Entrepreneurial Reluctance: Talent and Firm Creation in China*

Chong-en Bai† Ruixue Jia‡ Hongbin Li§ Xin Wang¶

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Abstract

This paper examines the correlation between ability and firm creation. Drawing on administrative college admissions data for over 1.57 million individuals and the universe of firm registration records in China, we investigate who had created firms by their mid-30s. We find a clear pattern of *entrepreneurial reluctance*: Given the same college and high school backgrounds, individuals with higher college entrance exam scores—a pivotal metric of cognitive abilities in this milieu—are less likely to create firms. Through an exploration of firm performance, alternative career trajectories, and variations across industries and regions, we propose an explanation: The ability represented by exam scores is useful across occupations, yet higher-scoring individuals are attracted to waged jobs, particularly those of the state sector. Our findings highlight how the reward structure of a society governs the allocation of talent, a dynamic with nuanced implications for economic development.

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†Tsinghua University, baichn@sem.tsinghua.edu.cn

‡UCSD, CEPR and NBER, rxjia@ucsd.edu.

§Stanford University, hongbinli@stanford.edu

¶CUHK, wangx2.04@gmail.com

1 Introduction

A growing literature in economics has shown that the ability of entrepreneurs is important for both firm-level productivity and aggregate-level economic growth (Bertrand and Schoar 2003; Bloom and Van Reenen 2007; Gennaioli et al. 2013; Queiró 2018; see the survey by Syverson (2011)), suggesting that the allocation of talent to the entrepreneurial sector may improve economic efficiency. The extent to which talented individuals are likely to become entrepreneurs, however, is not clear. On the one hand, canonical models of entrepreneurial choices predict a positive relationship between ability and entrepreneurial entry (e.g., Evans and Jovanovic 1989). On the other hand, an influential theoretical literature on talent allocation has long noted that talented individuals are often attracted to non-entrepreneurial sectors, which can lead to misallocation (Baumol 1990; Murphy, Shleifer and Vishny 1991, 1993; Acemoglu 1995). Despite its importance to productivity and economic growth, the association between individual-level ability and entrepreneurship has not been extensively examined.[1]

There are several empirical challenges to such an examination. It is difficult to measure entrepreneurship and ability using typical survey data. Most survey data do not differentiate firm creation from self-employment, even though the former is more important for the study of opportunistic entrepreneurship (e.g., Schoar 2010; Levine and Rubinstein 2017). Surveys of individuals or households also do not provide much information on the firms created by these individuals, making it difficult to study firm success. In addition, because firm creation is of low probability, we need a large sample size of household surveys to have a sufficient number of entrepreneurs. Moreover, it is also difficult to separate the impact of individual ability from that of education and family background on firm creation.

In this paper, we study the relationship between ability and entrepreneurship in China. With over 20 million private firms, some of which are globally leading firms, China is active in entrepreneurial activities. Moreover, other than becoming entrepreneurs or working for a private firm, as in most developed economies, Chinese face an additional important choice: joining the public sector, which is a common occurrence in developing economies. With its various government positions and the

[1]There are a few studies of this relationship that use survey data from the United States, including Hartog, Van Pragg and Van Der Sluis (2010), Levine and Rubinstein (2017) and Hegde and Tumlinson (2021). We compare our research design and findings with theirs when discussing the literature.

world's largest state-owned enterprises, having a job in the public sector in China is usually viewed as ideal by its citizens. Thus, *a priori*, it is unclear whether the relationship between ability and entrepreneurship is positive or negative.

We address the empirical challenges by linking two administrative datasets—the universe of college admission records during 1999–2003 and the universe of Chinese firms and their owners. The large sample size allows us to study entrepreneurship, a small probability event. Specifically, our analyses use a random sample of 20% of the linked data,[2] including over 1.57 million college graduates who created approximately 105,000 firms by 2015.[3] The linked administrative data have good measures of cognitive abilities, educational background (including both high schools and colleges), firm creation, and firm success as well as personal attributes. We supplement this linked administrative data with the Chinese College Students Survey (CCSS), a large survey of Chinese college graduates that we conducted during 2010–2015 to study waged jobs.

Our setting provides a clear measure of cognitive abilities: the National College Entrance Exam (known as *Gaokao*) score. The score is the criterion for college admission in China, which is popularly believed to determine the course of the life of the exam taker. As an influential cross-country literature has documented, exam scores outperform years of schooling as a proxy for assessing human capital in predicting economic growth (e.g., Hanushek and Kimko 2000, Hanushek and Woessman 2015). While it is evident that ability is multi-dimensional, this body of research indicates that exam scores are a more accurate measure of cognitive abilities, which is the central focus of our paper, than merely counting years of formal education. Recognizing that exam score is affected by family investment, we consider a set of proxies for family background in our analyses.

Another advantage of our datasets is that we can separate the effect of individual-level ability from that of colleges (e.g., college education, peer influence). Conceptually, we can compare individuals who graduated from the same college by including college fixed effects. Such a within-college design, however, is not ideal if there exist systematic selection biases. For instance, higher-scoring individuals may perform worse in extracurricular activities (that can affect future firm creation) than do their lower-scoring college peers in the college admission process. Before embarking on our main analysis, we examine college selection in detail and show that performance

[2]Our firm data include firms that have exited.

[3]The median age of firm creators in our sample was 33 in 2015, very close to the median age of college-educated firm owners in the entire firm registration data (33.9). According to the *Global Entrepreneurship Monitor*, China has a high proportion of young entrepreneurs, with 57 percent between 18 and 34 and less than 25 percent falling into the older 45–64 category (Xavier et al., 2013).

reflected in non-exam activities is not a critical concern in our setting, for which the exam score is the primary criterion in college admission.

We document a phenomenon that we refer to as "entrepreneurial reluctance": Higher-scoring individuals are less likely to create firms. The raw correlation between firm creation and the *Gaokao* score is negative. More importantly, after removing college fixed effects, we still find a strong and negative association between the score and firm creation: A one-standard-deviation higher score is associated with a 14% lower probability of creating a firm. The negative score-firm creation relationship holds even when we focus on the creation of more successful (large) firms, and the magnitudes are similar when using alternative definitions of firms. Moreover, we find that the negative score-firm link holds when we examine the relationship by major and by college quality, implying that the relationship is general.

Empirical results also suggest that the negative score-entrepreneurship relationship is unlikely to be due to unobserved advantages of lower-scoring individuals. In fact, we find that individuals from more advantaged backgrounds (e.g., those from better high schools and have more political capital) both score higher and are more likely to create firms.[4] In other words, higher-scoring individuals are less likely to create firms despite their more advantaged socioeconomic status, which tends to facilitate firm creation through, e.g., fewer liquidity constraints. Moreover, the entrepreneurial reluctance that we document appears stronger for those with a more advantaged background. Empirically, we examine the interactive effects of the score and various measures of personal background on firm creation and find that the negative score-firm slopes appear to be *stronger* for males, urban individuals and those who haved attended a better high school and have more political capital.

To understand why ability is negatively associated with firm creation, we build a simple theoretical framework following the Roy model (Roy 1951; Borjas 1987). Our model highlights two potential interpretations of the negative relationship: the relative returns hypothesis and the personal traits hypothesis.[5] The relative returns hypothesis assumes that ability proxied by exam scores is useful for both entrepreneurship and waged jobs, but that the waged sector attracts ability away from entrepreneurial activities. In contrast, the personal traits hypothesis assumes that

[4]This is consistent with existing literature on the importance of financial constraints and political connections in doing business. We cannot, however, give a sufficient overview here. See, e.g., Evans and Jovanovic (1989) and Blanchflower and Oswald (1998).

[5]A third possibility is to assume that the score is negatively associated with entrepreneurial ability. For instance, one can assume that those with higher scores are opposite to a jack-of-all-trades (e.g., Lazear 2004). This is not plausible in our setting, as we show with suggestive evidence on firm performance.

higher-scoring individuals possess unfavorable behavioral traits (e.g., more risk averse or less social) for entrepreneurship and, thus, are less fit to become entrepreneurs.

To discern which hypothesis aligns more closely with our empirical findings, we investigate firm outcomes, alternative career paths, industry and regional variations, and individual traits. Using the same within-college design, we find a positive link between higher exam scores and entrepreneurial success, demonstrated by larger firms, greater expansion, entry into non-local markets, higher survival rates, and increased likelihood of becoming publicly listed.[6] Additionally, exam scores correlate positively with success in waged jobs and a higher probability of working for the state sector. Our analyses further strengthen the relevance of the state sector by revealing a stronger negative association between scores and firm creation in regions with greater state employment and in industries with a higher share of state investment.

In regard to personal traits, we find that higher-scoring individuals tend to achieve higher GPAs, earn academic awards, and become Chinese Communist Party (CCP) members within their college cohorts. However, there are no strong correlations between exam scores and risk attitudes or engagement in social activities. Collectively, although causality remains challenging to prove, these findings consistently support the relative returns hypothesis, whereas explaining all four sets of results using personal traits appears less tenable.

Our findings contribute to a broad literature on entrepreneurship, where evidence on ability and firm creation is still elusive. Using data from the National Longitudinal Survey of Youth, Hartog, Van Pragg and Van Der Sluis (2010), Levine and Rubinstein (2017), and Hegde and Tumlinson (2021) investigate the relationship between ability and entrepreneurship.[7] Our approach is closest to that of Levine and Rubinstein (2017), although we are able to mitigate the confounding roles of colleges (an issue recognized by the literature) by employing a within-college design. Most importantly, different from our results, Levine and Rubinstein (2017) find that individuals with higher scores in the Armed Forces Qualifications Test are more likely to own incorporated businesses.[8] This contrast

[6]These results are robust to an approach that attempts to correct potential selection bias, whereby we use within-college peer exposure to predict firm entry.

[7]For the measurement of entrepreneurship, Hartog, Van Pragg and Van Der Sluis (2010) and Hegde and Tumlinson (2021) include self-employment as entrepreneurship, whereas Levine and Rubinstein (2017) highlight that the relationship between ability and entrepreneurship differs, depending on whether one includes self-employment as entrepreneurship or not. For the determinants of entrepreneurship, Hartog, Van Pragg and Van Der Sluis (2010) study different ability measures and highlight the importance of general ability and balanced ability. Levine and Rubinstein (2017) emphasize the interaction between cognitive ability and risk-taking attributes, whereas Hegde and Tumlinson (2021) note the importance of information friction in regard to ability that affects selection into entrepreneurship.

[8]In a different setting, Shu (2016) finds that higher-GPA graduates from MIT are more attracted to science and engineering

with our findings might be the result of institutional differences between the two countries, i.e., the state sector is more prevalent in China. We indeed find that higher-scoring individuals are less likely to create firms in industries and regions in which the state plays a more dominant role.

Our findings have nuanced implications for economic development. On the one hand, talent in the public sector is an important source of state capacity. A large political economy literature has documented the importance of Chinese policymakers for economic growth (e.g., Li and Zhou 2005). On the other hand, when a large number of talented individuals choose to work in the public sector, this can generate brain drain. Research has argued that the dominance of the state sector potentially hinders economic development in the Chinese context (e.g., Hsieh and Song 2015). Brandt, Kambourov, and Storesletten (2020) construct a quantitative model that highlights the importance of entry barriers to explain productivity differences across regions and show that these barriers are related to the size of the state sector. Although we cannot fully quantify these two aspects for economic development,[9] our results suggest that certain regions and industries could have more successful firms with reduced state sector involvement.

In addition, our study joins the recent empirical literature that tries to understand talent allocation in a variety of settings (e.g., Hsieh et al. (2019) on racial discrimination in the United States, Ashraf et al. (2021) on gender norms across countries). Our findings underscore the significant role of the state in shaping talent allocation, particularly in economies in which the public sector serves as a prominent career path for highly skilled individuals. This perspective can enrich our understanding of talent allocation across countries and economies.

2 Background and Data

2.1 *Gaokao* and Firm Owner Data

China has a centralized college admission system: All 2,300 or so colleges in China admit students based mainly on the score of a centralized college entrance exam (i.e., *Gaokao*). At the end of their senior year (Grade 12), normally in early June every year, students need to take the college entrance exam in either the sciences (exam subjects are Chinese, English, advanced math, and sciences) or the

than to the finance sector, which also suggests that talented individuals are not deterred from entering the sector that is more closely related to productivity.

[9]Knowing how the negative correlation between score and firm creation affects efficiency and social welfare is extremely difficult because one would need to know the full "social return function" of ability in every occupation.

social sciences (exam subjects are Chinese, English, basic math, and social sciences) track, which they chose in Grade 10. Because the exams and admissions are administered by each province every year, the exam scores are comparable only for students from the same province, year, and track (social or natural sciences). Although *Gaokao* serves as the primary criterion in college admission, a small share of students can obtain extra points via extracurricular achievements (e.g., winning medals in various Olympiads), which we consider when examining college selection.

We employ administrative data that cover the entire universe of all participants in *Gaokao* from 1999 to 2003 and their college admission outcomes across over 2,300 colleges. Out of the 20.3 million records,[10] including those who failed to go to any college, 12.4 million were accepted by some college. As we discuss below, although incorporating individuals not accepted by colleges does not affect our primary findings, narrowing our focus to college graduates proves valuable for disentangling the influence of colleges from individual variables, the latter of which is our focus.

The data provide detailed information on student exam performance, including total score, subject scores, and name of college and major (if admitted) as well as student biographical information, such as gender, *Hukou* (urban/rural status), birth year, birth county, high school name, and political memberships.[11]

To track firm creation and performance, we use the administrative data of all firms ever registered in China by February 2015.[12] These data include 27 million firms, 11 million of which had been deregistered by 2015, which we also observe and use as a proxy for exit. The administrative registration records provide information on the owners (known as shareholders), who can be individuals or firms. We call individual owners firm creators or entrepreneurs. We also know whether a firm invested in another firm as an owner, which we define as an "expansion." The data also include some basic firm information, such as industry, location, and registered capital size.

The college entrance exam and admission data are linked to the firm owner data by an encrypted national identity number in both datasets. Of the 12.4 million records, we succeed in linking 8.3

[10] We exclude those who attended vocational schools (around 2 million) and focus on those who graduated from high schools. As shown in an earlier version of this paper, including these schools does not vary our results by much.

[11] 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 that, in 2011, China's college dropout rate was 3%, whereas the Ministry of Education reported that the dropout rate that year was 0.75%.

[12] For small businesses, an individual may face a tradeoff between staying self-employed (not studied in this paper) and registering a firm. Putting aside that certain industries require registration for doing business, an important benefit of registering a firm is limited liability. Notably, however, remaining self-employed without registering a firm may have implications that contribute to tax evasion. We consider both small and big firms, for which registration is required.

million records,[13] with 7.9 million unique individuals. The extra 400,000 records are repeat exam takers, for whom we focus on the first-time score because we are interested in the score as a proxy for ability. For the purpose of de-identification, we randomly sampled 20% of the linked administrative data (i.e., 1.57 million individuals) for our analyses.

2.2 Chinese College Students Survey 2010–2015

We supplement the administrative data with our own Chinese College Students Survey data, which include information on wages. We conducted large-scale surveys of college graduates during the graduation months (May and June) of 2010–2015, which cover approximately 30,000 students from 90 colleges, approximately 14,800 of whom reported detailed information on their first jobs. We designed the surveys to evaluate the elite college premium and intentionally asked about *Gaokao* scores (see Jia and Li (2021) for a detailed description of these surveys and how the first job is important for future jobs). Moreover, the surveys include information on student performance and behaviors in college.

2.3 Key Variables and Summary Statistics

Firm Variables We present firm-level variables in Panels A and B of Table 1. By 2015, the 1.57 million college graduates in our data had established 150,472 firms, and the probability of creating any firm is 7.36%. The median firm was established in 2010, or around six years after college graduation of the founder. The top five industries are wholesale and retail (30.8%), leasing and business services (20.1%), scientific research and technology services (14.1%), manufacturing (8.9%), and information technology and services (6.9%). The remaining 15 industries accounted for 19% of the total.

In light of the recent literature that emphasizes the importance of large firms with transformative entrepreneurship, it is important to consider firm size. We use registered capital as a proxy for firm size, which is the maximum liability that a firm has and, hence, matters for doing business. We use the information on registered capital in 2015 to proxy firm size.[14] Using registered capital as a

[13] Matching of the two datasets is not perfect due to missing or invalid identifying numbers. The missing of identifying numbers usually occurs at a province-year level. We further restrict our analyses to province-years, with few missing numbers as a robustness check.

[14] After registration, firms can adjust their registered capital by submitting requests to the firm registration office. Once approved, the registered capital is updated. These decisions usually stem from the company's strategic considerations

proxy, we find that the 25th and 75th percentiles are RMB 200,000 (1 USD = 7 RMB) and 2 million. Of the college graduates, 1.7% had established firms over RMB 2 million and only 0.4% above RMB 15 million. We call firms with registered capital over RMB 2 million medium-sized firms and those above RMB 15 million large firms, which are relative concepts for trackability.

To verify that the registered capital is a reasonable measure of firm size, we employ another data set, the Chinese Annual Survey of Industrial Firms (CASIF) data, to examine the correlations between registered capital and other firm success measures including employment, sales, and TFP. As shown in Appendix A.1, there are strong correlations between registered capital and these measures in the survey.

Moreover, we use a few alternative variables that are available for all firms to measure firm success. The first is whether the firm was registered outside one's home province. It is well recognized that provincial governments tend to protect local firms from the competition of other firms (e.g., Young 2000). Thus, being able to start a firm outside one's home province indicates success. In our sample, fewer than half (40%) of the firms were registered outside one's home province, suggesting that, due to local protection, it is not easy to establish a firm beyond one's home province. The second variable is expansion, which is defined as one firm's investing in another firm as an owner. In our sample, 5% of firms expanded this way. The third variable is whether a firm became publicly listed. This measure can be considered a proxy for extreme success, as it is a rare event, with a chance of 3.5 per 10,000 firms. Finally, we use deregistration information to proxy firm exits. Notably, each measure has its own limitations. For instance, the size of the registered capital partly reflects credit access; deregistration is only a noisy measure of exit. Altogether, however, the five variables allow us to achieve a good understanding of entrepreneurial success.

Exam Scores The exam score is our ability measure. We should note that exam scores vary greatly within colleges, and there is a lot of overlap of scores across different tiers of colleges (Figure A.2(a)). College fixed effects can explain only half (49.6%) of the variation in exam scores.

As reported in Panel C of Table 1, the mean and standard deviation of the exam scores in the raw data are 444.7 and 95, respectively. Once we control for province-year-tracks fixed effects, the standard deviation decreases to 82.9. The standard deviation decrease to 60.6 after we also control for college fixed effects, and 58.7 if we further control for 12 major fixed effects. Similarly, Figure

such as increasing access to credit, which are difficult to follow dynamically. If a firm exited before 2015, its registered capital size refers to the most recent information before the exit.

A.2(b) shows the remaining large variation of the score after we control for all of the fixed effects.

The large within-college variation of scores could be due to certain institutional reasons. First, the college application and admission process is highly uncertain. In our study period, students in most provinces applied for colleges before they knew their exam scores. Each exam taker needed to indicate college preference, via a 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 nearly useless). As a result, the match between score and college was far from ideal.[15] Second, scores for each college vary greatly across provinces due to the uneven distribution of admission quotas. Each province is assigned a quota for each college by the central government. Due to political and historical considerations, major metropolitan areas, such as Beijing and Shanghai, and minority provinces, such as Tibet, Xinjiang, and Yunnan, typically get a larger quota, especially for elite colleges. Finally, there is 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 for humanities.[16]

Personal Background We consider five sets of personal background variables: gender, *Hukou* (urban or rural status), age, political capital, and high school dummies.[17] As reported in Panel C of Table 1, 55% of college students are male, slightly higher than the male share in the population (51.3% in 2001), and 52% of students have urban *Hukou*, much higher than the urban share in the population (37% in 2001), which is consistent with the fact that fewer rural students are able to attend college. The median age of firm creators in our sample was 33 in 2015, very close to the median age of college-educated firm owners in the entire firm registration data (33.9).[18]

We know whether one was a member of the Chinese Communist Party (CCP) or other political parties at the time of college application, which measures one's political capital at an early stage in

[15] Such uncertainty was mitigated only in recent years, when the admission system was reformed to become a parallel system that, thanks to computer technology, allows students to apply to a few more colleges.

[16] In our analyses, we control for the majors, and thus, the first two institutional reasons are the main driver for the within-college variation in exam scores.

[17] We also know one's county of origin. Because each county has one or more high schools, including high school fixed effects in our analysis is stricter than including county fixed effects.

[18] Azoula et al. (2020) document that, in the United States, the mean age at founding for the 1-in-1,000 fastest growing new ventures is 45. Our aim, however, concerns more than star firms, and thus, it is reassuring to observe the comparability between our sample and administrative data and other sources, such as the *Global Entrepreneurship Monitor*, noted above.

life. As we show, college is an important channel for the CCP to recruit members. The fact that someone already held a political party membership primarily reflects his or her family background.

A final and important proxy for economic status is the high school dummies. Different from a centralized college system, high school education in China is locally financed, and wealthier families are more likely to be able to afford better high schools (Ye 2015). By including over 32,000 high school fixed effects in our analysis, we are able to compare individuals with relatively similar socioeconomic status.

Perhaps not surprisingly, those with more political capital and from a better high school (e.g., measured by the share of students accepted by top-100 colleges) scored higher in *Gaokao*. As we will show below, however, the correlation between exam score and firm creation is opposite to that between political-economic status and firm creation.

3 Descriptive Evidence and Research Design

Motivational Patterns We first visualize the relationship between the college entrance exam score and firm creation, both unconditional and conditional on the colleges, recognizing that the former relationship reflects both within- and between-college effects. We isolate province-year-track fixed effects from exam score and used the residualized score to proxy ability.

Figure 1(a) encompasses all individuals, including those who were admitted and not admitted by colleges, and Figure 1(b) focuses on the individuals with college education. In Figure 1(c), we control for college fixed effects and present within-college comparisons. Figure 1(d) is based on the same within-college design but defines firms as those with a registered capital no smaller than 2 million RMB.

As revealed by these figures, the correlation between exam score and firm creation is generally negative but even more so when we control for college fixed effects. In addition to the linear approach illustrated in Figure 1, we adopt a more nuanced specification by segmenting the within-college score into 10 deciles. The data presented in Appendix A.3 indicates a consistent negative correlation between score rank and firm establishment, resembling a near-linear trend. Next, we formalize our within-college design and discuss how college selection matters for our research design.

Research Design Leveraging detailed information on colleges and individuals, we employ the following specification:

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

where $Firm_{i,pyt,c}$ is a dummy variable that indicates whether individual i of province-year-track (pyt) in college (c) created a firm. The dependent variables are the creation of firms by size. The key independent variable of interest is the exam score ($Score_{i,pyt,c}$). Because $Score_{i,pyt,c}$ is comparable only within province-year-track, we always control for province-year-track fixed effects (λ_{pyt}) in our analysis. X_i indicates one's personal characteristics, which include gender, *Hukou* (rural vs. urban), age, political capital, as well as high school fixed effects. Although we do not have measures such as parental income, it is conceivable that high school fixed effects account for considerable variation in family status. Our assumption here is that ability distributions are similar across provinces so that the top 10 percentile in the score distribution in Province A can be compared with the top 10 percentile in Province B.

θ_c indicates college fixed effects, which control for the potential influence of college network and reputation on firm creation. We also control for major fixed effects in X_i in some specifications. We report standard errors that are clustered at the college level.

College Selection Our within-college design helps us to address an important challenge in the literature, as we can sperate college reputation and networks on firm creation from individual ability. Such a design, however, can be problematic if there are other criteria in the college admission process. For instance, in other settings, such as the United States, college admission also considers extracurricular activities. In such cases, it is possible that within the same college, higher-scoring individuals performed worse in extracurricular activities, and it could be the latter that explains the entrepreneurial reluctance we find.

As explained above, however, Chinese college admissions use the exam score as the primary criterion, and only a small portion of students can obtain extra points from extracurricular activities, such as national-level and international-level Olympiads. Our data contain the information on the extra points, and thus, we could examine the importance of potential selection concerns. First, only 8.7% of the individuals admitted by colleges obtained extra points. Among those who obtained extra points, the mean is 12.8, which is minimal compared with their college entrance exam scores (with a mean of 444 points). This pattern is consistent with the fact that the exam score is the primary criterion in college admission.

In Appendix A.4, we present the results when we examine whether extra points can mechanically drive the negative correlations in Figure 1. As shown, extra points can partially compensate for a lower exam score in college admission, which leads to a negative correlation between extra points and exam scores. However, the magnitude of the correlation is very small, as only a limited number of students benefited from these extra points.

We find that factoring in these extra points does not alter the relationship between exam scores and firm creation (Appendix A.4). First, there is only a slight positive correlation between extra points and firm creation, suggesting that such points might sometimes represent a more privileged family background. Second, incorporating these extra points does not modify the existing correlation between exam scores and firm creation. This pattern remains consistent, regardless of whether we include candidates who were not accepted into colleges.

These results suggest that the observed negative correlation is not merely a byproduct of supplementary considerations in the college admission process. It is worth noting, however, that exam scores might still be interrated with other individual characteristics. We will consider this possibility in depth in Section 6.4.

4 Entrepreneurial Reluctance: Estimation Results

In this section, we present the quantitative results relate to entrepreneurial reluctance and discuss how prevalent our findings are across majors, colleges, and personal characteristics.

4.1 Exam Score and Firm Creation

Main Results For ease of interpretation, we focus on the college sample; however, as reported in Appendix A.4, our findings hold if we include those not accepted by colleges.[19] We report the coefficients for a one-standard-deviation difference in the exam score in the tables.

As shown in Column (1) of Table 2, within a college, a one-standard-deviation higher exam score decreases the probability of creating any firm by 1.08 percentage points, or over 14.6% of the mean (7.36). The estimates remain stable when we control for all personal characteristics (Column (2)) and add 12 major fixed effects (Column (3)). If we define firms as those with registered capital

[19]In such analyses, those not accepted by colleges are treated as one additional group and have an extra fixed effect.

of no less than RMB 2 million or 15 million, the magnitudes of the estimates benchmarked to the mean are very similar, approximately 12–14% of the mean (Columns (4)–(9)).

Theoretically, the relationship between the score and firm creation may differ by college major and college quality due to different opportunity costs. In the above analysis, we control for major and college dummies and find that the score-firm creation correlation holds. We now go a step further to allow the effect of scores on firm creation to vary across major and college quality. To track our analysis, we categorize the 12 majors into three groups: STEM, economics-finance-law, and humanities. STEM majors account for 52% of college students, consistent with the fact that Chinese higher education encourages a large number of students to enter STEM fields. Economics-finance-law majors account for 28% of the students and humanity majors, for the remaining 20%. We also divide colleges into three groups by quality: the top 10, those ranked 11–100, and the remainder.

The relationship between the exam score and firm creation does not change dramatically across major and college quality. As shown in Table 3, students who are economics-finance-law majors have a higher mean probability of firm creation, consistent with the conjecture that the choice of these majors indicates a preference for entrepreneurship. Most importantly, the negative relationship between scores and firm creation holds within each major. For instance, for creating any firm (Columns (1)–(3)), a one-standard-deviation higher exam score within a college decreases the probability of creating firms by 14% for STEM majors, 11% for economics-finance-law majors, and 14% for humanities majors. Similarly, as shown in Table 4, those who go to better colleges are more likely to start a firm, but the negative association between the score and firm creation holds for each college-quality group. Thus, the negative score-entrepreneur relationship holds for different majors and colleges.

Potential Data Issues We check the sensitivity of our analysis by considering a number of data issues. First, to check whether missing data is an issue, we restrict our analysis to province-years with missing probabilities lower than 5%. As reported in Appendix Table B.1, the results remain similar, suggesting that the missing data may not have been a critical issue in our case.

Second, we exclude repeat exam takers from our analysis to examine whether including them caused an issue. Again, we obtain results very similar to our baseline estimates (reported in Appendix Table B.2).

Third, as indicated in Figure A.2, there are a small number of students on the tails of the within-college score distribution. Although the negative link through the entire range of scores in

Figure 1(b) suggests that outliers may not be an issue, as another test, we conduct an analysis in which we remove 10% of observations from both tails. The estimated negative correlations become stronger, as shown in Appendix Table B.3.

Finally, our firm data include family firms. The concern is that college graduates may come to these firms through succession rather than through creation. The data suggest that the share of family succession in our sample is likely to be small, as over 98.2% of the firms were established after the exam year of the students. We also can gauge the extent of family succession by examining the age difference between shareholders. In this exercise, we exclude potential family firms, i.e., firms that were established before the owner took the exam and firms with an age difference between our college-educated owner and the eldest shareholder in a firm of more than 20 years. Excluding these firms, we again find that a one-standard-deviation higher exam score is associated with a 10% lower probability of firm creation (Appendix Table B.4).

4.2 Exam Score vs. Personal Background

As seen in Table 2, personal attributes exert a significant influence on the likelihood of firm creation. A notable gender disparity is evident, with females being only 50% as likely as males to embark on entrepreneurial ventures. Additionally, we find that students with urban Hukou exhibit a higher inclination toward firm creation compared to their rural counterparts, although this difference is less pronounced than the gender gap. This suggests that individuals with advantageous social and economic backgrounds tend to have an edge in establishing firms. In our sample, age does not exhibit a systematic correlation with firm creation, due primarily to the relatively similar age profiles of the individuals under study. Another strong predictor of firm creation is political capital.

These findings align with the literature on the pivotal role of liquidity constraints and political connections in shaping firm creation. However, it is noteworthy that the relationship between ability, as proxied by exam scores, and firm creation deviates from the socioeconomic status patterns observed elsewhere.

4.3 Heterogeneities by Personal Background

We further examine how the relationship between the score and firm creation varies by gender, urban/rural origins, high school quality, and political capital. Here, we also allow for the impacts of

these characteristics to differ across colleges by including the interactions of these variables with college fixed effects.

As reported in Table 5, the negative relationship between the score and firm creation holds across these characteristics. Notably, the negative slopes appear to be stronger for males, urban individuals, those from better high schools, and those with more political capital. Specifically, the slope for males is 41% higher than that for females; the slope for the urban is 23.5% higher than that for the rural; the slope for those from above-median high schools is 26% higher than that for their below-median counterparts; and the slope for those with political memberships at an early age is twice that for non-members.

These variations strongly indicate that the connection between scores and firm creation cannot be attributed to liquidity constraints. If liquidity constraints were the primary factor, we would expect to observe opposite patterns, as the presence of social and political capital has the potential to alleviate such constraints

5 Interpretations: A Conceptual Framework

What insights can we gain from the inverse relationship between ability and firm creation? Specifically, does this correlation suggest that individuals with higher ability are drawn toward other sectors or that they may not possess the qualities required for entrepreneurship? We consider two broad hypotheses that express this relationship, which we term the *relative returns* and *personal traits* hypotheses. To better understand how these hypotheses work to generate the negative correlation between the score and firm creation, we present a stylized framework built on the seminal Roy model (Roy 1951; Borjas 1987).[20]

Setup An individual with score S chooses to either establish a firm or become a worker. The score feeds into two types of ability: entrepreneurial ability (A_E) and waged-job ability (A_W). We allow for a flexible mapping between the score and these two types of ability, specified as

$$A_E = e^{aS+\varepsilon_1} \text{ and } A_W = e^{bS+\varepsilon_0}, \tag{2}$$

[20]There is an influential literature that estimates the Roy model (e.g., Heckman and Honore 1990, Dahl 2002). Because we do not have income data for the firm creators, we cannot take this approach. Nevertheless, we employ this model to highlight possible channels, even though we cannot identify each one.

where a and b can have any sign. $\varepsilon_1 \sim N\left(0, \sigma_1^2\right)$ and $\varepsilon_0 \sim N(0, \sigma_0^2)$ denote the unobserved factors that also may influence the two types of ability, which we call idiosyncratic productivity shocks. We assume that ε_1 and ε_0 follow joint normal distribution and have a correlation coefficient ρ.

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

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

where β captures the return to entrepreneurial ability.

A firm owner maximizes the following expected returns by choosing the optimal size of capital K,

$$R = A_E^{\beta} K^{\alpha} - rK,$$

where r is the price of capital. Solving this, we get the optimal amount of physical capital

$$K^* = \left(\frac{\alpha A_E^{\beta}}{r}\right)^{\frac{1}{1-\alpha}}. \tag{3}$$

Given that $A_E = e^{aS+\varepsilon_1}$, we obtain the expected returns as

$$\begin{aligned} \ln R^* &= \tfrac{1}{1-\alpha} \ln A_E^{\beta} + \ln \Gamma \\ &= \tfrac{1}{1-\alpha} aS\beta + \ln \Gamma + \tfrac{1}{1-\alpha}\beta\varepsilon_1, \end{aligned} \tag{4}$$

where $\Gamma = (1-\alpha)\left(\frac{\alpha}{r}\right)^{\frac{\alpha}{1-\alpha}}$.

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

$$W = A_W^{\mu},$$

where μ captures the return to waged-job ability.

We can allow for risk preferences in regard to the choice of becoming an entrepreneur by introducing a risk parameter in the utility function (e.g., $U = \frac{C^{1-\gamma}}{1-\gamma}$), where C is the expected income from creating a firm and γ captures the degree of risk aversion, which can be correlated with S. Alternatively, as a simpler way to capture personal traits, such as risk aversion, we assume that the utility function in regard to wage income includes an element $\delta(S)$, where δ refers to the extra utility of being a waged worker (e.g., the utility of avoiding risks of firm creation). Thus, the utility of being a worker can be written as

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

and taking a log, we get

$$\begin{aligned} \ln V &= \mu \ln A_W + \delta(S) \\ &= bS\mu + \delta(S) + \mu\varepsilon_0. \end{aligned} \tag{5}$$

Choosing to Create a Firm An individual will choose to create a firm iff $lnR^* \geq lnV$, which means $v = \frac{\beta}{1-\alpha}\varepsilon_1 - \mu\varepsilon_0 \geq -\frac{1}{1-\alpha}aS\beta + \mu bS + \delta(S) - \ln\Gamma$. Note that by assumption, v is also normally distributed, $v \sim \mathcal{N}(0, \left((\frac{\beta}{1-\alpha}\sigma_1)^2 + (\mu\sigma_0)^2 - 2\rho(\frac{\beta\mu}{1-\alpha})\sigma_0\sigma_1\right)$. Thus, we have the probability of creating a firm:

$$\mathbb{P}(Firm) = 1 - \Phi\left(\frac{-\frac{1}{1-\alpha}aS\beta + \mu bS + \delta(S) - \ln\Gamma}{\sqrt{(\frac{\beta}{1-\alpha}\sigma_1)^2 + (\mu\sigma_0)^2 - 2\rho(\frac{\beta\mu}{1-\alpha})\sigma_0\sigma_1}}\right) \tag{6}$$

where Φ is the cumulative distribution function of the standard normal distribution function.

From equation (6), we can see that a negative link between exam score and firm creation (dP/dS) is equivalent to the following inequality,

$$\frac{1}{1-\alpha}a\beta - b\mu - \delta_s(S) < 0. \tag{7}$$

The negative link between exam score and firm creation ($d\mathbb{P}/dS$) could be due to two broad channels:

(1) The first channel is the *"relative returns"* hypothesis, which assumes $a > 0$ and $b > 0$, and $\frac{1}{1-\alpha}a\beta < b\mu$. Here, the score is positively correlated with both types of ability, but the return of wage ability to the score rises faster with the score than that of entrepreneurial ability, leading to a negative relationship between exam score and firm creation. In other words, talent is allocated to the non-entrepreneurial sector due to high opportunity cost.

(2) The second channel, the *"personal traits"* hypothesis, does not assume any clear correlation between the score and entrepreneurial ability. Instead, the score reflects other personal traits that are unfavorable to becoming an entrepreneur, or $\delta_s(S) > 0$. For example, those who score higher might be more risk averse or from family backgrounds that limit their chances of starting a firm.

To be complete, one may entertain a hypothesis by assuming $a < 0$. Given that the exam score is a primary proxy for cognitive abilities in our setting, such an assumption is not plausible, as evidenced below.

Testable Implications and Challenges To test the *"relative returns"* hypothesis versus the *"personal traits"* hypothesis, it is useful to recover the signs of a and b by studying the relationship between the score and firm success. Positive a and b support the relative returns hypothesis.

Similarly, we could test the *"personal traits"* hypothesis by examining the relationship between the score and personal traits, which will help us to get a sense of the sign of $\delta_s(S)$. However, these tests do not show causality due to potential selection bias, i.e., individuals self-select into creating firms due to productivity shocks that we cannot observe. To see this bias formally, we can derive the following relationship between the expected return of firm creation as a function of a and S:

$$\begin{aligned} E[\ln R^* | \text{ starting a firm}] &= \ln\Gamma + \frac{\beta}{1-\alpha}aS + \frac{\beta}{1-\alpha}\mathbf{E}[\epsilon_1 | \frac{v}{\sigma_v} > z] \\ &= \ln\Gamma + \frac{\beta}{1-\alpha}aS + \frac{\beta}{1-\alpha}\sigma_1\mathbf{E}\Big[\frac{\epsilon_1}{\sigma_1} | \frac{v}{\sigma_v} > z\Big] \\ &= \ln\Gamma + \frac{\beta}{1-\alpha}aS + \frac{\beta}{1-\alpha}\sigma_1\rho_{1v}\frac{\phi(z)}{1-\Phi(z)}, \end{aligned} \tag{8}$$

where $\phi(\cdot)$ is the PDF of the normal distribution, ρ_{1v} is the correlation between ϵ_1 and v, and $z = \frac{-\frac{1}{1-\alpha}aS\beta + \mu bS + \delta(S) - \ln\Gamma}{\sqrt{(\frac{\beta}{1-\alpha}\sigma_1)^2 + (\mu\sigma_0)^2 - 2\rho(\frac{\beta\mu}{1-\alpha})\sigma_0\sigma_1}}$.

The estimated sign of the marginal effect of the score on firm success $d(\ln R^* | \text{ starting a firm})/dS$ has two terms. An important test would be the sign of the first term, which is the same as a given that $\frac{\beta}{1-\alpha} > 0$. The second term is the selection bias, as the probability z is a function of the score. A similar challenge exists when we assess b.

In recognition of these complexities, we are not able to causally estimate a and b or separate the two hypotheses. Instead, we present a range of additional analyses, which collectively contributes to a better understanding of the more plausible hypothesis.

6 Interpretations: Suggestive Evidence

To gain insight into the underlying mechanisms that contribute to entrepreneurial reluctance, we conduct four sets of additional analyses, including firm performance, waged employment, industrial and regional heterogeneities, and personal characteristics.

6.1 Exam Score and Firm Success

We first examine the association between exam score and firm success using the following specification:

$$y_{f,i,pyt,c} = \gamma Score_{f,i,pyt,c} + \alpha X_i + \lambda_{pyt} + \theta_c + \epsilon_{i,pyt,c}, \tag{9}$$

where $y_{f,i,pyt,c}$ refers to different success measures for firm f created by individual i. Similar to our analyses above, we remove the impact of colleges by including the college fixed effects. We use a few measures for firm success and find that they are all positively correlated with the score. Our first measure is firm size.[21] Employing log capital size demeaned by the province-industry mean as the outcome (Columns (1) of Table 6), we find that a one-standard-deviation increase in within-college scores is associated with a 1.1% larger registered capital. The positive links between score and firm success are stronger when we use alternative measures of firm success, including whether a firm is located outside one's home province, firm expansion, and becoming publicly listed. For these three measures, we find positive and sizable correlations between the exam score and firm success (Columns (2)–(4)): A one-standard-deviation higher within-college exam score increases the probabilities of investing out of one's home province and of expansion by about 11% and 14% (i.e., 0.045/0.4 and 0.007/0.05). In regard to the rare event of becoming listed, the estimate is less precise, but the magnitude of the increase is even larger, about 35% (0.124/0.35) of the mean. In Appendix C.1, we visualize these positive correlations and document that the patterns are general.

As another way to measure success (or failure), we conduct a survival analysis to study how within-college scores correlate with firm exits (deregistration in our data). We plot the firm survival probabilities for owners with within-college scores in the top 20% in relation to those in the bottom 20%.[22] As shown in Appendix Figure C.2, firms founded by those with higher scores are more likely to survive, and the advantage increases over time. In a Cox regression, the estimated hazard ratio with respect to the increase of one-standard-deviation within-college exam scores is approximately 0.975. The smaller-than-1 ratio means that firms created by higher-scoring students are less likely to exit.

Equation (9) could potentially be subject to selection bias because we observe only firms that are self-selected into existence, and the selection could be correlated with the score. In Appendix C.3, we make an effort to correct potential selection bias by employing the Heckman two-stage estimation method (Heckman 1976). Specially, we use the geographic origins of peers within the same college-cohort (indicated by peer origin$_{c,t}$) as an instrument to predict firm entry. Intuitively, after controlling for college sorting, the temporal composition of students' geographic origin measures entrepreneurship exposure and has some randomness that we can empirically demonstrate.

[21] Because different provinces and industries have different regulations for the minimal entry capital size, we demean a firm's log capital size by the province-industry mean.

[22] Specifically, we first obtain the within-college score distribution by isolating province-year-track fixed effects and year fixed effect. Then, we divide the residual scores into five quartiles.

As discussed in detail in Appendix C.3, the Heckman estimates are slightly smaller than but not far from the OLS results.

To summarize, we find that the score is positively correlated with entrepreneurial success, and the importance of the score is more apparent when we use stricter definitions of success.

6.2 Exam Score and Waged Jobs

First-job Wages and Benefits Employing our Chinese College Students Survey data on first-job wages, we estimate the relationship between the score and log wages, using a within-college specification similar to equation (1).[23] Although the first-job wages are typically compressed, we find that the score is indeed positively correlated with wages. As shown in Columns (1) and (2) of Table 7, a one-standard-deviation increase in the score is associated with 2.6–2.9% higher first-job wages. Further, males, urban individuals, and those from better high schools also have higher wages than do their counterparts, confirming their advantages in the job market.

The score is also rewarded in terms of other non-wage benefits. One important measure of job benefits is the provision of local *Hukou*, which determines whether the worker and family can access local public goods, such as education and health care. Using the same within-college specification, we find that higher-scoring individuals are more likely to get jobs that provide local *Hukou* (Columns (3)–(4)), showing that higher-scoring individuals are also more likely to get jobs that provide more non-wage benefits.

Which Alternative Sectors? One important feature of China's job market is the dominance of the state sector. In our survey, 43.4% of the graduates worked in the state sector, 50.4% worked in private firms, and 6.1% became entrepreneurs.[24] We further examine, using survey data, the choices of waged jobs in the state sector or in the private sector versus becoming an entrepreneur.

We find that the state sector plays a larger role as an alternative opportunity for becoming an entrepreneur than does the private sector.[25] In Columns (5)–(8) of Table 7, we report multinomial

[23] All results based on the survey data have considered the sampling weight, i.e., the regressions are weighted by the inverse of sampling weight in our surveys.

[24] Unlike the administrative data that focus on firms, the survey did not differentiate between firm owners and the self-employed.

[25] Note that state-owned-enterprise (SOE) managers are close to being bureaucrats in our context: They have official bureaucratic ranks and can move from managing SOEs to working for the government.

logit regression results in regard to how the score is associated with the relative risk of working in the state or private sector versus becoming an entrepreneur. The relative risk of working in the state sector for individuals with a one-standard-deviation higher score is 1.28–1.32 times higher, and it is significantly different from 1 (see the p-values in Columns (5) and (7)). The relative risk for higher-scoring individuals to work in the private sector is smaller (around 1.18), and it is not significantly different from 1 (Columns (6) and (8)).

In our survey of college graduates, we inquired about their preferences for firm ownership. Of respondents, a significant share (64%) indicated state ownership as their first choice and this preference can be attributed to several factors, including job stability, additional benefits beyond wages, and social status (Li et al. 2023). Our results confirm that such preferences can be consequential: Those with higher scores are more likely to join the state sector.

6.3 Entrepreneurial Reluctance across Location and Industry

Patterns across Birth and College Locations We further investigate whether the negative correlation between scores and firm creation exhibits systematic variations based on the state's control power across locations and industries. At the prefectural level, we utilize state employment per capita as a proxy for the significance of the state sector and divide it into four quantiles. Recognizing that an individual's career choice may be influenced by both their home and college locations (prefectures), we incorporate both factors into our analyses.

As indicated in Table 8, our findings reveal that a higher level of state employment is associated with an even more pronounced reluctance toward entrepreneurship. Further, it appears that state employment opportunities in both the birth prefecture and college prefecture play a role. In comparison to individuals from the first quartile of state employment, those from fourth-quartile birth (and college) prefectures experience a 14.8% (and 26.5%) steeper decline in the score-firm relationship.

We can conduct a simple back-of-the-envelope calculation based on our findings. For instance, we can gauge how firm creation changes for those at the 75th and 90th percentiles if the state employment in their birth prefecture changed from the 4th quartile to the 1st quartile. Specifically, the standardized exam score for individuals at the 75th percentile is 7.37. If the slope increases by 0.148, as shown in Table 8, their probability of creating a firm would increase by 1.09 percentage points, which is 14.6% of the average (7.46). A similar calculation indicates that the probability of

firm creation would have increased by 17.9% for those at the 90th percentile.

Patterns across Industries At the industry level, we estimate equation (1) by industry and plot the 18 industry-specific estimates in Figure 2(a). Here, the dependent variable is a dummy that indicates whether an individual created a firm in a certain industry (i.e., the variable is zero if he or she does not create a firm or creates a firm in other industries). To make the estimates comparable, we plot estimates relative to the mean of the dependent variable. As shown, the estimates vary greatly. On one end of the spectrum, with an increase of the score by one standard deviation, the probability of entering the construction, mining, public management, culture, real estate, and residential sectors decreases by 25–35%; on the other end, with an increase of the score by one standard deviation, the probability of entering the restaurant and hotel, science and technology service, and IT sectors decreases by less than 5%.

Using industrial level measures, we also find that higher-scoring individuals are more likely to avoid creating firms in industries with stronger state penetration. We define the degree of *state penetration* as the share of state fixed investment (relative to total investment) in an industry.[26] The variation across industries partly reflects the importance of human capital across industries, which we control for in the regressions by including as a covariate the average schooling years of employees in each industry.[27] We plot the residual relationship between the estimated correlation between the score and firm creation by industry and the share of state fixed investment, controlling for schooling.[28] The results in Figure 2(b) show that the negative correlations between the score and firm creations are stronger in industries with a higher state concentration. Our estimates suggest that one log point in state penetration is associated with a further decrease by around 7.2%.

6.4 Exam Score and Personal Traits

According to the personal traits hypothesis, higher-scoring individuals in a college possess unfavorable traits for becoming entrepreneurs. For instance, they might be more risk averse or less social, which consequently affects firm creation. This hypothesis cannot be reconciled with the variations across location and industry found above, unless we can make a strong assumption that the

[26] We use the data on fixed investment in 2010, which come from the China statistical yearbook in 2011. The pattern we show is robust to using information from alternative years.

[27] We calculate the schooling by industry from the 2010 census.

[28] Because the number of firms varies greatly across industries, the estimate is weighted by the number of firms in each industry.

relationship between the score and these traits also varies by location and industry in the same manner. Nevertheless, using our survey data, we can examine the correlations between the score and personal traits, including in-college academic performance, CCP membership, participation in social activities in college, and risk attitudes.

The results also suggest that the score is positively associated with some favorable personal traits. We find that higher-scoring individuals have a higher GPA and are more likely to obtain academic awards than are lower-scoring college peers (Columns (1) and (2) of Table 9). These patterns are expected, as the score measures cognitive ability. Higher-scoring students also are more likely to become a CCP member in college (Column (3)), consistent with our earlier finding that they also are more likely to enter the state sector, which values the political membership.

We do not find clear evidence regarding social activities and risk attitudes. Our measure of participation in social activities is whether an individual has had a position in the college student union or in any social organization. In either case, we do not find much of a relationship between the score and participation in social activities (Columns (4) and (5) of Table 9). In the 2011 wave of our Chinese College Students Survey, we asked two risk attitude questions. The first was, "Do you prefer to obtain RMB 1,000 with certainty or play a lottery to get between 0 and 2,000 with an equal chance?" We assume that one is more risk averse if he or she rejected the lottery option. The second question was, "Do you agree with the statement that ensuring certain returns on investment is more important than is taking more risks to gain higher returns?" Risk aversion is a dummy variable that takes the value of 1 if a student chooses to agree or strongly agree with this statement. In either case, we do not find strong correlations between the score and risk attitudes, as shown in Columns (6) and (7).

Our analysis does not yield compelling evidence to suggest that individuals with high scores inherently lack the personal traits required for entrepreneurship. On the contrary, all available evidence aligns with the relative returns hypothesis. Therefore, we argue that it is challenging to argue that individuals with higher scores are ill-suited for entrepreneurship. Instead, we find that ability, as represented by exam scores, holds value across sectors.

7 Conclusion

Utilizing a rich dataset that combines administrative records and survey data, we explore the relationship between ability and firm creation. Our analysis reveals a striking pattern: Individuals

who have higher college entrance exam scores, all else equal, are paradoxically *less* inclined to venture into entrepreneurial pursuits. This intriguing inverse relationship, however, does not suggest that high-scoring individuals lack the aptitude for entrepreneurship. On the contrary, it suggests a more nuanced narrative whereby firms established by individuals with higher exam scores tend to exhibit a higher degree of success compared to those founded by their lower-scoring counterparts. These contrasting dynamics between ex ante firm creation and ex post firm prosperity suggest a possible interpretation: Although college entrance exam scores serve as a reasonable proxy for ability, individuals with higher scores are drawn to non-entrepreneurial sectors.

Within our context, the state sector emerges as a notable force in diverting talent away from entrepreneurial pursuits. This interpretation is supported by data showing that higher-scoring individuals are more inclined to join the state sector. In addition, the pattern of entrepreneurial reluctance is more pronounced in regions and industries with stronger state influence. Although we do not assert that this mechanism is universally applicable,[29] our research offers a broader perspective: The way a society configures its reward system has an impact on how talent is distributed. This point is critical to the discussion of talent allocation, a fundamental topic in political economy and development studies. Hence, we speculate that the distribution of talent across sectors varies greatly from country to country, depending on each nation's economic reward system.

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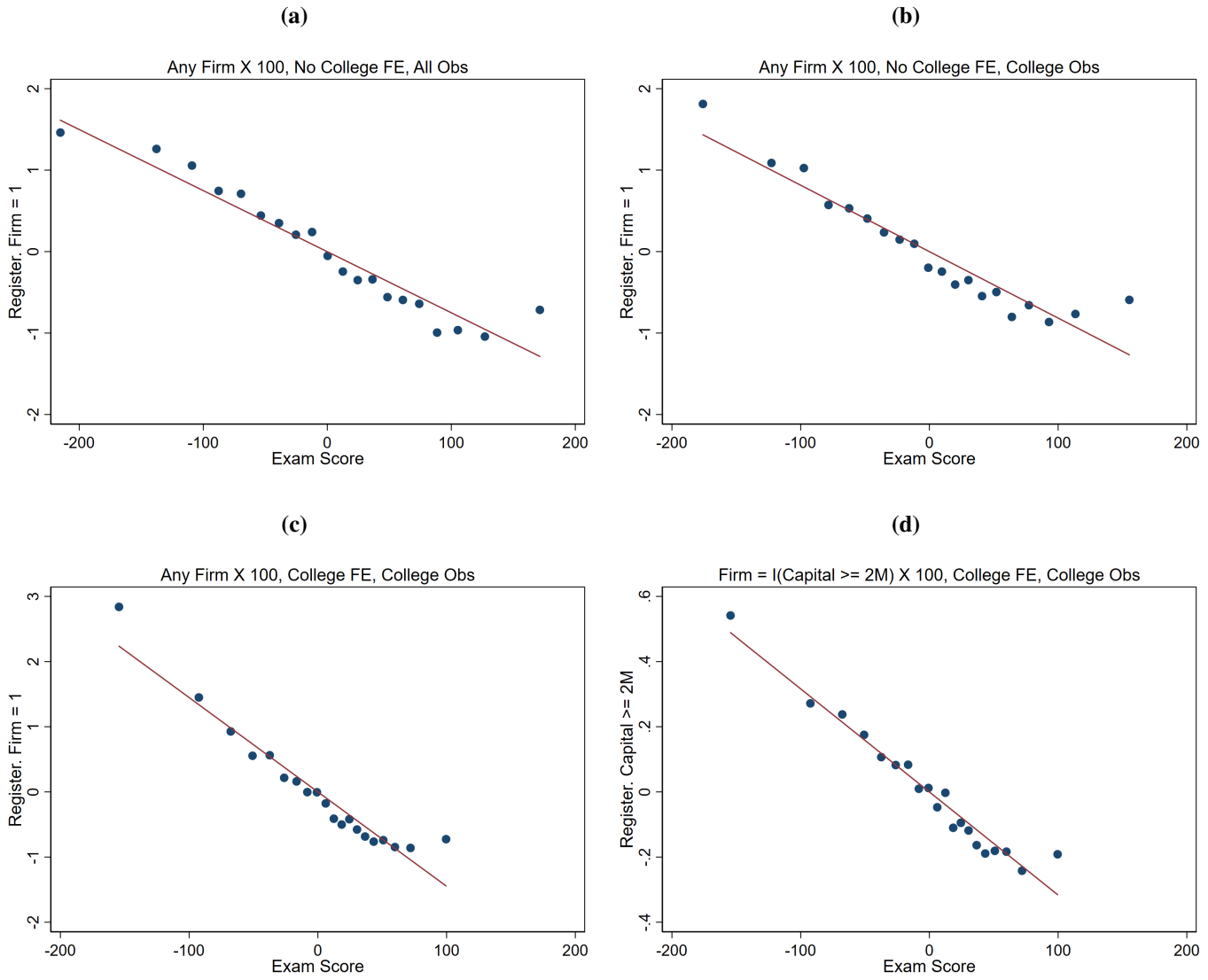
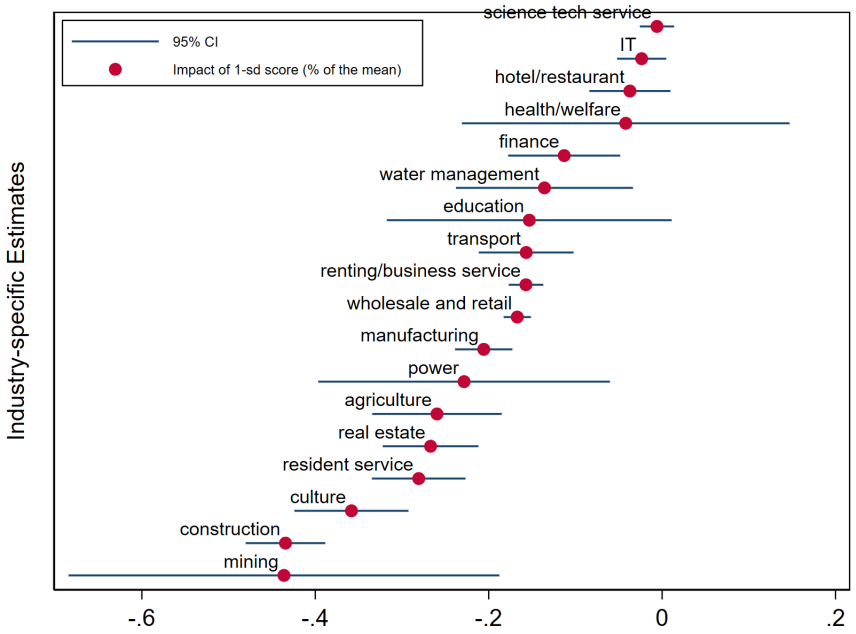
Figure 1. College Entrance Exam Score vs. Firm Creation



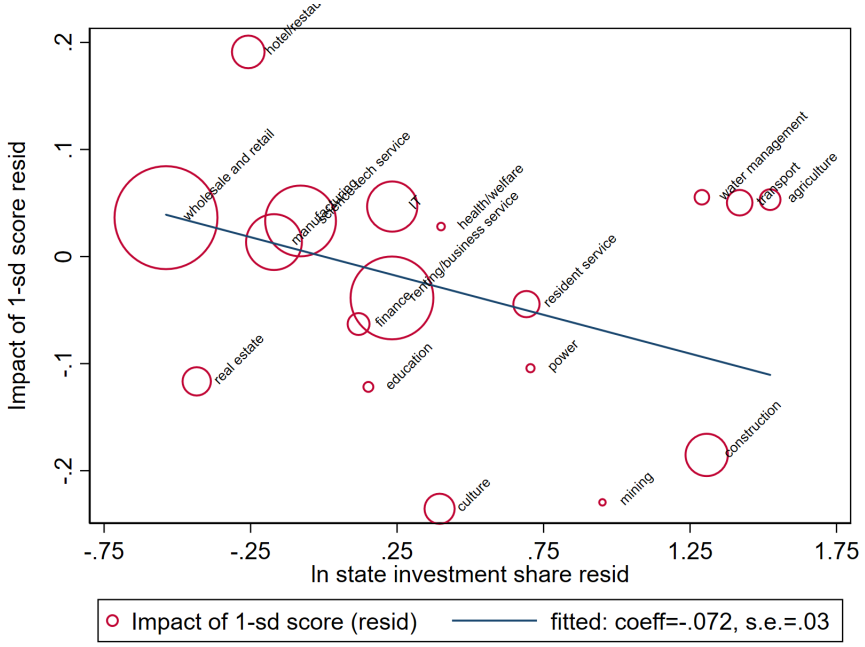
Notes: Panel (a) includes both admitted and non-admitted students to colleges. Panel (b) focuses on college students. Panel (c) controls for college fixed effects. Panel (d) controls for college fixed effects and define firms as those with registered capital no less than RMB 2 million.

Figure 2. Score-Firm Relationships by Industry

(a) Estimates by industry



(b) Estimates vs. State penetration (controlling schooling by industry)



Notes: Figure (a) plots the estimates by industry where the dependent variable is a dummy indicating entering a certain industry. The coefficients can be interpreted as "one standard deviation score is negatively associated with X% of the dependent variable". Figure (b) plots the correlation between these estimates and the share of state investment by industry, where we control for the average years of schooling of employees by industry. The size of the circles indicates the number of firms in each industry.

Table 1. Summary Statistics

A. Firms	Mean	Std Dev	p25	p75
n=150,472				
Registered Capital	644.67	5758.72	20	200
ln Registered Capital	4.29	1.74	3.04	5.3
Registered Outside Home Province	0.4	0.49	0	1
Expanding (Investing in Other Firms)	0.05	0.22	0	0
Becoming Public Listed (*1000)	0.35	18.59	0	0
Establishment Year	2010.59	3.71	2009	2013
B. Firms by Industry	Percent			
Wholesale and Retail	30.78			
Leasing and business services	20.11			
Scientific research and tech services	14.13			
Manufacturing	8.77			
Info. Trans, software and i.t. services	6.88			
the other 15 industries	19.33			
C. Individuals	Mean	Std Dev	p25	p75
n=1,572,009				
Prob of Creating a Firm (*100)				
Any Firm	7.36	26.11		
Firms w. Capital>=RMB 2M	1.69	12.89		
Firms w. Capital>=RMB 15M	0.41	6.4		
College Entrance Exam Score	444.68	95.01	380	510
Exam Score (w. prov-yr-tr FEs)	24.27	82.91	-31.89	83.52
Exam Score (w. prov-yr-tr FEs+college FEs)	0.09	60.6	-32.09	40.67
Exam Score (w. prov-yr-tr FEs+college FEs + major FEs)	0	58.68	-31.56	39.09
Extra points	1.11	4.86	0	0
Birth Year	1982.7	1.63	1982	1984
Male	0.55	0.50	0	1
Urban	0.52	0.50	0	1
High School (Sh. Stud. in Top 100 Colleges)	0.12	0.12	0.04	0.16
Political capital	0.005	0.06	0	0

Notes: Our data links administrative data on college admission during 1999–2003 with that on firm registration records from the 1980s to 2015. We focus on the college sample in this table.

Table 2. Score 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		7.36			1.69			0.41	
Exam score (sd)	-1.083	-1.069	-1.007	-0.250	-0.243	-0.236	-0.055	-0.052	-0.053
	(0.039)	(0.039)	(0.039)	(0.015)	(0.015)	(0.015)	(0.007)	(0.007)	(0.007)
Male		3.452	3.568		0.867	0.879		0.190	0.189
		(0.066)	(0.067)		(0.027)	(0.027)		(0.012)	(0.012)
Urban		0.193	0.173		0.255	0.250		0.117	0.114
		(0.062)	(0.062)		(0.031)	(0.031)		(0.015)	(0.015)
Age		-0.029	-0.021		-0.055	-0.053		-0.027	-0.027
		(0.024)	(0.024)		(0.011)	(0.011)		(0.006)	(0.006)
Political capital		1.351	1.264		0.568	0.513		0.177	0.171
		(0.387)	(0.386)		(0.206)	(0.201)		(0.105)	(0.103)
Prov-year-track FFs	Y	Y	Y	Y	Y	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
College FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
Major FE			Y			Y			Y
Obs (excl. singletons)	1,560,038	1,560,038	1,546,390	1,560,038	1,560,038	1,546,390	1,560,038	1,560,038	1,546,390

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. Score and Firm Creation by Majors, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent var.		Any firm			Firm=I(capital≥2M)			Firm=I(capital≥15M)	
Major	STEM	Econ-Fin-Law	Humanity	STEM	Econ-Fin-Law	Humanity	STEM	Econ-Fin-Law	Humanity
Mean	6.66	8.41	7.54	1.56	2.08	1.43	0.36	0.57	0.29
Exam score (sd)	-0.866	-0.915	-1.075	-0.227	-0.285	-0.187	-0.056	-0.094	-0.018
	(0.053)	(0.071)	(0.067)	(0.022)	(0.034)	(0.026)	(0.010)	(0.017)	(0.012)
Male	2.964	4.114	4.376	0.805	1.090	0.821	0.178	0.241	0.149
	(0.077)	(0.104)	(0.146)	(0.033)	(0.050)	(0.058)	(0.016)	(0.025)	(0.026)
Urban	0.304	-0.025	0.063	0.246	0.280	0.209	0.090	0.149	0.110
	(0.082)	(0.130)	(0.141)	(0.041)	(0.068)	(0.064)	(0.019)	(0.039)	(0.028)
Age	-0.049	0.084	-0.125	-0.045	-0.058	-0.071	-0.025	-0.025	-0.028
	(0.030)	(0.050)	(0.049)	(0.015)	(0.026)	(0.025)	(0.008)	(0.013)	(0.010)
Political capital	1.595	0.518	1.839	0.685	0.250	0.324	0.268	0.047	0.080
	(0.483)	(0.725)	(1.027)	(0.272)	(0.420)	(0.480)	(0.150)	(0.209)	(0.214)
Prov-year-track FFs	Y	Y	Y	Y	Y	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
College FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs (excl. singletons)	804,644	426,615	306,269	804,644	426,615	306,269	804,644	426,615	306,269

Notes: 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. 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.

Table 4. Score and Firm Creation by College Rank, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent var.		Any Firm			Firm=I(Capital≥2M)			Firm=I(Capital≥15M)	
College rank	Top 10	11-100	100+	Top 10	11-100	100+	Top 10	11-100	100+
Mean	8.36	7.79	7.25	2.29	2.02	1.61	0.6	0.5	0.39
Exam score (sd)	-0.951	-1.525	-0.945	-0.267	-0.404	-0.209	-0.071	-0.093	-0.045
	(0.467)	(0.110)	(0.039)	(0.159)	(0.040)	(0.015)	(0.049)	(0.020)	(0.007)
Male	3.834	3.340	3.465	1.194	0.965	0.844	0.301	0.254	0.178
	(0.640)	(0.141)	(0.075)	(0.379)	(0.074)	(0.028)	(0.183)	(0.041)	(0.012)
Urban	1.034	0.568	0.110	0.690	0.347	0.229	0.308	0.151	0.108
	(0.450)	(0.145)	(0.069)	(0.200)	(0.094)	(0.033)	(0.124)	(0.043)	(0.016)
Age	-0.003	0.092	-0.052	-0.222	-0.037	-0.055	-0.183	-0.020	-0.025
	(0.218)	(0.070)	(0.025)	(0.111)	(0.037)	(0.012)	(0.083)	(0.018)	(0.006)
Political capital	-0.317	1.037	1.550	0.639	0.527	0.514	0.049	-0.086	0.232
	(1.606)	(0.846)	(0.470)	(0.623)	(0.443)	(0.248)	(0.335)	(0.168)	(0.136)
Prov-year-track FFs	Y	Y	Y	Y	Y	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
College FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
Obs (excl. singletons)	29,515	239,213	1,283,493	29,515	239,213	1,283,493	29,515	239,213	1,283,493

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

Table 5. Score and Firm Creation by Personal Background
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)
Dependent Var.	Any Firm			
Male * Exam score	-0.353			
	(0.049)			
Urban * Exam score		-0.221		
		(0.051)		
Above-ave. high school. * Exam score			-0.246	
			(0.055)	
Political capital * Exam score				-1.068
				(0.457)
Exam score (sd)	-0.860	-0.938	-0.935	-1.065
	(0.039)	(0.048)	(0.045)	(0.039)
Personal characteristics	Y	Y	Y	Y
Prov-year-track FFs	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y
College FEs	Y	Y	Y	Y
Obs (excl. singletons)	1,560,001	1,559,987	1,559,992	1,559,703

Notes: This table shows that the negative relationship between the score and firm creation is stronger for males, urban individuals, those from better high schools, and those with more political capital. Standard errors in the paraphrases are clustered at the college level.

Table 6. Score and Firm Success, within Colleges
Administrative Data, Firm-level Analysis

	(1)	(2)	(3)	(4)
	ln Reg Capital within prov-ind	Out of Home Prov	Expand	Listed (*1000)
Mean		0.4	0.05	0.35
Exam score (sd)	0.011	0.045	0.007	0.124
	(0.006)	(0.002)	(0.001)	(0.065)
Male	0.007	-0.032	-0.001	0.261
	(0.012)	(0.003)	(0.002)	(0.136)
Urban	0.056	-0.054	0.007	0.100
	(0.014)	(0.004)	(0.002)	(0.151)
Age	-0.022	0.006	-0.003	-0.105
	(0.006)	(0.002)	(0.001)	(0.064)
Political capital	0.055	0.013	0.016	0.655
	(0.079)	(0.023)	(0.011)	(1.648)
Prov-year-track FFs	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y
College FEs	Y	Y	Y	Y
Obs (excl. singletons)	144,315	144,316	144,316	144,316

Notes: The table shows that one's score is positively associated with firm success. Standard errors in the paraphrases are clustered at the college level.

Table 7. Score and Wage-jobs, within Colleges
Survey Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ln Wage		Local Hukou via job		Relative risk			
					State	Private	State	Private
Exam score (sd)	0.029	0.027	0.045	0.037	1.320	1.189	1.274	1.168
	(0.007)	(0.007)	(0.009)	(0.009)	(0.155)	(0.162)	(0.151)	(0.158)
Male		0.049		0.109			1.950	1.197
		(0.007)		(0.009)			(0.359)	(0.161)
Urban		0.008		-0.039			1.207	1.158
		(0.007)		(0.009)			(0.135)	(0.139)
Age		-0.004		0.001			0.860	0.837
		(0.003)		(0.004)			(0.071)	(0.070)
Political capital (parent)		0.022		-0.006			1.298	1.034
		(0.008)		(0.010)			(0.240)	(0.173)
Elite high school		0.018		-0.026			1.310	1.425
		(0.008)		(0.010)			(0.221)	(0.277)
Prov-year-track FFs	Y	Y	Y	Y	Y	Y	Y	Y
College FEs	Y	Y	Y	Y	Y	Y	Y	Y
Obs (excl. singletons)	14,801	14,094	14,801	14,094	14,651	14,651	14,094	14,094

Notes: This table presents the correlations between scores and first-job wages and benefits, as well as the relative risk of entering different sectors. The reference group for Columns (4)–(8) is being an entrepreneur.
This data comes from the College Graduate Student Survey we conducted during 2010–2015. Standard errors in the paraphrases are clustered at the college level.

Table 8. Entrepreneurial Reluctance by Home and College Prefectures
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)
Dependent Var.		Any Firm	
Exam score (sd)	-0.997	-0.928	-0.911
	(0.057)	(0.076)	(0.084)
BirthPref-StateEmployment-Quartile 2 * Exam score	-0.102		-0.082
	(0.064)		(0.064)
BirthPref-StateEmployment-Quartile 3 * Exam score	-0.156		-0.141
	(0.064)		(0.066)
BirthPref-StateEmployment-Quartile 4 * Exam score	-0.148		-0.087
	(0.076)		(0.078)
CollegePref-StateEmployment-Quartile 2 * Exam score		-0.080	-0.036
		(0.105)	(0.108)
CollegePref-StateEmployment-Quartile 3* Exam score		-0.094	-0.061
		(0.089)	(0.093)
CollegePref-StateEmployment-Quartile 4 * Exam score		-0.246	-0.198
		(0.094)	(0.101)
Prov-year-track FFs	Y	Y	Y
High school FEs	Y	Y	Y
College FEs	Y	Y	Y
Personal characteristics	Y	Y	Y
Obs (excl. singletons)	1,432,333	1,535,716	1,418,796

Notes: This table shows that the negative relationship between the score and firm creation is stronger in prefectures with a higher state employment share, including both birth prefecture and college prefecture. Other personal controls include gender, rural/urban status, agem, and political capital. Standard errors in the paraphrases are clustered at the college level.

Table 9. Score and Other Personal Traits, within Colleges
Survey Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Academic performance		Political membership	Social activity		Risk aversion (2011)	
	GPA	Academic awards	Party membership	Union leader	Union/Social org. leader	Prefer certain pay to a lottery	Ensure certainty in investment
Mean	3.01	0.063	0.265	0.125	0.495	0.636	0.329
Exam score (sd)	0.070	0.016	0.050	0.004	-0.009	0.029	0.042
	(0.012)	(0.007)	(0.019)	(0.007)	(0.014)	(0.030)	(0.028)
Male	-0.277	-0.022	-0.108	-0.019	-0.090	-0.063	-0.036
	(0.017)	(0.006)	(0.024)	(0.009)	(0.013)	(0.030)	(0.023)
Urban	-0.057	-0.003	-0.021	0.033	0.053	0.014	0.003
	(0.014)	(0.006)	(0.017)	(0.010)	(0.011)	(0.035)	(0.038)
Age	-0.005	-0.000	0.011	-0.002	-0.009	0.011	0.027
	(0.005)	(0.003)	(0.006)	(0.005)	(0.005)	(0.010)	(0.013)
Political capital (parent)	-0.003	0.006	0.039	0.010	0.026	0.053	-0.009
	(0.015)	(0.007)	(0.018)	(0.011)	(0.017)	(0.022)	(0.024)
Elite high school	-0.002	0.007	0.025	0.031	0.058	-0.019	-0.032
	(0.011)	(0.007)	(0.022)	(0.011)	(0.020)	(0.020)	(0.028)
prov-track-year FE	Y	Y	Y	Y	Y	Y	Y
college FE	Y	Y	Y	Y	Y	Y	Y
Obs (excl. singletons)	12,226	14,094	14,094	14,094	14,094	3,024	3,024

Notes: This table presents the correlations between scores and various personal traits. This data comes from the College Graduate Student Survey we conducted during 2010-2015. We only asked risk-related questions in 2011. Standard errors in the paraphrases are clustered at the college level.

Online Appendix

Table of Contents

A Background and Data: More Results

A.1 Registered Capital vs. Other Firm Attributes

We analyze the relationships between registered capital and several firm attributes, including total assets, sales, employment, and TFP, using data from the 2013 Annual Survey of Industrial Firms. The interconnections between these variables are demonstrated in Table A.1, revealing strong correlations.

Table A.1. Registered Capital vs. Other Firm Variables in Survey Data

	(1)	(2)	(3)	(4)
	ln Total Asset	ln Sales	ln Employment	ln TFP
ln Registerd capital	0.503***	0.233***	0.106***	0.015***
	(0.001)	(0.001)	(0.001)	(0.001)
Obs.	330816	330866	330751	313013
R2	0.455	0.143	0.056	0.001

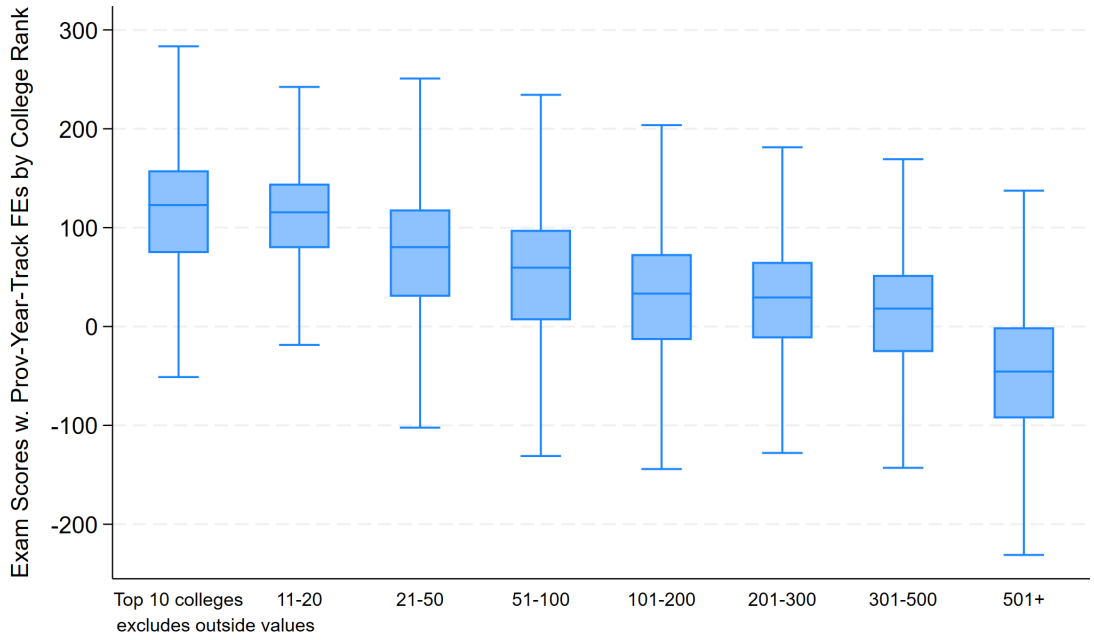
Notes: Robust standard errors are presented in the paraphrases. Here, we use all the firms in our data instead of 20% random sample in our main analyses.

A.2 Exam Score Distribution across and within Colleges

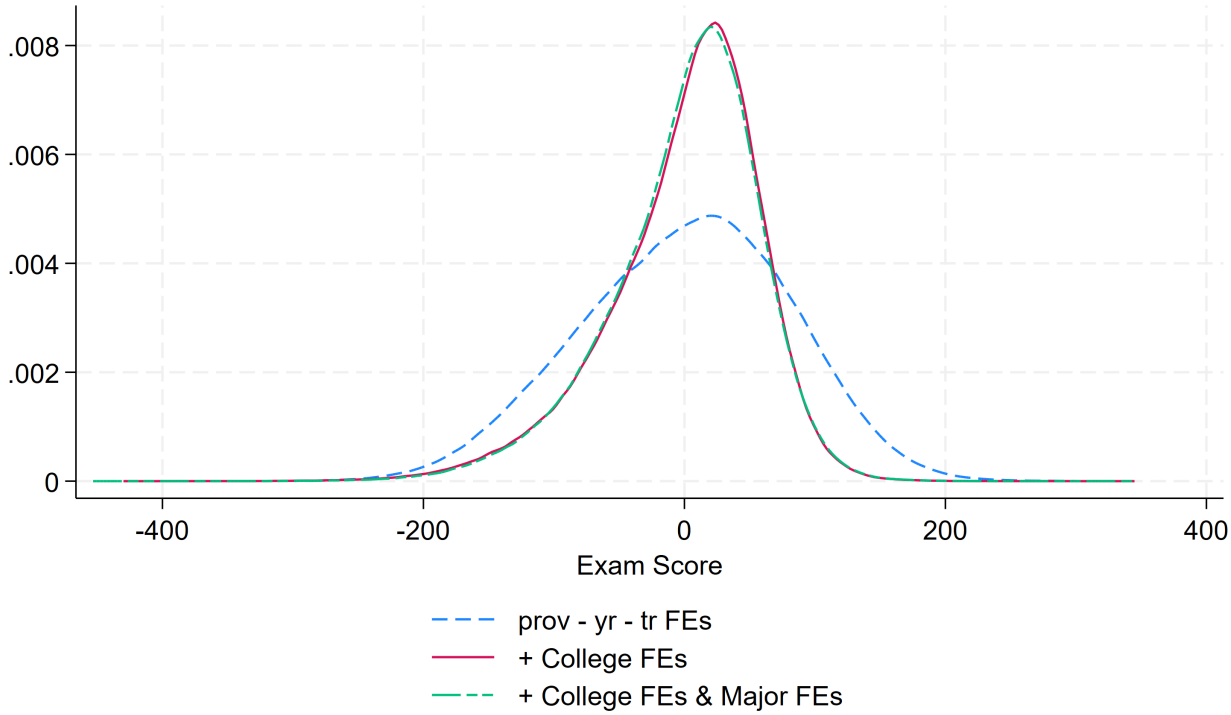
Figure (a) shows that better colleges have higher-scoring students on average. Meanwhile, score distributions overlap across different batches of colleges. The two marks outside the box indicates the upper and lower adjacent values. The shaded box ranges from the 25th to the 75th percentiles, where the middle mark indicates the median. Figure (b) confirms the wide variation within colleges.

Figure A.2. Exam Scores Distribution across and within Colleges

(a) Exam Scores by College Ranks



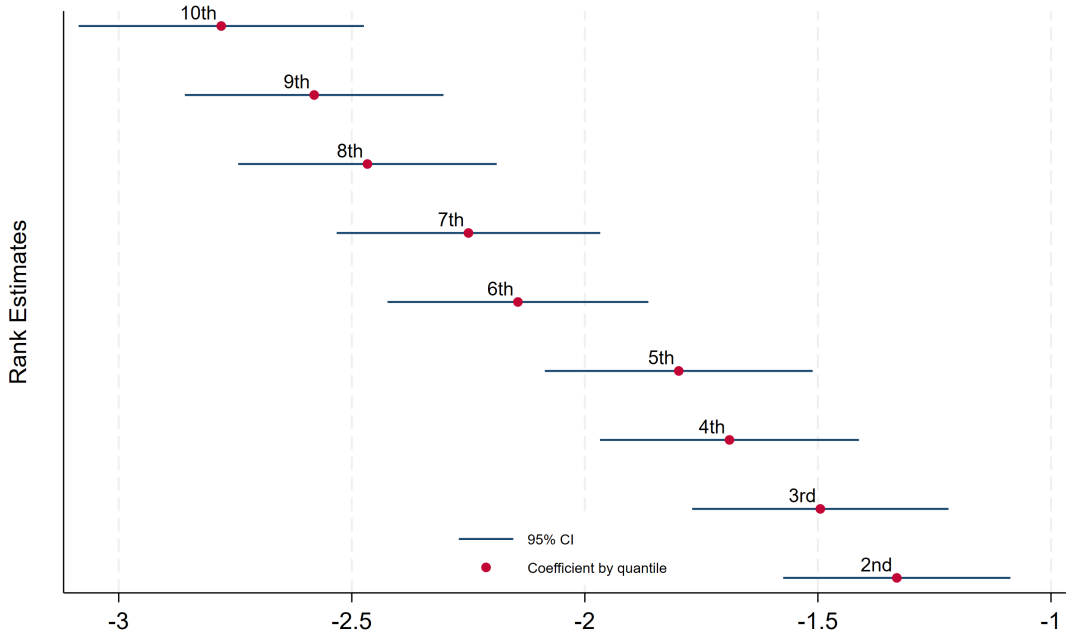
(b) Exam Score Distributions



A.3 Scores and Firm Creation: within-college Rank

In addition to linear specifications, we estimate the coefficients by within-college rank where we divide the score into 10 quantiles. As see below, we obtain a pattern similar to those from linear specifications.

Figure A.3. Estimates by within-college Score Rank



A.4 Examining College Selection: Extra Points

A small share of students obtained extra points from non-exam performances that are considered in college admission. In Table A.4, we find that (1) these extra points are weakly correlated with firm creation and (2) that considering them does not affect the finding on the relationship between exam score and firm creation.

Table A.4. Examining College Selection: Extra Points
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Var.	Extra points (sd)		Firm creation (0/1)					
Sample	All	College	All	All	All	College	College	College
Mean								
Exam score (sd)	-0.017	-0.026		-0.873	-0.873		-1.069	-1.068
	(0.005)	(0.005)		(0.089)	(0.089)		(0.039)	(0.039)
Extra points (sd)			0.027		-0.002	0.079		0.042
			(0.041)		(0.038)	(0.029)		(0.029)
Male	0.009	0.010	3.415	3.419	3.419	3.446	3.452	3.452
	(0.001)	(0.001)	(0.060)	(0.062)	(0.062)	(0.066)	(0.066)	(0.066)
Urban	-0.003	-0.003	0.852	0.594	0.594	0.472	0.193	0.193
	(0.001)	(0.002)	(0.245)	(0.251)	(0.251)	(0.064)	(0.062)	(0.062)
Age	-0.020	-0.023	0.082	-0.013	-0.013	0.078	-0.029	-0.028
	(0.002)	(0.002)	(0.017)	(0.020)	(0.020)	(0.025)	(0.024)	(0.024)
Political capital	0.084	0.109	1.226	1.339	1.339	1.151	1.351	1.347
	(0.021)	(0.014)	(0.283)	(0.285)	(0.284)	(0.388)	(0.387)	(0.387)
Prov-year-track FEs	Y	Y	Y	Y	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y	Y	Y	Y	Y
College FEs		Y	Y	Y	Y	Y	Y	Y
Obs. (excl singletons)	2,171,492	1,560,009	2,172,582	2,171,559	2,171,492	1,560,646	1,560,038	1,560,009

Notes: Standard errors in the paraphrases are clustered at the college level. When including those not admitted by colleges, they are treated as one group.

B Score-Firm Creation: Additional Results

B.1 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%.)

Table B.1. Province-Years with Little Missing Info., within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Var.	Any Firm			Firm=I(Capital≥2M)			Firm=I(Capital≥15M)		
Exam score (sd)	-1.226	-1.223	-1.163	-0.289	-0.285	-0.276	-0.066	-0.065	-0.063
	(0.062)	(0.063)	(0.063)	(0.025)	(0.025)	(0.026)	(0.012)	(0.012)	(0.012)
Personal characteristics		Y	Y		Y	Y		Y	Y
Prov-year-track FFs	Y	Y	Y	Y	Y	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
College FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
Major FE			Y			Y			Y
Obs (excl. singletons)	640,385	640,385	633,167	640,385	640,385	633,167	640,385	640,385	633,167

Notes: Personal characteristics include gender, urban/rural status, age and political capital. Standard errors in the paraphrases are clustered at the college level.

B.2 Results Excluding Repeat Exam Takers

Our findings remain similar after excluding repeat exam takers, as shown in Table B.2.

Table B.2. Excluding Repeated Exam Takers, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Var.	Any Firm			Firm=I(Capital≥2M)			Firm=I(Capital≥15M)		
Exam score (sd)	-1.226	-1.206	-1.145	-0.296	-0.283	-0.278	-0.072	-0.067	-0.068
	(0.047)	(0.048)	(0.048)	(0.018)	(0.018)	(0.018)	(0.009)	(0.009)	(0.009)
Personal characteristics		Y	Y		Y	Y		Y	Y
Prov-year-track FFs	Y	Y	Y	Y	Y	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
College FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
Major FE			Y			Y			Y
Obs (excl. singletons)	1,108,781	1,108,781	1,098,566	1,108,781	1,108,781	1,098,566	1,108,781	1,108,781	1,098,566

Notes: Personal characteristics include gender, urban/rural status, age and political capital. Standard errors in the paraphrases are clustered at the college level.

B.3 Results Excluding Students with Scores at 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.3, the estimates become even stronger if we exclude the students at the tails.

Table B.3. Excluding Students with Scores on the Tails, within Colleges
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Var.	Any Firm			Firm=I(Capital≥2M)			Firm=I(Capital≥15M)		
Exam score (sd)	-1.108	-1.114	-1.033	-0.297	-0.295	-0.275	-0.079	-0.077	-0.073
	(0.056)	(0.057)	(0.056)	(0.023)	(0.023)	(0.023)	(0.011)	(0.011)	(0.011)
Personal characteristics		Y	Y		Y	Y		Y	Y
Prov-year-track FFs	Y	Y	Y	Y	Y	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
College FEs	Y	Y	Y	Y	Y	Y	Y	Y	Y
Major FE			Y			Y			Y
Obs (excl. singletons)	1,253,700	1,253,700	1,243,600	1,253,700	1,253,700	1,243,600	1,253,700	1,253,700	1,243,600

Notes: Personal characteristics include gender, urban/rural status, age and political capital. Standard errors in the paraphrases are clustered at the college level.

B.4 Addressing Family Firms

To address the concern of family firms, we keep a subgroup of firms with two conditions: (1) it was established after one took the exam, (2) the age difference between an individual in our college population and the eldest shareholder of the firm is smaller than 20 years. Such a definition is unlikely to include any family firms. The results are presented in Table B.4.

Table B.4. Restricting the Definition of Firms
Administrative Data, Individual-level Analysis

	(1)	(2)	(3)
	Any firm, excl. possible family firm		
Mean	5.99		
Exam score (sd)	-0.826	-0.820	-0.759
	(0.033)	(0.033)	(0.034)
Personal characteristics Y	Y	Y	Y
High school FEs	Y	Y	Y
College FEs	Y	Y	Y
Major Fes			Y
Obs (excl. singletons)	1,560,038	1,560,038	1,546,390

Notes: Personal characteristics include gender, urban/rural status, age and political capital. Standard errors in the paraphrases are clustered at the college level.

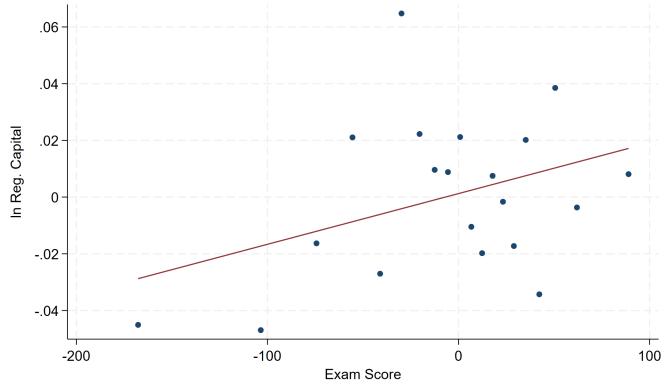
C Interpretations: Additional Evidence

C.1 Visualization: Score-Firm Success Conditional on Entry

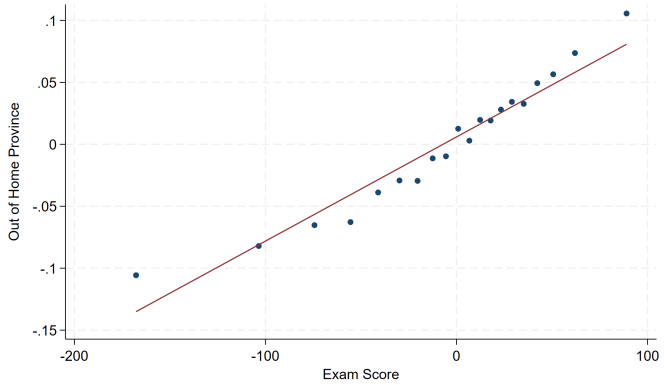
Given entry, exam scores (within colleges) appear positively associated with multiple measures of firm success, including (a) registered capital (demeaned by industry mean), (b) the propensity of creating a firm outside one's home province, (c) the propensity of investing in other firms as a shareholder, and (d) the propensity of becoming publicly listed. Figure C.1 visualizes these correlations.

Figure C.1. Firm Capital Size and Other Success Measures (given entry)

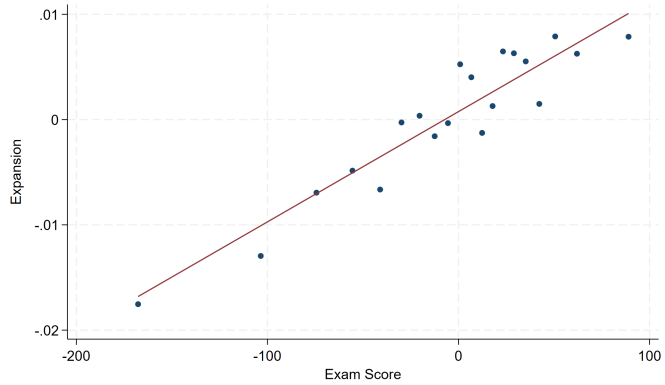
(a) log Registered Capital



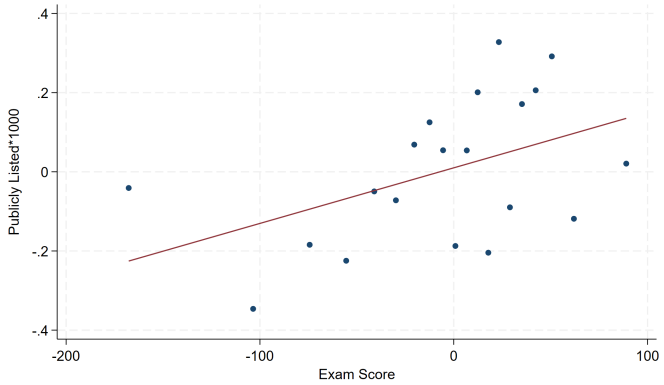
(b) Firms Created Out of Home Provinces



(c) Expansion



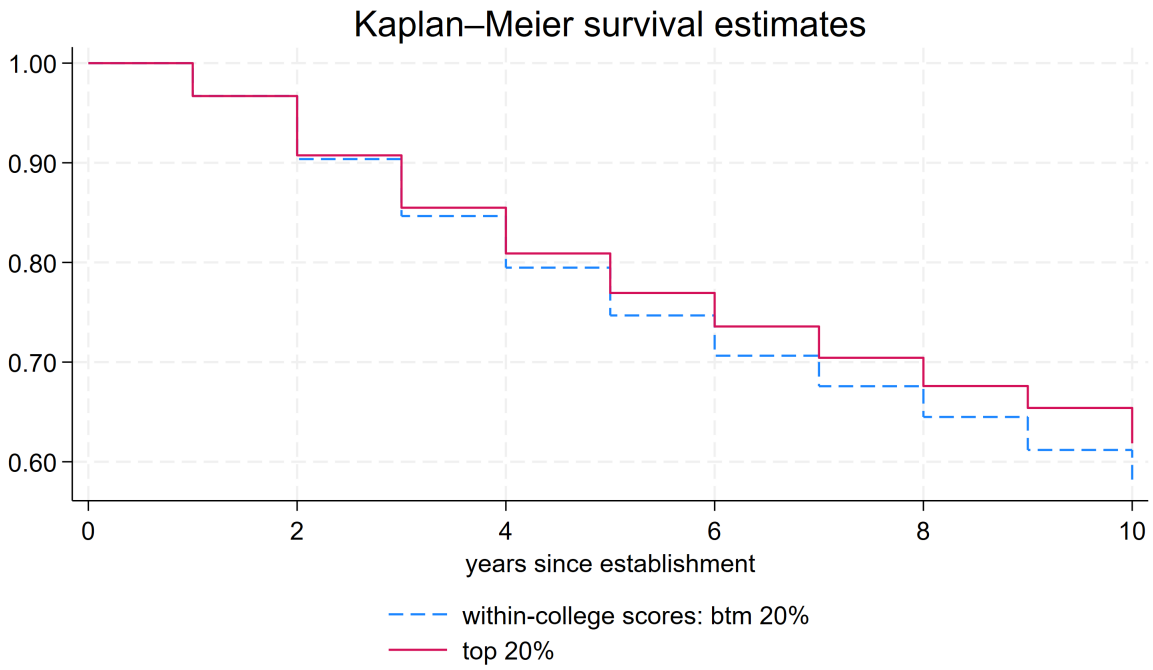
(d) Becoming Listed



C.2 Survival Analysis

Figure C.2 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 0.97, with a standard error of 0.006, which is consistent with the pattern in the figure.

Figure C.2. Score and Firm Survival, within Colleges
Administrative Data, Firm-level Analysis



C.3 Heckman Estimates

Equation (9) could potentially be subject to selection bias because we observe only firms that are self-selected into existence and the selection could be correlated with the score. To correct potential selection bias, we employ the Heckman two-stage estimation method (Heckman 1976). In the first stage, we estimate the probability of entry, which is

$$Pr(Firm = 1|Z_{i,pyt,c}) = \Phi(Z_{i,pyt,c}), \tag{10}$$

where $Z_{i,pyt,c}$ includes X_i, λ_{pyt}, θ_c in equation (9) as well as an instrumental variable described below. 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 use the geographic origins of peers within the same college-cohort (indicated by peer origin$_{c,t}$) as an instrument to predict firm entry. Essentially, we employ two sources of variation: the variation in entrepreneurship intensity across one's birth prefecture and the geographic composition of peers in a college. Intuitively, after controlling for college sorting, the temporal composition of students' geographic origin measures entrepreneurship exposure and has some randomness that we can empirically demonstrate.

Specifically, we define the instrument as

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

where n refers to the number of students in a college-cohort, and $EntrepreneurProp_{j,pref}$ is calculated as the number of entrepreneurs in one's birth prefecture who had established firms before 1999, divided by the adult population in the prefecture. We use this historical information of entrepreneurial propensity to further minimize the potential issue of reflection.

To see how our instrument avoids college sorting concerns, we examine the correlations between the instrument and personal characteristics in Table C.3(I). As shown, without controlling for college fixed effects (Column (1)), we find that the score and other personal characteristics are strongly correlated with peer-origin$_{c,t}$. In contrast, the correlations are minimal once we control for the college fixed effects (Column (2)), suggesting that the within-college peer exposure is close to being random. Moreover, not surprisingly, peer-origin$_{c,t}$ is predictive of one's own firm creation.

Using this instrument, we implement Heckman correction and obtain the following estimates on firm success, reported in the upper panel of Table C.3(II). Compared with the OLS estimates in the lower panel, Heckman estimates are slightly lower. This indicates that, there is indeed positive selection bias in our OLS estimates. However, considering the potential bias does not significantly influence our findings.

Table C.3. Validity Checks of the Instrument

	(1)	(2)	(3)
Dependent var.	$\text{Peer}_{c,t}$ (sd)	$\text{Peer}_{c,t}$ (sd)	Firm creation (0/100)
$\text{Peer}_{c,t}$ (sd)			1.5499
			(0.3233)
Exam score (sd)	0.0561	0.0012	-1.3758
	(0.0073)	(0.0007)	(0.0525)
Male	0.0108	-0.0000	4.8523
	(0.0045)	(0.0004)	(0.0974)
Urban	0.0613	0.0012	0.4157
	(0.0045)	(0.0004)	(0.0829)
Age	-0.0175	-0.0007	-0.0617
	(0.0014)	(0.0002)	(0.0334)
Political capital	0.1261	0.0034	1.8508
	(0.0172)	(0.0023)	(0.5311)
Prov-year-track FFs	Y	Y	Y
High school FEs	Y	Y	Y
College FEs		Y	Y

Notes: $\text{Peer}_{c,t}$ refers to the college-cohort peers' entrepreneurial propsensity, calcauted based on historical firm creation in the peers' birth prefecture. Standard errors in the paraphrases are clustered at the college level.

Table C.3. II. Heckman Estimates vs. OLS Estimates

	(1)	(2)	(3)	(4)
Dependent var.	ln Reg Capital within prov-ind	Out of Home Prov	Expand	Listed (*1000)
Heckman Estimates				
n=1,572,009				
Exam score (sd)	0.008	0.036	0.006	0.093
	(0.005)	(0.001)	(0.001)	(0.058)
OLS Estimates				
n=150,472				
Exam score (sd)	0.011	0.045	0.007	0.124
	(0.006)	(0.002)	(0.001)	(0.065)
Personal characteristics	Y	Y	Y	Y
Prov-year-track FFs	Y	Y	Y	Y
High school FEs	Y	Y	Y	Y
College FEs	Y	Y	Y	Y

Notes: Personal characteristics include gender, urban/rural status, age and political capital. Standard errors in the paraphrases are clustered at the college level.