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High-stakes exams are often administered at designated test centers, requiring many students to test in unfamiliar environments. We investigate whether such arrangements impact students' test performance and, by extension, access to educational opportunities. Using unique administrative data from China's national college entrance examination between 2016 and 2018 and its random assignment of test centers, we find that students assigned to a non-home school score 0.14 standard deviations lower than classmates testing at their home school, and they are 3.8 percentage points less likely to be admitted to college. The performance penalty is most pronounced in STEM subjects and partly driven by longer travel distances. Furthermore, it has significant inequality implications: the penalty is especially severe for low-achieving students and those from disadvantaged backgrounds. As test centers are predominantly located in high-performing schools, such ostensibly neutral assignment policies may unintentionally exacerbate existing achievement gaps between privileged and less privileged groups. A back-of-the-envelope calculation suggests that exam location accounts for over 7.6% of the observed performance gap between students from test-center and non-test-center schools.

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Testing Away from One's Own School: Exam Location and Performance in High-Stakes Exams*

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Abstract: High-stakes exams are often administered at designated test centers, requiring many students to test in unfamiliar environments. We investigate whether such arrangements impact students' test performance and, by extension, access to educational opportunities. Using unique administrative data from China's national college entrance examination between 2016 and 2018 and its random assignment of test centers, we find that students assigned to a non-home school score 0.14 standard deviations lower than classmates testing at their home school, and they are 3.8 percentage points less likely to be admitted to college. The performance penalty is most pronounced in STEM subjects and partly driven by longer travel distances. Furthermore, it has significant inequality implications: the penalty is especially severe for low-achieving students and those from disadvantaged backgrounds. As test centers are predominantly located in high-performing schools, such ostensibly neutral assignment policies may unintentionally exacerbate existing achievement gaps between privileged and less privileged groups. A back-of-the-envelope calculation suggests that exam location accounts for over 7.6% of the observed performance gap between students from test-center and non-test-center schools.

Keywords: High-Stakes Test, Exam Location, Cognitive Performance, Disparity

JEL: D90, H75, I23, I24, I28

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1 Introduction

Most students take standardized tests before graduating from high school. These high-stakes exams play a crucial role in college admissions and can have lasting effects on long-term outcomes, such as future earnings. A key organizational characteristic of these tests is that they are typically administered at designated test centers. As a result, students — particularly those from disadvantaged backgrounds — often need to travel to unfamiliar, non-home schools to take the exam. While prior research has shown that such testing arrangements can influence the likelihood of taking the exam (Bulman, 2015), much less is known about their impact on test performance. Psychological evidence suggests that unfamiliar environments can heighten anxiety and impair cognitive performance (Smith, 1979; Nejati, 2023), raising important concerns that these testing policies may unintentionally exacerbate existing educational inequalities.

A central empirical challenge in identifying the causal effect of exam location lies in self-selection and the endogenous choice of where to take the exam. For example, students taking the Scholastic Assessment Test (SAT) can choose whether to take the exam and select their preferred test center at the time of registration. In this paper, we address the challenge by leveraging administrative data on the full population of high schoolers taking the national college entrance examination (NCEE) in a Chinese county. Nearly all high school graduates in China register for the NCEE as university admissions are based solely on NCEE scores. To streamline logistics and prevent cheating, local education authorities pool all NCEE takers and randomly assign them to designated test centers — typically selected local high schools — after exam registration. As a result, students are unaware of their test center assignment at the time of registration, and the random assignment introduces exogenous variation in exam locations. Crucially for our identification, this assignment mechanism generates within-class variation for students from high schools designated as test centers: while some remain at their own school to take the exam, others are required to travel to different schools. This setting enables comparisons between otherwise similar students who take the exam in different testing environments.

Using data on the entire population of approximately 11,000 students who took the NCEE in a county from 2016 to 2018, we first validate the random assignment system. We show a student's assignment to a non-home school is not correlated with demographic characteristics, including gender, age, and socioeconomic status (SES). After confirming the random assignment, we proceed to estimate the impact of testing at a non-home school on exam performance. We find that students assigned to a non-home school score 0.14 standard deviations lower than those taking the exam at their home school — equivalent to a 10-point reduction on the 750-point scale used in China's NCEE. The performance penalty associated with non-home location remains persistent throughout the sample period, and it is consistently observed across all high schools and among both male and female students. The effect is primarily driven by STEM subjects, which demand higher cognitive resources and may be more sensitive to environmental influences under conditions of elevated pressure (Beilock and Carr, 2005). Furthermore, we find that longer travel distances are associated with even poorer performance: students assigned to test centers located far from their homes experiencing a more pronounced performance penalty. This suggests that increased fatigue and logistical uncertainty can likely exacerbate cognitive declines.

To put the magnitude of this performance decline into context, we examine its implications for students' access to future educational opportunities. Students assigned to non-home schools are ranked behind an additional 2.9% of their peers within the same year-track in their province, are 3.8 percentage points less likely to be admitted to any college, and are 0.6 percentage points less likely to gain admission to an elite college. Moreover, they are 13.3 percentage points more likely to retake the exam the following year.

Finally, we discuss the broader implications of our findings for understanding educational disparities. We highlight that the performance penalty associated with testing location is both (1) more severe for less privileged students, and (2) more likely to affect them. One, our within-class comparison reveals that the performance penalty is more pronounced among lower-performing and socioeconomically disadvantaged students. Although students have the option to retake the exam the following year, this response is largely limited to those from higher socioeconomic backgrounds, likely due to the substantial costs involved. Two, we show that — consistent with patterns observed in the United States and other settings — test centers are predominantly located in more developed areas, and thus closer to more advantaged groups. This implies that students from less privileged backgrounds are more likely to be assigned to non-home test centers and disproportionately bear the performance penalty. We conduct a simple back-of-the-envelope calculation and find 7.6% of the observed performance gap between students from test-center high schools and those from non-test-center schools could be attributed to the exam location.

Our paper primarily contributes to the policy discussion on socioeconomic gaps in education, by highlighting an integral component of the college access process that has received relatively little attention. The existing studies focus on students' decisions regarding whether to take or retake college entrance exams (i.e., the extensive margin) (Bulman, 2015; Goodman, 2016; Frisancho et al., 2016; Goodman, Gurantz and Smith, 2020; Kang et al., 2024). Another line of research examines how environmental or institutional factors influence students' performance gaps (i.e., the intensive margin) (Ebenstein, Lavy and Roth, 2016; Graff Zivin et al., 2020a; Park, 2022; Bond et al., 2022; Chang and Padilla-Romo, 2023; Wang, Wang and Ye, 2023; Li et al., 2024). Our context allows us to net out test environments (via test room fixed effects) and students' self-selection, enabling us to uncover the impact of exam location on test performance. We find that students who take exams at a school other than their own score 0.14 standard deviations lower than those who test at their home school, resulting in reduced educational opportunities. This effect is particularly pronounced among low-achieving students and those from disadvantaged backgrounds. Combined with the fact that high-performing high schools are more likely to serve as test centers, our results suggest that ostensibly neutral assignment policies may inadvertently widen existing achievement gaps between privileged and less privileged groups.

The study most closely related to ours is Bulman (2015), which examines inequalities in access to test centers — specifically, how the presence of a test center at a student's home high school affects their likelihood of taking a college admissions exam.[1] We complement this work by focusing on the intensive margin: how taking a high-stakes exam at a non-home school, rather than at one's own school, affects test performance. We provide causal evidence in China's college entrance exam, one of the most high-stakes exams in the country. Our results suggest that exam location imposes an intensive margin penalty on top of the extensive margin access barriers documented in Bulman (2015). Given the uneven global distribution of test centers, this potential double penalty has broader implications for educational inequality and access to opportunity.

2 Background and Data

2.1 Setting: National College Entrance Examination (NCEE)

The national college entrance examination in China is a high-stakes assessment that uniquely determines college admissions through a single annual test. Often characterized as a "life-changing event," this examination profoundly shapes both educational pathways and subsequent labor market outcomes (Jia and Li, 2021). Each year, approximately 40% of examinees can be admitted to college.

During our sample period (2016 – 2018), the NCEE in China generally follows a structured assessment framework consisting of four components, with a total score of 750 points: Chinese language (150 points), Mathematics (150 points), English language (150 points), and a comprehensive examination (300 points). The curriculum offers two academic tracks: science and liberal arts. For science-track students, the comprehensive examination includes physics, chemistry, and biology, whereas liberal arts-track students are assessed in history, politics, and geography. The examination is conducted over two consecutive days in early June. On the first day, students take the Chinese exam from 9:00 to 11:00 AM and the Math exam from 3:00 to 5:00 PM. On the second day, they take the comprehensive exam from 9:00 to 11:00 AM,

[1] In the U.S., fewer than half of public high schools serve as SAT test centers, with even lower rates among schools serving low-income communities. Since the SAT's introduction in 1901, proximity to a test center has played a crucial role in determining access to college entrance exams. Bulman (2015) finds that opening a new test center increases test-taking by an average of 8.5 percent (4 percentage points) among students at the host school, with about 40 percent of these students subsequently enrolling in a four-year college.

followed by the English exam from 3:00 to 5:00 PM.

The administration of this high-stakes examination follows a rigorous protocol established by the provincial government to ensure procedural integrity and standardization. Within each county, several designated high schools serve as test centers for all local students, with the number of centers ranging from 2 to 7 depending on the student population. Each center consists of multiple test rooms (ranging from 20 to 40), with each room accommodating 30 students. The provincial government assigns students to specific test centers, rooms, and seats one week before the exam. In other words, students' registration decisions are unaffected by their test center assignment.[2] These assignments remain fixed throughout the entire examination period. To further promote academic integrity — and as a key aspect of our identification strategy — several provinces have implemented a randomized assignment system that distributes students from the same high school across different test centers. For students graduating from high schools that serve as examination centers, some are allowed to remain at their home school, while others are reassigned to different locations.

Students are allowed to visit the test center the afternoon before the exam to familiarize themselves with their assigned room and nearby facilities, such as restrooms. The test rooms will be re-inspected after the students' familiarization visit. Participation in this pre-exam visit is optional, as not all students choose to attend. During the examination, each room is supervised by two proctors — one male and one female — who are high school teachers recruited from other counties and randomly assigned to help ensure impartial oversight. After the exam, the papers are scanned by computer and then randomly assigned to experienced graders for evaluation in a double-blind process. Appointed by the provincial education authority, these graders—typically high school teachers—gather for one week at a government-designated fa-

[2] Since the NCEE is a high-stakes exam that students spend 12 years preparing for, we find that in our county, all registered students ultimately sit for the exam.

cility in the provincial capital to evaluate the examination scripts.[3]

College admission outcomes depend on individual application strategies, available quotas, and a student's ranking among applicants from the same province competing for spots at the same institution. The national college entrance examination in China exemplifies intense academic competition, where even marginal score differences can substantially impact a student's provincial ranking. To illustrate this competitiveness, consider our sample province in 2018, which had approximately 200,000 science track examinees. In this context, a student with a score of 500 achieved a provincial rank of 63,000. A reduction of just one point would lead to a drop of 680 positions, disadvantaging the student relative to hundreds of peers in the college selection process.

2.2 Data

Our data is sourced from the Bureau of Education of a county in Central China. This administrative dataset covers all students who registered for the national college entrance examination in our sample county from 2016 to 2018. It contains detailed information on each student's gender, ethnicity, age, academic track, high school and class, test center, and test room. The dataset also includes subject-level test scores and, importantly, college admission outcomes.

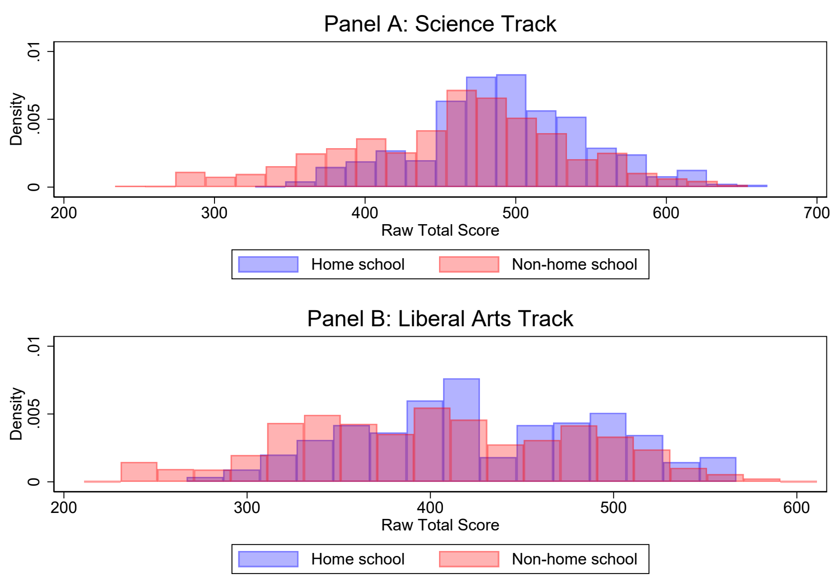
The county has a geographical size comparable to that of Houston or Greater London. Table A1 provides background information regarding the sampled county characteristics. For comparison, we also provide corresponding statistics for an average county. While our sampled county is less prosperous than the average, it has a comparable share of high schoolers in its population and a similar student-teacher ratio relative to other counties in the same

[3] To enhance exam integrity, additional protocols have been implemented during the NCEE to prevent cheating: (1) while students are permitted to use the restroom during the exam, few do so due to time constraints, and those who do are accompanied and monitored by a same-sex proctor; (2) students are prohibited from wearing school uniforms to prevent identification with specific high schools; (3) students are prohibited from bringing any electronic devices into the test room; (4) all examinees are individually screened with metal detectors upon entry, and radio signal jammers are used to ensure full and effective coverage of the test rooms; (5) monitoring cameras are installed in every test room, recording the entire exam process in real time under the supervision of the provincial authorities; and (6) the nearby road will be closed to motor vehicles in order to reduce the noise level.

province.

Each year, approximately 4,000 students from eleven high schools in our sample county register for the national college entrance examination. Five of these schools serve as designated test centers, each accommodating a roughly equal number of students, though some host slightly more than others. Specifically, the largest test center hosts 21% of students, while the smallest hosts 18.4%. Figure A1 presents the spatial distribution of high schools and designated test centers to show their relative positions. All five test centers are centrally located within the county situated closer to the local government offices. Students from the most remote high school must travel 9 kilometers — often navigating mountainous roads by bus or electric bicycle — to reach their designated test center for the exam.

Figure 1: Distribution of Raw Total Scores



Notes: This figure shows the distribution of raw total scores by test center for students in the science track (Panel A) and the liberal arts track (Panel B). The histograms are based on raw data. Blue bars represent students who took the exam at their home schools, while red bars represent those who took the exam at non-home schools. The x-axis displays raw total scores, and the y-axis indicates the density.

Figure 1 presents the distribution of raw total scores for students in two academic tracks, comparing those who took the exam at their home school (in blue) versus a non-home school (in red). Panel A illustrates the distribution for the Science Track. Both groups exhibit approximately bell-shaped distributions, but home-school test takers tend to cluster at slightly higher score ranges. On average, students who took the exam at their home school scored 492 points, compared to 459 points for those who tested at a non-home school, indicating a substantial performance gap. Panel B displays the distribution for the Liberal Arts Track, where the score distributions are more similar across test center types. Nonetheless, home-school test takers still show a slight concentration in the upper score range, with average scores of 427 for home-school test takers and 401 for their non-home school counterparts. Overall, the figure highlights consistent performance differences by test center type: students who take the exam at their home schools tend to perform better. However, this initial comparison reflects the influence of two factors: (1) the potential performance penalty associated with the exam location, and (2) underlying differences between students from schools that serve as test centers and those from schools that do not.

Because our primary research question focuses on isolating the effect of exam location on performance, our following analysis will center on students from the five schools that serve as test centers.These schools provide meaningful within-school variation in exam location, as each has students who took the exam both at their home school and at a non-home school. These five top high schools enroll 81% of all students in the county. Among them, 82.9% took the exam at a non-home school, and the maximum distance between any two of these schools is 6.5 kilometers.

3 Empirical Strategy

3.1 Identification

Our baseline specification is defined as follows:

$$TotalScore_i = \beta_1 NonHomeSchool_i + \pi_c + \pi_r + \epsilon_i \tag{1}$$

where $TotalScore_i$ represents student i's standardized total score on the NCEE. To ensure comparability of test scores across different years, we standardize test scores within each year and academic track (i.e., liberal arts or science) to have a mean of 0 and a standard deviation of 1. Student i attends high school s, belongs to high school class c, and takes the NCEE in test room r at test center t. $NonHomeSchool_i$ is a dummy variable that is one if the student s is assigned to a test center outside their own home school (i.e., $s \neq t$).

Crucially for our identification, we introduce π_c, the high school class fixed effects, which allow us to compare students within the same class and thus absorb any *high school* $\times$ *year* $\times$ *track* differences. In China, students are typically placed into classes according to their academic track and ability at the outset of 11th grade. Each class consists of 25 to 45 students with similar academic performance, and these students attend all of their courses together with the same group of classmates. The inclusion of high school class fixed effects enhances the comparability of our sample by controlling for these class-level groupings. This approach also addresses potential selection concerns, as some schools host a larger number of exam takers, and students from these schools are more likely to take the exam at their own institution. We also include test room fixed effects, π_r, which account for differences in the testing environment among students assigned to the same room, capturing factors such as temperature and the condition of school facilities. β is the coefficient of interest, capturing the performance gap attributable to assignment to non-home test centers. Standard errors are clustered at the high school class level.

3.2 Balance checks

Given the random assignment process, it is reasonable to expect that a student's assignment to a non-home school is uncorrelated with individual-level characteristics. To validate the randomness of test center assignment, we examine whether a student's placement at a non-home school is associated with individual-level characteristics.

Table A2 presents summary statistics and balance checks for demographic and background variables available in our data, comparing students taking exams at home schools and non-home schools. 49.3% of students are male, the average age is 17.6 years, 38.6% of students originate from urban areas, 81.7% are enrolled in the science track, and 52.3% live in neighborhoods with house prices above the median (i.e., ¥2500 per square meter).[4] The results show no statistically significant differences between the two groups in terms of gender, age, class leadership roles, participation in the science track, or socioeconomic status (proxied by house price). These findings confirm successful randomization and comparable student populations in our context.

4 Results

4.1 Main results

Table 1 presents our main results. We begin by regressing test scores on non-home school assignments, incorporating only the high school class fixed effects. This approach enables comparisons among students within the same high school class — a more comparable group with similar academic backgrounds and an equal likelihood of being assigned to different test centers. We find that students who take the exam at their home school perform substantially better. In Column (2), we include test center fixed effects to account for factors specific to each center, such as location and the condition of school facilities. All high schools that served as test centers in our sample county underwent renovations between 2006 and 2008 and thus have relatively modern facilities. We again find that students who take the exam at their home school perform substantially better, with a similar magnitude of effect.

Column (3) presents our preferred specification, which incorporates both high school class fixed effects and test room fixed effects. The inclusion of test room fixed effects accounts for test room-specific factors, such as floor location, student composition, proctors, and other environmental influences. The estimated coefficient remains virtually unchanged. On average, students assigned to a non-home school score 0.14 standard deviations lower than their class-

[4] Notably, the urban–rural classification is based on household registration and thus reflects students' places of origin. The house price indicator is based on current home addresses and serves as a better proxy for socioeconomic status.

Table 1: Main Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total Score				Rank Percentile	College Admission	Elite College Admission	Exam Retake
Non-Home School	-0.136***	-0.133***	-0.141***	-0.140***	2.930***	-0.0375***	-0.00583*	0.133***
	(0.0174)	(0.0172)	(0.0186)	(0.0185)	(0.425)	(0.0103)	(0.00330)	(0.0115)
Observations	8,535	8,535	8,535	8,535	8,535	8,535	8,535	5,619
R-squared	0.486	0.487	0.512	0.520	0.550	0.465	0.215	0.100
Individual Controls	.	.	.	X	.	.	.	.
Test Center FEs	.	X	.	.	.	.	.	.
Test Room FEs	.	.	X	X	X	X	X	X
Highschool Class FEs	X	X	X	X	X	X	X	X

Notes: This table presents our main results. *Non-Home School* is a binary variable indicating whether student i is assigned to a test center outside their home school to take the exam. *Total Score* represents the student's total test score, standardized by year and academic track. *Rank Percentile* measures provincial rank percentile. *College Admission* is a binary variable indicating whether student i is admitted to an elite college. *Elite College Admission* is a binary variable indicating whether student i is admitted to an elite college. *Exam Retake* is a binary variable indicating whether student i retook the exam in the following year. Individual controls include gender, age, class leadership status, urban residency, and socioeconomic status, proxied by housing prices. Standard errors are clustered at the high school class level. *** p<0.01, ** p<0.05, * p<0.1.

mates who take the exam at their home school.[5] In Column (4), we add individual controls, including gender, age, class leadership status, urban residency, and socioeconomic status. The results remain consistent.[6]

College admission outcomes in China depend more on a student's relative ranking among applicants from the same province and academic track than on their absolute test scores. It is therefore important to understand how changes in test scores translate to shifts in provincial ranking percentiles. In Column (5), we match our data to the score distribution in the province,

[5]To understand how this magnitude compares to the effects of short-run environmental and psychological shocks on student performance in other contexts, consider the following examples: in Mexico, violent crimes occurring in the week prior to exams reduce female students' test scores by 0.11 standard deviations (Chang and Padilla-Romo, 2023); in Israel, a 10-unit increase in PM2.5 exposure lowers scores by 0.08 standard deviations (Ebenstein, Lavy and Roth, 2016). Moreover, Park et al. (2020) finds that taking the Regents Exams in New York City when outdoor temperatures reach 90°F reduces performance by approximately 0.13 standard deviations compared to taking the exam at 75°F. In comparison, the impact of being assigned to a non-home school in our context is larger, though still within the same order of magnitude as these shocks. In the Chinese context, a 5°C (9°F) increase in temperature during the national college entrance exam period reduces total test scores by 0.15 standard deviations (Graff Zivin et al., 2020b). Students taking the NCEE in China may be more sensitive to external environmental shocks such as temperature due to its exceptionally challenging nature, coupled with the intense competition and high pressure surrounding it.

[6]In addition, we report an alternative measure of exam performance in Table A3: raw total scores. Column (1) shows that students who take the exam at a non-home school score 10 points fewer (out of 750).

accounting for year and academic track, and calculate the provincial rank percentiles, which measures the proportion of students with higher test scores within the same year-track. This measure is pertinent to college admissions, as admission decisions are essentially based on a student's ranking among peers within the same cohort and academic track. On average, the decline in test scores places affected students behind an additional 2.9% of their peers within the same year-track in the province.

In Column (6) of Table 1, we find that the decline in test scores translates into a meaningful reduction in access to future educational opportunities. In our sample county, 67.6% of students are admitted to college. However, those assigned to non-home schools are 3.8 percentage points less likely to be admitted — a 5.6% decrease relative to the baseline. Among more than 2,000 universities in China, 39 are designated as top-tier institutions under the "985 Initiative". Column (7) shows that students assigned to non-home schools are 0.6 percentage points less likely to gain admission to one of these elite universities. It is worth noting that this result should be interpreted with caution though, as admission outcomes are influenced by both test scores and students' application strategies (Li and Qiu, 2023).

Lastly, NCEE takers who believe their initial scores do not accurately reflect their true abilities or meet their expectations may choose to retake the exam the following year (Kang et al., 2024). These retakers typically remain in their home county to prepare for and sit the exam again. Because we have data on the full population of exam takers in our sample county from 2016 to 2018, we are able to identify retakers from the 2016 and 2017 cohorts; this results in a smaller sample size for analysis. To do so, we match observations across two consecutive years using full name, exact date of birth, gender, and academic track (science or liberal arts). Individuals successfully matched to records in the subsequent year are classified as having retaken the NCEE. In our sample county, approximately 19.7% of students retook the NCEE in the following year. In the last column of Table 1, we find that students assigned to a non-home school are significantly more likely to be dissatisfied with their admission outcomes and are 13.3 percentage points more likely to retake the exam the following year.

We conduct an array of additional analyses to better characterize the non-home school penalty and its potential drivers.

Robustness. We use alternative clustering levels in Table A3. In Column (2), standard errors are clustered at the school-year-track level, while in Column (3), they are clustered at the test room level. Column (4) also presents results based on the full student population (including those from non-test-center schools without within-class variation), and yields similar findings. Table A4 presents additional results disaggregated by year, gender, and high schools. We demonstrate that our results are not driven by a specific year, as the non-home school performance penalty persists throughout the sample period. Furthermore, this performance penalty is gender-neutral, with both male and female students experiencing a similar effect. Panel B of Table A4 further reports results disaggregated by high school. We find that the observed performance penalty is not driven by any single school; rather, it is consistently present among students from all high schools that serve as test centers. Therefore, our results are unlikely to be explained by the notion that non-home schools have poorer facilities that negatively impact academic performance. While the magnitude of the effect varies across schools, this likely reflects differences in student composition.

Table 2: Suggestive Evidence on Mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Math	Chinese	English	Comp. test (Science)	Comp. test (Liberal Arts)	Total Score	
Non-Home School	-0.205***	-0.0527**	-0.0486*	-0.153***	-0.0977*	-0.151***	-0.114*
	(0.0250)	(0.0238)	(0.0255)	(0.0205)	(0.0544)	(0.0198)	(0.0605)
Observations	8,535	8,535	8,535	6,965	1,499	6,965	1,499
R-squared	0.333	0.325	0.325	0.504	0.422	0.578	0.411
Test Room FEs	X	X	X	X	X	X	X
Highschool Class FEs	X	X	X	X	X	X	X
Academic Track	All	All	All	Science	Liberal Arts	Science	Liberal Arts

Notes: This table presents our additional results. *Non-Home School* is a binary variable indicating whether student i is assigned to a test center outside their home school to take the exam. *Total Score* represents the student's total test score, standardized by year and academic track. *Chinese* represents the student's standardized test score on Chinese. *Math* represents the student's standardized test score on Math. *English* represents the student's standardized test score on English. *Comp. test (Science)* refers to the student's standardized score on the comprehensive science exam, which includes physics, chemistry, and biology. *Comp. test (Liberal Arts)* refers to the standardized score on the comprehensive liberal arts exam, covering history, geography, and political science. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Potential Mechanisms. First, according to psychological studies, unfamiliar environments can impair cognitive functioning (e.g, Smith, 1979). Although our high-stakes, realworld setting precludes us from providing direct neuroscientific evidence as psychologists have done in laboratory experiments, Table 2 offers suggestive evidence by examining the impact disaggregated by subject. STEM subjects — particularly math and science — require sustained attention, multi-step reasoning, and problem-solving under pressure. As a result, any discomfort or distraction in the testing environment is more likely to impair cognitive performance in these subjects compared to those that rely more on recall or reading comprehension. We find that STEM subjects are more sensitive to exam location. Students assigned to a non-home school score 0.2 standard deviations lower in math and 0.15 standard deviations lower in the comprehensive science test (which includes physics, chemistry, and biology). In contrast, the impact is smaller for language subjects, with scores decreasing by approximately 0.05 standard deviations in Chinese and English, and 0.1 standard deviations in the comprehensive liberal arts test (which includes history, geography, and political science).[7] Although geography is categorized as a non-STEM subject, it involves complex calculations akin to those in STEM fields, which may partly explain the slightly larger effect observed in the comprehensive liberal arts test. Accordingly, Columns (6) and (7) provide suggestive evidence that students in the science track are slightly more affected by non-home test taking than those in the liberal arts track, although the difference is not statistically significant due to limited power.

Second, traveling to the test center may also partly contribute to the non-home school penalty: longer commutes to unfamiliar test centers may lead to increased fatigue and logistical uncertainty, potentially undermining cognitive performance.[8] To investigate this mechanism, we calculate the travel time between each student's home and their assigned test center using e-bike transportation, the most common mode of transportation in our sampled county.[9] On average, it takes a student 24.6 minutes to travel from home to the test center, with the

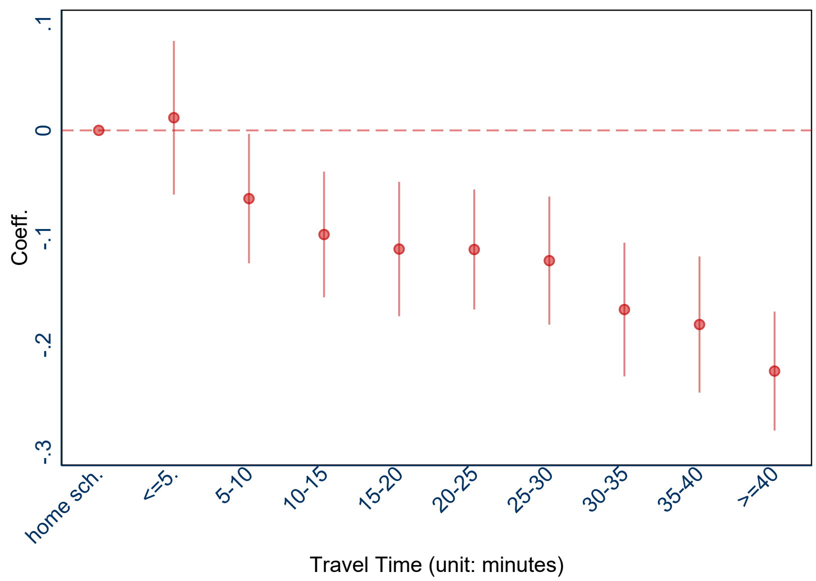
[7]The analysis of the comprehensive test has a smaller sample size because the science version is taken only by students in the science track, while the liberal arts version is taken only by students in the liberal arts track.

[8]Anecdotally, students from distant areas may sleep less due to longer travel times and may need to take breaks and eat in unfamiliar communities during the exam period. Relatedly, Heissel and Norris (2018) find that school start time and sleep patterns can impact student academic performance.

[9]The calculation is performed by a local government agent using our code, which relies on the AMap API — the Chinese equivalent of Google Maps. Due to changes in street names, however, travel time information is unavailable for around 300 students.

25th percentile at 13 minutes and the 75th percentile at 35 minutes. We categorize travel time into 5-minute intervals, using students who take the exam at their home school as the baseline group. The results are presented in Figure 2. We find that being assigned to a non-home test center within the neighborhood does not negatively affect student performance; however, longer travel distances are generally associated with significantly lower test scores, with the most adverse impact observed among those living farthest from the test center.

Figure 2: Impact of Non-home School Testing by Travel Time (E-Bike)



Notes: This figure illustrates the relationship between travel time and the performance penalty associated with taking the exam at a non-home school, using students who take the exam at their home school as the baseline group. 95% confidence intervals based on high school class clusters are reported.

In addition, a substantial body of research has examined how temporary environmental factors — such as temperature, air pollution, and pollen — can affect test performance (Marcotte, 2015; Ebenstein, Lavy and Roth, 2016; Bensnes, 2016; Graff Zivin, Hsiang and Neidell, 2018; Graff Zivin et al., 2020a; Park, 2022). However, these factors are unlikely to explain our main findings. First, the test centers in our sample are all located in the central part of the county, a relatively compact area with limited variation in environmental conditions. Second, our preferred specification includes test-room fixed effects, which account for environmental differences at a highly granular level, including room-specific characteristics such as floor level, facility conditions, and other location-specific features.

Lastly, it is worth noting that cheating is unlikely to be a major concern in our setting. As noted in Footnote 3, during our sample period, real-time video surveillance and rigid protocol rules make the NCEE one of the most difficult exams to cheat on. Since 2015, individuals caught facilitating mass cheating in the NCEE can face up to seven years in prison. No such cases have been reported in our sampled county. Given the consistency of our results across different test centers and years, it is unlikely that undetected, isolated incidents of cheating could meaningfully explain the observed patterns.

4.2 Understanding implications on disparity

Heterogeneity by Student Background. In this section, we identify the most vulnerable group and explore the broader implications of our findings for educational disparities. We begin by examining whether low-performing students are more sensitive to unfamiliar environments than their high-performing peers. Students are classified based on their total exam scores, with those scoring above the median defined as high achievers.[10] The results are presented in Columns (1) and (2) of Table 3. We find that our main results are primarily driven by low achievers: their total test scores are 0.175 standard deviations lower when they take the exam in a non-home school. In contrast, the negative effect of a non-home school setting is substantially smaller for high achievers.

Furthermore, we investigate whether the performance penalty associated with the exam location differs for students from different socioeconomic backgrounds. Although students do not report their household income when registering for the exam, they are required to provide their home address in order to receive a potential offer letter. We match their home address to the average price of the neighborhood and classify students as belonging to a low

[10] Our classification may be endogenous to test center assignments, as it is based on realized test scores from the college entrance exam. However, this approach is likely to introduce only moderate measurement error. As shown in Table 1, taking the exam at a non-home institution alters a student's rank percentile by an average of just 3 points. To ensure robustness, we also adopt an alternative definition of high and low achievers by excluding students ranked in the 45th to 55th percentiles. Specifically, we define high achievers as those ranked in the 0–45th percentile and low achievers as those in the 55th–100th percentile. The results remain similar under this alternative classification.

Table 3: Heterogeneity Analysis

	Total Score		Total Score		Exam Retake		Total Score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Low achievers	High achievers	Low SES	High SES	Low SES	High SES	All
Non-Home School	-0.175***	-0.0313**	-0.171***	-0.101***	0.0281	0.237***	
	(0.0269)	(0.0152)	(0.0297)	(0.0270)	(0.0171)	(0.0213)	
Non-Home School (worse)							-0.0801***
							(0.0276)
Non-Home School (better)							-0.203***
							(0.0299)
Statistical difference	P-value<0.001***		P-value=0.076*		P-value<0.001***		-
Observations	4,135	4,379	4,070	4,459	2,733	2,882	8,535
R-squared	0.368	0.450	0.569	0.555	0.169	0.198	0.513
Test Room FEs	X	X	X	X	X	X	X
Highschool Class FEs	X	X	X	X	X	X	X
Mean of dep. var.	-0.569	0.890	0.128	0.232	0.110	0.280	0.176

Notes: This table presents our additional results. $Non\text{-}Home\ School$ is a binary variable indicating whether student i is assigned to a test center outside their home school to take the exam. Student socioeconomic status (SES) is classified based on whether the average housing price in their neighborhood falls above/below the county median of ¥2,500 per square meter. $Non\text{-}Home\ School\ (worse)$ is a binary variable indicating whether student i is assigned to a non-home school with a lower rank than their home school for taking the exam. $Non\text{-}Home\ School\ (better)$ is a binary variable indicating whether student i is assigned to a non-home school with a higher rank than their home school for taking the exam. $Total\ Score$ represents the student's total test score, standardized by year and academic track. $Exam\ Retake$ is a binary variable indicating whether student i retook the exam in the following year. Standard errors are clustered at the high school class level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

socioeconomic class if the price of their neighborhood is below the median house price (i.e., ¥2500 per square meter). The results, presented in Columns (3) and (4) of Table 3, show that students from low socioeconomic backgrounds are more strongly affected by testing in a non-home school.

We then examine the heterogeneity in exam retaking. While retaking the SAT boosts scores and four-year college enrollment, Goodman, Gurantz and Smith (2020) find that low-income students are 21 percentage points less likely to retake the exam potentially due to financial barriers. In their setting, addressing this gap could close up to 10% of the income-based disparity in four-year college enrollment.[11] While Table 1 shows that students assigned to non-home schools are more likely to be dissatisfied with their scores and retake the exam the following year, this average effect masks substantial heterogeneity across socioeconomic groups. In Columns (5) and (6) of Table 3, we find that the retaking is largely driven by students from higher socioeconomic backgrounds, who are 23.7 percentage points more likely to retake the exam when assigned to a non-home test center. In contrast, students from lower socioeconomic backgrounds are only 2.8 percentage points more likely to retake the exam, likely due to financial constraints imposed by the high costs associated with retaking.

Column (7) of Table 3 further categorizes non-home schools based on their academic rankings. Some high schools are ranked academically higher than a student's designated home school, while others are ranked lower. We determine these rankings using the minimum score required for admission on the Senior High School Entrance Examination. Students are generally aware of these rankings within their county, as there are typically only a limited number of high schools available during the application process. Although students generally perform worse when taking exams at a non-home school, we find that the negative effect is more pronounced for those assigned to a school with a higher academic ranking than their own, with an effect size of -0.203. One speculative explanation is that while higher-ranked schools may offer better facilities, these advantages do not necessarily offset the increased pressure or discomfort students may experience in a more competitive academic environment. As a result, students may struggle more in such settings, which could impair their performance.

Uneven Distribution of Test Centers. In China, test centers tend to be concentrated in more advantaged high schools. To provide a more comprehensive understanding, we present a quantitative comparison of high schools that serve as test centers and those that do not in Table

[11] Similarly, in China, retaking the NCEE also tends to improve scores and lead to better college admission outcomes on average. However, there are two key differences between the NCEE and the SAT (Kang et al., 2024). First, retaking the NCEE involves even more substantial costs. Since the exam is administered only once a year, students must spend an additional year preparing. Public high schools do not admit NCEE retakers, so these students typically enroll in private schools, which cost ¥15,000 in our sample county — where the GDP per capita was approximately ¥25,000 in 2016. In addition to tuition, retakers also forgo the income they could have earned during that year. Second, unlike the SAT —where students can submit their highest score, and retaking generally increases admission chances — the NCEE system is more uncertain. Retaking the NCEE means competing against a new cohort of students with new scores, and even with improved performance, better college admission outcomes are not guaranteed.

A5. Our findings show that students from high schools that do not serve as test centers are more likely to come from disadvantaged backgrounds: they are more likely to come from low-SES families, must travel greater distances to reach test centers, exhibit significantly poorer academic performance, and are less likely to be admitted to any (elite) college. It is important to note that our main analysis focuses primarily on students from high schools designated as test centers. While this approach provides meaningful variation in test center allocation for causal identification, it excludes students from high schools that do not serve as test centers, who may be even more vulnerable to testing in an unfamiliar environment. In fact, the average performance of students from non-test-center high schools is slightly lower than that of low-achieving students — those below the median — from test-center high schools (-0.59 vs. -0.57). Therefore, our baseline estimates likely represent a lower bound of the overall cognitive performance penalty associated with non-home test locations.

Lastly, we conduct a simple back-of-the-envelope calculation to assess the extent to which the performance gap between students from test-center high schools and those from non-test-center schools can be explained by exam location. The performance gap is 0.767 (0.182 v.s. -0.586). In our sample county, 82.9% of students from test-center high schools took the exam at a non-home school and on average experience a performance decline by 0.140. On the other hand, 100% of students from non-test-center high schools took the exam at a non-home school and on average experience a performance decline by 0.175.[12] In a counterfactual scenario where all students take the exam at their home school, those from test-center high schools would score an average of 0.298, while students from non-test-center high schools would score −0.411, resulting in a performance gap of 0.709.[13] Therefore, 7.6% of the observed performance gap could be attributed to the exam location.

In our sample county, which has five test centers, approximately 17.1% of students from test-center high schools were assigned to take the exam at a non-home school under fully

[12] We use the results for low-achieving students from Table 3 as an approximate estimate, given that the two groups exhibit similar average performance on the NCEE. However, the actual magnitude may be even larger, as students from non-test-center high schools are also more likely to travel longer distances and come from lower-SES families.

[13] (1-0.829)*0.298+0.829*(0.298-0.140)=0.182.

randomized conditions. However, in counties with fewer test centers, a larger proportion of students from test-center high schools may end up taking the exam at their home schools. As a result, the performance penalty associated with the exam location could further exacerbate the realized performance gap between students from test-center and non-test-center high schools. Similarly, in a context where students are allowed to freely choose their preferred test center such as SAT, we might even expect a larger performance gap between students from test-center and non-test-center high schools.

Remarkably, the concentration of test centers in high-performing schools is not unique to China. For example, in the U.S., Bulman (2015) finds that students attending high schools without an SAT test center are more likely to come from disadvantaged backgrounds—characterized by higher eligibility for free lunch, greater representation of underrepresented groups, lower academic performance, and reduced college admission rates. In practice, some policymakers have made efforts to improve equal access through better test design. Since 2000, several U.S. states have implemented mandates requiring high school juniors to take a college entrance exam (e.g., the SAT or ACT), a policy that has increased four-year college enrollment rates, particularly among students from underrepresented minority (URM) groups (Klasik, 2013; Hurwitz et al., 2015; Goodman, 2016; Hyman, 2017). When a state mandates ACT/SAT testing, it typically funds and administers the exam during school hours at students' home schools. While this approach removes logistical and financial barriers — such as weekend travel to testing centers and registration fees — that might otherwise deter some students from taking the exam, our findings suggest that improved educational outcomes may also be partly attributed to students performing better when taking the test at their home schools. Our findings thus contribute a new evidence-based perspective to these ongoing policy discussions.

5 Conclusions

Significant disparities in access to college admission exams exist among students across countries, with disadvantaged students more likely to travel beyond their home schools to take the test. In this paper, we analyze administrative data from a Chinese county that randomly assigned students to test centers for the college entrance examination between 2016 and 2018. We examine whether taking the exam at a non-home school has a significant impact on student performance.

We find that students assigned to a non-home school score 0.14 standard deviations lower than those taking the exam at their home school, which in turn affects opportunities to college admission. Consistent with psychological and cognitive theories, the performance penalty is primarily driven by STEM-related subjects, and increases by traveling distance between student homes and their test centers. Importantly, this decline in cognitive performance disproportionately affects less-privileged groups. First, when assigned to an unfamiliar test center, lower-performing students and those from lower socioeconomic backgrounds experience greater performance drops. Second, the concentration of test centers in high-performing schools implies that less-privileged students are more likely to take exams in distant, unfamiliar locations — further widening the achievement gap between advantaged and disadvantaged groups.

While we leverage the Chinese context for identification purposes, our findings may have broader implications. Testing in unfamiliar environments and long travel distances to test centers are common challenges in many contexts. Exams such as the SAT (Scholastic Assessment Test), TOEFL (Test of English as a Foreign Language), IELTS (International English Language Testing System), CFA (Chartered Financial Analyst exam), and many other qualification tests often require students to travel to other cities, imposing both financial and psychological burdens. To mitigate performance penalties associated with test location, it may be beneficial to designate more low-performing schools as test centers. In addition, technological advancements — such as the increasing feasibility of at-home or online testing — offer promising avenues for reducing these barriers. Future research could explore whether such progress may reduce cognitive disruption in high-stakes settings and examine its potential for reducing educational inequality.

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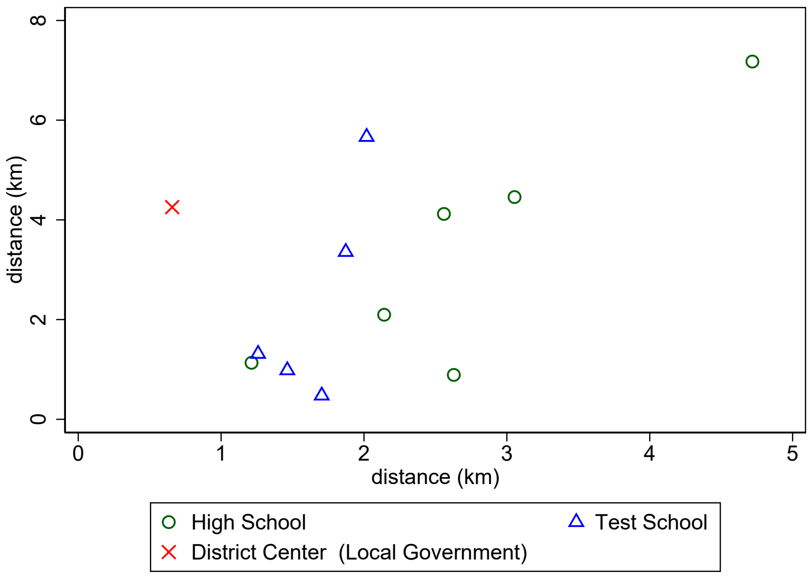
6 Appendix

Figure A1: Locations of High Schools in the Sample County



Notes: This figure shows the spatial distribution of high schools and designated test centers within the sample county. Green circles represent all high schools, while blue triangles indicate the five that also serve as test centers. The red cross marks the location of the local government. Both axes measure distance in kilometers, illustrating the relative positions of these locations.

[Back to Page 8]

Table A1: Socioeconomic Characteristics of the Sampled County

	GDP (10,000 CNY)	Fiscal income (10,000 CNY)	Fiscal expenditure (10,000 CNY)	High schoolers (share of pop.)	Schooler-Teacher ratio in high schools
Year: 2016					
Sampled county	2,753,981	81,094	481,908	4.3%	14.5
Average same-province county	2,760,522	110,193	351,205	4.4%	15.4
Average Chinese county	2,235,025	167,878	344,827	4.4%	13.7
Year: 2017					
Sampled county	2,820,765	85,413	509,171	4.3%	14.5
Average same-province county	2,922,147	109,135	377,517	4.5%	15.1
Average Chinese county	2,377,611	175,838	375,689	4.5%	13.4
Year: 2018					
Sampled county	2,913,472	90,765	557,982	4.5%	14.3
Average same-province county	2,922,147	109,135	377,517	4.5%	14.7
Average Chinese county	2,583,394	184,745	409,540	4.6%	13.1

Notes: This table presents the socioeconomic conditions of our sampled county. For comparison, we also provide corresponding statistics for an average county in the same province and for an average county in China. Data source: national, provincial, and county statistical yearbooks.

[Back to Page 8]

Table A2: Balance Checks

	(1) Male (binary)	(2) Student age	(3) Urban household (binary)	(4) Class monitor (binary)	(5) Science track (binary)	(6) High house price (binary)
Non-Home School	0.0146	-0.00345	-0.00582	-2.90e-05	0.00602	-0.0219
	(0.0144)	(0.0124)	(0.0140)	(0.00713)	(0.0112)	(0.0143)
Observations	8,535	8,535	8,535	8,535	8,535	8,535
R-squared	0.000	0.000	0.000	0.000	0.000	0.000
Mean of dep. var.	0.493	17.59	0.386	0.0657	0.817	0.523

Notes: This table presents balance checks for various demographic and background variables, comparing students taking exams in home schools versus non-home schools. $Non\text{-}Home\ School$ is a binary variable indicating whether student i is assigned to a test center outside their home school to take the exam. Robust standard errors are reported in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

[Back to Page 10]

Table A3: Robustness Checks

	(1) Raw Total Score	(2) Total Score	(3) Total Score	(4) Total Score
Non-Home School	-10.13***	-0.141***	-0.141***	-0.150***
	(1.390)	(0.0214)	(0.0192)	(0.0183)
Observations	8,535	8,535	8,535	11,282
R-squared	0.554	0.512	0.512	0.550
Test Room FEs	X	X	X	X
Highschool Class FEs	X	X	X	X
Cluster level	Highschool Class	School × Year × Track	Test room	Highschool Class
Sample	Main sample	Main sample	Main sample	Full sample

Notes: This table presents a series of robustness checks. $Non\text{-}Home\ School$ is a binary variable indicating whether student i is assigned to a test center outside their home school to take the exam. Column (1) uses raw total test scores as the outcome variable. Columns (2)–(4) use standardized total scores. Standard errors are clustered at the school-year-track level in Column (2), at the test room level in Column (3), and at the high school class level in Columns (1) and (4). Column (4) also expands the analysis to the full sample, including students from high schools that did not serve as test centers. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

[Back to Page 12]

Table A4: Additional Results

	Panel A: Results by Year and Gender				
	(1)	(2)	(3)	(4)	(5)
	Total Score			Total Score	
Sample	2016	2017	2018	Male	Female
Non-Home School	-0.134***	-0.125***	-0.164***	-0.152***	-0.129***
	(0.0368)	(0.0340)	(0.0260)	(0.0272)	(0.0263)
Observations	2,762	2,857	2,916	4,203	4,328
R-squared	0.507	0.508	0.520	0.613	0.508
Test Room FEs	X	X	X	X	X
Highschool Class FEs	X	X	X	X	X

	Panel B: Results by School				
	(1)	(2)	(3)	(4)	(5)
	Total Score				
Sample	School A	School B	School C	School D	School E
Non-Home School	-0.108***	-0.127***	-0.146***	-0.107***	-0.202***
	(0.0310)	(0.0429)	(0.0459)	(0.0380)	(0.0395)
Observations	2,283	1,746	1,661	1,208	1,637
R-squared	0.428	0.424	0.447	0.390	0.484
Highschool Class FEs	X	X	X	X	X
Mean of indep. var.	0.823	0.848	0.827	0.801	0.839

Notes: This table presents our additional results. $Non\text{-}Home\ School$ is a binary variable indicating whether student i is assigned to a test center outside their home school to take the exam. $Total\ Score$ represents the student's total test score, standardized by year and academic track. Standard errors are clustered at the high school class level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

[Back to Page 14]

Table A5: Summary Statistics for High Schools

	High schools as test centers	High schools not as test centers	Mean difference
Panel A: Student characteristics			
Male	0.493	0.454	0.039***
	(0.500)	(0.498)	(0.000)
Han ethnicity	0.997	0.998	-0.001
	(0.053)	(0.047)	(0.552)
Age	17.588	17.594	-0.006
	(0.436)	(0.414)	(0.010)
Urban household	0.386	0.324	0.061***
	(0.487)	(0.468)	(0.000)
High-housing-price community	0.523	0.485	0.038***
	(0.500)	(0.500)	(0.000)
Science track	0.817	0.501	0.316***
	(0.387)	(0.500)	(0.000)
Distance	6.144	6.308	-0.163**
	(3.244)	(3.225)	(0.025)
Panel B: College entrance exam scores (standardized by year $\times$ track)			
Total	0.182	-0.586	0.767***
	(0.939)	(1.047)	(0.000)
Chinese	0.137	-0.437	0.574***
	(0.972)	(1.002)	(0.000)
Math	0.165	-0.534	0.698***
	(0.945)	(1.035)	(0.000)
English	0.136	-0.447	0.583***
	(0.974)	(0.997)	(0.000)
Comprehensive (STEM)	0.181	-0.826	1.007***
	(0.955)	(0.950)	(0.000)
Comprehensive (Non-STEM)	0.082	-0.222	0.304***
	(0.956)	(1.021)	(0.000)
Panel C: College admission			
Any college	0.674	0.248	0.426***
	(0.469)	(0.432)	(0.000)
Elite college	0.016	0.002	0.014***
	(0.124)	(0.043)	(0.000)

Notes: This table presents summary statistics for students attending high schools that do and do not serve as college entrance exam testing centers. Each cell reports the mean, with the standard deviation in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

[Back to Page 20]