-North	S-on-S	S-on-N	S-on-S	S-on-N	S-on-S	S-on-N	S-on-S	S-on-N
Exam score (sd)	0.0045	0.0044	22.64	22.76	0.0381	0.0378	0.0050	0.0049	0.0686	0.0683
	(0.0039)	(0.0039)	-13.23	-13.24	-0.0059	(0.0024)	(0.0005)	(0.0005)	(0.0444)	(0.0447)
prov-track-year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
age FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
other personal controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs. (excl singletons)	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053	1,858,053

Notes: Other personal controls include gender, rural status, higher school types and log GDP per capita of one's birth county. Standard errors in the paraphrases are clustered at the college level.

C.4 A Survival Analysis

Figure C.4 shows that the firms founded by those with higher scores are more likely to survive, and the difference becomes more important over time. The estimated hazard ratio with respect to within-college exam scores is around 0.975, with a standard error of 0.006, which is consistent with the pattern in the figure.

Figure C.4: Within-college Scores vs. Firm Survival



C.5 The State Sector and the Private Firms as Alternatives

We examine how scores affect the relative risk of working in different sectors in C.5, using self-employment as the reference group. As shown, scores are positively associated with a higher risk of working in the state sector as well as the private firms, while the former risk ratio is higher.

Table C.5: The Relative Risk of the First-Job Sectors, within Colleges
Survey Data, Individual-level Analysis, Reference: Self-Employment

	(1)	(2)	(3)	(4)
	State Sector	Private Firms	State Sector	Private Firms
Exam score (sd)	1.345	1.238	1.383	1.246
	(0.165)	(0.163)	(0.196)	(0.186)
prov-track-year FE	Y	Y	Y	Y
college FE	Y	Y	Y	Y
age FE	Y	Y	Y	Y
other personal controls		Y		Y
Obs. (excl singletons)	15,735	15,735	11,805	11,805

Notes: Other personal controls include gender, rural status, and higher school types. Standard errors in the paraphrases are clustered at the college level.