Gender Bias in Standardized Tests: Evidence from a Centralized College Admissions System *

Perihan Ozge Saygin†

January 16, 2018

Abstract

Debate regarding student assessment methods, which also concerns the gender gap, has critiqued the use of standardized tests to select and/or assign students to colleges, given that high school grades are found to be better predictors of college performance. This paper aims to analyze the gender gap in educational outcomes from different student assessment methods using Turkish administrative data and a college application setting in which the centralized admission system allocates students based on a composite score, which is a weighted average of high school grade point average and a standardized test score. I find that females significantly outperform males in high school grade point average in every subject, and not only on average but also at all quintiles. Yet the situation is reversed when it comes to standardized test scores: Males outperform females in all subjects and almost all quintiles, with the largest magnitude of the difference in quantitative subjects and highest quintiles.

JEL Classification: I21, I24, I25
Keywords: gender gap, standardized test, college admissions, centralized admissions

*The author declares that she has no relevant or material financial interests that relate to the research described in this paper. Some of the results presented in this paper are from my PhD dissertation. An earlier version of this paper was a working paper titled "Do Girls Really Outperform Boys in Educational Outcomes?". I am indebted to David Card and Francesca Lotti for their advice and encouragement, and to the Student Selection and Placement Center (OSYM in Turkish) in Turkey for sharing data. I would also like to thank Scott Kostyshak, Andrea Weber, Richard Romano, and anonymous referees for their insightful comments. Any errors are my own.

†University of Florida, Department of Economics, e-mail: psaygin@ufl.edu

1 Introduction

Standardized tests are commonly used in college applications around the world, millions of senior high school students annually take a standardized test, as these are the most widely used college entrance exams. Ideally, the results of the standardized tests are indicative of a student's college performance. Yet the debate is twofold: Advocates of standardized testing argue that the tests offer fair placement by treating everyone equally; their critics argue that such tests are a poor measure of ability, and that high school grades are found to be better predictors of college performance (Easton et al. 2017).

In countries with centralized college application systems[1], standardized tests remain the sole determinant of student admissions. In some cases, a student's high school grade point average is also considered, and may be combined with a standardized test score to produce a composite score used for admission decisions; in some decentralized systems, other required application materials are also considered.

Some studies concerning the gender bias have criticized the use of standardized tests to select and/or assign students to schools or colleges (Connor and Vargyas (1992); Medina and Neill (1990); Rosser (1989)). Since the 1970s, for instance, in the United States the gender gap in SAT takers has averaged 45 points each year. This gender gap persists despite the reverse in the gender gap in college attendance, and females generally achieving better freshman year grades than males with the same SAT scores[2]. As for the gender gap, the debate on standardized tests has several additional dimensions that may be relevant. First, most of these standardized tests are associated with a large number of applicants, which generates higher levels of competition on college entrance exams. In the case of standardized tests associated with centralized admissions, test scores are the main determinant of admission, which imposes extra pressure to succeed. Second, they are usually one-shot tests given annually, and being fast is a comparative advantage. Given the high-stakes nature of the tests, this creates additional pressure that might affect the outcome differently if people differ in their performance under pressure. Finally, the outcomes of standardized tests with multiple-choice questions are presumed to be affected by willingness to take risks and self-confidence (Ben-Shakhar and Sinai (1991); Badilga

[1] In some countries, the admission process is centrally coordinated (i.e., examinations are overseen by a central authority, which also determines student placements) or the university system as a whole is centrally planned, including determination of the number of seats available in each university.

[2] See The College Board (2012).

(2013)).

The literature on gender differences in social preferences and attitudes toward competition provides consistent evidence that females underperform in competitive environments (Gneezy et al. (2003); Paserman (2010); Niederle and Vesterlund (2007)). These findings motivated other studies to explain gender differences in labor markets and educational outcomes (Croson and Gneezy (2009); Niederle and Vesterlund (2011); Buser et al. (2014)). For instance, Shurchkov (2012), Ors et al. (2013), and Azmat et al. (2014) show that the competitive nature of evaluations explains a significant part of the gender gap in academic examinations. Niederle and Vesterlund (2010) show that the persistent gender gap in mathematics performance at high percentiles may in part be explained by the differential manner in which men and women respond to competitive test-taking environments. In the latest Programme for International Student Assessment (PISA), Organisation for Economic Co-operation and Development (OECD) also reports this notable gender difference: In every country tested, girls had much higher levels of schoolwork- and test-related anxiety than boys. On average across OECD countries, girls were 17 percentage points more likely to feel "very anxious" before a test, even if they were well prepared (OECD, 2017).

Given that there is convincing evidence on significant gender differences in all of these factors that are relevant to gender bias in a one-shot standardized test, it is possible that the gender gap might be different in educational outcomes measured by standardized tests than the gender gap in educational achievement (i.e., grades obtained) during high school or later in college. If found, a varying gender gap in high school grades compared to standardized tests is concerning, particularly in countries with centralized college admission systems in which standardized tests alone determine admissions.

The aim of this paper is to provide an overview of the difference between gender gaps in educational attainment assessed with different methods and highlight the importance of this bias in a college application setting, which affects students' lifetime earnings. Using administrative data from the centralized university entrance examination in Turkey, I investigate whether the gender gap in high school GPA differs from the gender gap in standardized test scores. Focusing on Turkey's particular institutional setting in Turkey allows me to compare the gender gap for the same student sample evaluated under different assessment methods, where the combination of these outcomes determines students' college admissions in a centralized system. Due to data limitations, this paper does not focus on alternative channels through which standardized tests might create a gender bias, yet it provides evidence for differences in the gender gap under different student assessment methods, which has important policy implications for designing a university entrance system.

In addition to demonstrating the advantages of using administrative data on high school GPA and standardized test scores for the same sample of students[3], the Turkish case is an interesting context studying the potential gender bias in standardized tests for two reasons. First, the institutional setting in Turkey is a relevant example, and helps to identify potential bias that could be due to the assessment method. In Turkey, similar to several other countries in the world[4], access to a university education[5] is only possible through a nationwide university entrance exam. Universities have no say in admissions, and students are allocated by a centralized algorithm based on their scores and choices. The algorithm assigns applicants according to their final admission score, which is calculated for each applicant as a weighted sum of the standardized test score and high school GPA, where the latter has a small weight. The high school GPA is calculated based on the weighted averages of the grades of every exam during the 4 years of high school education. While most of these are essay or short-answer exams, the standardized test is a 3-hour multiple-choice test conducted on a national level only once a year. Moreover, the number of applicants far exceeds the capacity of Turkish universities; therefore, college applicants compete fiercely for high-return majors in top universities, with an increasing number of retakers every year. Since the standardized test is combined with a centralized placement system in Turkey, the test outcome becomes even more crucial in college admissions. Comparing the gender gap in high school GPA to the one in standardized test scores in the Turkish college admissions system provides

[3]The advantage of studying the Turkish case is that high school GPA and standardized multiple-choice test scores are used together to evaluate students for college admissions. Since I observe the same students' high school GPAs and test scores and compare the gender gap in the two different measures of achievement that are relevant for college admissions, I can argue that the positive selection of females in the sample of university applicants would be the same for both gender gap estimations.

[4]United States (SAT and ACT), Sweden (Swedish Scholastic Aptitude Test, abbreviation SweSAT, *Hogskoleprovet* in Swedish), France (*Baccalaurèat* (or *le bac*)), Colombia (SABER 11 Exam), Chile (*Prueba de Selecciòn Universitaria* or PSU), Brazil (*Vestibular* or ENEM), and National College Entrance Examination (*gaokao*) in China. For a summary of worldwide university admission systems and policy issues, see the World Bank report by Helms (2008)

[5]Both public and private universities accept students through the centralized system; access to private universities is less competitive.

a natural setting to investigate potential bias generated by a standardized test applied in a centralized system, with fierce competition for an outcome as potentially critical as college admissions.

Second, Turkey is a case that is worth studying because recent reports have yielded interesting results for the gender gap in educational outcomes in Turkey. While the gender gap in average educational achievements or in selection into science seems to be comparable to OECD averages, the gender gap in completion rates at all levels of education seems to be persistent in Turkey. According to PISA 2009 (OECD 2010), although Turkey does not rank very high in general, gender differences in reading performance favor girls (43 points) and exceed the OECD average, which is 39 points. The gender gap in math performance favors boys by 11 points, but is slightly lower than the OECD average, which is 12 points. Girls outperform boys in science by 17 points, while the OECD average gender gap was zero. On the other hand, similar to most developing countries, a sizable gap remains in overall schooling levels in Turkey. In 2014, the percentages of adults who had attained at least a high school degree in Turkey were 40% for men and 31% for women, while the OECD averages were 77% and 76%, respectively. As for higher education overall (including all vocational, bachelor's, master's, and PhD degrees), the percentages of adults who had attained a higher education degree were 18% for men and 15% for women, while the OECD averages were 32% and 35%, respectively.

Putting together the OECD reports and PISA findings, it seems that the gender gap is diminishing or reversing in favor of females in educational outcomes, while the gap in college enrollment and completion[6] remains significant. Although the data in hand do not allow us to link the gender gap in college enrollment to the potential gender bias due to standardized tests in a centralized college system, it helps us to shed light on the sources of the gender gap among college applicants[7].

In this paper, I document the gender gap in educational outcomes obtained based on two different evaluation methods, using a sample of the Student Selection and Placement System (OSYS in Turkish) for college admissions in Turkey in 2008. After a descriptive

[6]The gender gap in admissions to top-ranked universities is also found to be persistent Saygin (2016).

[7]This is particularly important in Turkey, because Turkey has one of the highest earnings premiums for tertiary education among OECD countries. In 2013, tertiary-educated adults earned 88% more on average than adults with upper secondary education (the OECD average proportion was 60%). The returns to schooling are found to be even more significant for females in Turkey: In 2013, tertiary-educated women aged 25-64 years earned 111% more than those with an upper secondary education while the OECD average was 63% (OECD 2015).

analysis of data and a graphical analysis of gender differences, I estimate the average gender gap, as well as at different quantiles of the test score and high school GPA distributions. First, I explore the gender gap in high school GPAs in different high school tracks and find a significant and large gender gap in favor of female students at all quantiles of high school GPAs in all high school tracks. Second, I analyze the gender gap in standardized test scores in different subjects, and find that females' superior performance reverses when it comes to standardized test scores. Conditional on high school GPA, I find a significant gender gap in favor of males, with the largest magnitude in quantitative subjects and highest quintiles.

These findings are important not only because this is a comprehensive study that compares the gender gap under different assessment methods using administrative data, but it also provides evidence on variations in the gender gap under different evaluation methods. Although it is difficult to disentangle the different channels that can create the difference in gender gap under the two student assessment methods, this paper's findings are consistent with the literature on gender differences in attitude toward competition and pressure[8]. The fact that female students outperform males in terms of high school grades but are not as successful on standardized tests raises the question of whether the competitive nature and pressure of a 3-hour exam for such a critical matter might have a negative effect on females, especially at the higher ends of test score distributions - i.e., the range that results in top-ranked university placements.

The structure of the paper is as follows. In the next section, I describe the institutional setting, which is relevant for the gender gap analysis. Section 3 describes the data and presents a detailed descriptive analysis of the sample and the gender gap in various outcomes. I present the main empirical analysis and results in Section 4, and Section 5 concludes with discussion of the interpretation of the findings and further channels to be explored.

2 College Admissions in Turkey

Admission to both public and private universities has been conducted using a centralized system since 1974. Access to any kind of higher education program is provided only through a standardized test called the Student Selection Test (OSS in Turkish) that

[8] I provide a brief discussion of interpretation of results in the concluding section.

is administered at the national level annually around June — i.e., at the end of the academic year— by a central authority (Student Selection and Placement Center; OSYM in Turkish). After taking the test and receiving their scores, applicants submit a list of higher education programs in order of preference, and OSYM assigns students to each university program (major) according to the preferences and test scores[9], and given each program's limited capacities. In other words, each applicant gets one or no assignment as an outcome of the allocation mechanism, in which universities and/or departments have no say.

Looking more closely at college applications, every year approximately 90% of senior high school students take the test, along with retakers who did not get a desirable assignment in previous years. In 2008, about 1.6 million applicants took the university entrance examination; about 20% were high school graduates who were taking the exam for the first time, and the rest were retakers. Given the limited capacities of university programs, there is significant excess demand. Only 51% of applicants[10] are assigned to a university program, which leads to a growing number of retakers every year. This creates fierce competition for a seat at a high-quality university and a major with high and secured returns on the labor market. Those who do not get an assignment must wait a year to try again. Given these numbers, college admissions is clearly a very competitive matter, which starts influencing students' lives much earlier than the actual application period; students and their families face more extreme pressure during the last year of high school.

In terms of the gender gap, it seems that female students are less likely to take the test for university entrance. In 2008, 44% of high school graduates eligible to apply for the university entrance test were female, while only 38% of applicants (including retakers) were female. Another significant gender gap seems to be present in retaking ratios: 55% of females and 66% of males are retakers, while for those who end up being assigned to a university program, 76% of females and 84% of males have taken the test at least once before.

The formal education system in Turkey consists of primary education, high school education, and university. Allocation of primary school graduates to high schools is also conducted by a centralized system with a standardized test. Depending on their

[9]See Balinski and Sonmez (1999) for further information about the allocation algorithm.

[10]Out of 1.6 million applicants, only 16% were assigned to four-year university programs, 15% were assigned to two-year programs, and 20% were assigned to distance-education programs.

test scores, all students are sorted into different type of high schools in line with their preferences[11]. After entering high school, another important decision students face in their second year is the choice of a subject track: Sciences, Social sciences, Equally-Weighted[12], foreign languages, or arts. This specialization results in different subject curricula.

The OSS test consists of two main parts, a quantitative and a qualitative section[13], and there are two sets of these sections, in which questions for Quantitative-I and Qualitative-I are less sophisticated than those for Quantitative-II and Qualitative-II. All applicants, regardless of their high school track, are expected to answer the questions in Quantitative-I and Qualitative-I, while Quantitative-II and Qualitative-II are required only for certain university major applications. For instance, the Qualitative-II section is irrelevant for a student with a science high school specialization subject who aims to obtain an engineering major, and the Quantitative-II section is the most relevant. Similarly, a student who followed a social science track in high school does not need to focus on the Quantitative-II section, but she must maximize her correct answers on Qualitative-II. These scores are calculated for different categories, in which differing weights are given across sections of the test[14].

High school GPA is also part of the evaluation for university entrance, even though it has a rather small impact. First, three types of high school GPA scores are calculated that consider grades in social science, science, and equally weighted subject tracks[15]. These are calculated by taking high school track subjects into account to give, for instance, students who chose science as their track a bonus when calculating the science GPA score. These weighted high school GPA scores are then added to OSS test scores in their corresponding subjects to calculate the final admission score for assignments[16]. Each university program puts emphasis on one of these admission score types. For instance, a student

[11]This examination is called the Secondary School Examination (OKS in Turkish) and is administered by the Ministry of Education. The aim of this examination is to restrict access to top-ranked high schools that are expected to provide a higher standard of education. Those types include Anatolian High Schools, Scientific High Schools, Foreign Language High Schools, and some private high schools. There are also general type high schools as well as vocational high schools that are open to every student, regardless of their test scores on the OKS. OKS test scores, therefore, are only important for students who aim to attend one of these top-ranked high schools.

[12]This track focus on Turkish and mathematics and give equal weight to both and relatively less weight to science

[13]There is also an additional foreign language section.

[14]A higher weight is given to the math and science sections when calculating quantitative test scores.

[15]Equally weighted high school GPA scores are calculated considering the grades in math and Turkish subjects equally and give lower importance to science.

[16]These weights lead to a situation in which students are strongly encouraged to apply to university programs that fit their high school specialization tracks.

can be assigned to an engineering major according to the Quantitative-II admission score, which is calculated as a weighted sum of the OSS test score in Quantitative-II and the quantitative-weighted high school GPA.

The empirical analysis of the gender gap in test scores and high school GPA will be performed by considering different type of test scores, high school GPA, and high school tracks.

3 Data, Descriptive Statistics, and Sample Selection

The dataset employed in this study was obtained by merging the 2008 OSS dataset and the 2008 Survey of OSS Applicants and Higher Education Programs dataset. The OSS dataset provides administrative individual information on test scores, high school GPA, submitted choice list of university programs, and assignment outcome for 1,646,376 applicants. In contrast, the Survey of OSS applicants conducted by OSYM asks applicants about the socioeconomic characteristics of their household, their high school achievements, expenditures on private tutorials, and their views on high school education. The survey is conducted online, and 62,775 applicants answered the survey questions in 2008. I have access to only a random sample of about 16%, with 9,983 observations[17].

Table 1 provides summary statistics for the sample of 9,983 applicants in the 2008 OSS dataset. It is clear that on average, females have higher high school GPAs and test scores, and a lower rate for retaking the test than males. Similar characteristics hold when only first-taker applicants are considered. On closer examination, Figure 1 shows cumulative distribution functions of high school GPA and weighted GPA scores, and there is visible female outperformance in all GPA distributions. On the other hand, looking at Figure 2, in which standardized test score distributions are shown, female outperformance is less clear —especially at the highest ends of the distributions— and disappears once I condition on high school GPA, as shown at Figure 3.

As our sample consists only of university entrance test applicants who are senior high school students and those who already graduated from high school, we do not observe those who either drop out or graduate from high school but do not apply for university. Although the gender gap in terms of university applications is not as severe as seen in

[17] I provide more information on sample selection in the appendix. Also, OSYM provided a report to show that the sample that answered the survey is representative of the whole population of university applicants in 2008; this report is available on their website: http://osym.gov.tr/belge/1-10386/2008-ogrenci-secme-ve-yerlestirmesistemi-osys-2008-osy-.html.

earlier levels of education, still 44% of high school graduates were girls, while only 38% of applicants (including retakers) were girls. As girls are less likely to obtain a high school degree and take the university entrance test, this might create a positive selection bias. Hence, the estimates of gender gap in high school GPA and test scores could be biased in favor of girls due to positive selection. Indeed, it seems that females have better financial support and their parents are relatively better educated with respect to boys. Table 2 shows parental education and family support indicators by gender, and that the mean differences in parental education levels are positive and significant. Female applicants not only have better educated parents, but they are also significantly more likely to attend private tutoring centers. Additionally, it seems that their parents are more likely to be willing to pay a private university tuition, which is considerably higher than the tuition at public universities. Looking at sample descriptive statistics, selection could be an issue for precise estimate of the gender gap. On the other hand, this paper aims to detect a significant difference in gender gap estimates in student outcomes assessed under different methods (high school GPAs vs standardized test scores) for the same exact sample. Therefore, it is possible to argue that selection bias would be the same for both gender gap estimations. There is no reason to expect that positive selection of females would bias the gender gap in high school GPA more than the gender gap in test scores, since they are both relevant for university applications and all students in my sample are university applicants.

Although selection is not expected to confound the results of interest, to reduce the selection bias I use a rich set of control variables as well as high school type, track, and city fixed effects. Controlling for high-school-related fixed effects is crucial to control for unobserved heterogeneity, as selection into high schools is also based on a national exam with a high level of competition for the best high schools. Table 3 shows high school type and track subjects by gender for both the first-taker sample and the whole sample. In the following section, the gender gap is estimated for several subsamples to ensure that selection into retaking, high school type, and tracks do not substantially affect the results.

4 Empirical Design

In this section, to determine whether there is a difference in gender gap in high school GPA compared to the gender gap in test scores in a more comprehensive empirical setting, I analyze the gender gap in high school GPA and weighted high school GPA scores and OSS test scores. I compare gender differences in different subjects and compare them on different samples, taking into account selection into high school tracks in the empirical design explained below. The variable of interest, M, is an indicator variable taking the value of 1 for male applicants and 0 otherwise. Let the educational outcome Y (high school GPAs and OSS test scores) of applicant i, graduating or graduated from high school school type h, with track t be denoted by Y_{iht}, then the model is given by:

$$Y_{iht} = \delta M_i + x_i'\beta + \mu_h + \mu_t + \epsilon_{iht} \tag{1}$$

where $i = 1, ...N$, $h = 1, ...H$, $t = 1, ..., T$, and ϵ_{iht} is a random error term.

The goal is to identify whether the estimate of δ is different when the outcome is high school GPA as opposed to the outcome of test scores. I separately estimate this model for both high school GPA and test scores in different track subjects[18] in order to elaborate on the differences in gender gap in different subjects.

Further, I test whether the estimates of δ change when the model is estimated on different subsamples of applicants, such as only first-time takers, only first- and second-time takers[19], and subsamples of different high school types and tracks. The dataset described in the previous section allows the use of a rich set of control variables[20], high school type, and high school city fixed effects, as well as high school track-subject fixed effects with robust standard errors. As explained in Section 2, the process for transition to high schools in Turkey is based on a similar centralized standardized-test-based system, and therefore students are already sorted into different types of high schools based on their observed and unobserved characteristics. This feature helps to control for unobserved individual characteristics once I control for high-school-related fixed effects.

[18]The types of scores are Equally Weighted-I, Equally Weighted-II, Qualitative-II, Qualitative-II, Quantitative-I, and Quantitative-II.

[19]This analysis is necessary not only because retaking status could be a crucial determinant of success, but it is also important because selection into retaking is not equal across gender. As mentioned earlier, when we consider the full sample of applicants including retakers, female applicants' share drops to 38%, while among new high school graduate applicants, this share is 44%.

[20]I introduce indicator variables for working status and attending private tutoring. Household controls include mother and father education categorical variables, as well as an index of availability of opportunities in the household in which the applicant lives. This index is created based on access to internet, own room in the house, buying a daily newspaper, number of books, etc.

4.1 The Gender Gap in High School GPA

Estimation results for high school GPA are reported in Table 4, in which high school type, track subject, and city fixed effects are included, as well as controls for other individual characteristics such as retaking, private tutoring, and working status, and household controls. The gender gap in high school GPA is around 5 points, where the average high school GPA of the sample is 73.63 with a standard deviation of 11.65. The following columns of Table 4 report results for, respectively, the sample of only first- and second-time takers, only first-time takers, and finally only applicants with one of the three main high school subjects, which excludes technical and vocational high school types.

High school GPA is used as an input to calculate the weighted high school GPA scores to be combined with standardized test scores to calculate the assignment score for university entrance. These weighted high school GPA scores are calculated in three different categories: Quantitative High School GPA Score, Qualitative High School GPA Score, and Equally Weighted High School GPA Score. I estimated the gender gap in these high school GPA scores separately, and results are reported in Tables 5–7, which provide evidence for a statistically significant gender gap in favor of females in all tracks.

Results for Equally Weighted High School GPA Scores are reported in Table 5. The first column represents the whole sample and reports a gender gap of 3.02 points in favor of females. The gender gap remains almost the same when we exclude retakers who had taken the OSS test more than once before. On the other hand, the gender gap among first-time takers reported in column 3 seems to be relatively smaller than the gender gap in the whole sample. Column 4 represents applicants with one of the three main high school subjects, while column 5 also excludes science background students[21]. Similar results are obtained for Qualitative and Quantitative High School GPA scores, and results are reported in Tables 6 and 7, respectively. It seems that the magnitudes of the gender gap in favor of females is similar for Equally Weighted and Quantitative High School GPAs while female outperformance is slightly smaller for Qualitative High School GPA.

After confirming that females outperform, on average, on high school GPA in all high school tracks, I estimated the gender gap in high school GPA using a quantile estimation method. Results are reported for overall high school GPA and subject weighted GPA scores in Table 8. While the overall high school GPA is estimated on the full sample, the

[21] Column 5 includes applicants with equally-weighted and social science tracks.

gender gap in subject-weighted high school GPA scores is estimated on the subsample of students in corresponding high school tracks. The first columns in Table 8 show OLS results with robust standard errors and the following columns show quantile regression results for the 10th, 25th, 50th, 75th, and 90th percentiles, respectively. I find a significant gender gap in favor of females at all percentiles, with slight changes in magnitude, but are mostly comparable to their OLS estimates. Female outperformance is highest at the 75th percentile in Equally Weighted and Qualitative High School GPA Scores, while it is highest at the 25th percentile for Quantitative Weighted GPA Score and gets smaller, but remains significant, at the 90th percentile. I do not find a significant difference in the gender gap when I run the estimation on only the subsample of first-time takers or first- and second-time takers. In all types of GPA estimations, there is a slight increase in magnitude of the gender gap in favor of females when I consider the subsample of first-time takers compared to the sample of all 9,983 applicants[22].

4.2 The Gender Gap in Standardized Test Scores

OSS test scores in the different subjects are calculated based on the number of correct and incorrect answers in relevant sections of the test for each category[23]. The three main test scores —Quantitative-I, Qualitative-I, and Equally Weighted-I— are calculated based on the four main sections of the test: Turkish-I, Social Science-I, Math-I, and Science-I. These sections are relevant for all applicants regardless of their high school track subject, and the three test scores are calculated for all applicants, no matter which major they are interested in.

There are also subject-specific test scores: Quantitative-II, Qualitative-II, and Equally Weighted-II. These scores are calculated based on performance on the second part of the test, which is designed to be more sophisticated. For instance, for the Quantitative-II test scores, the number of correct answers in the Math-II and Science-II sections would be particularly important while for those who want to maximize the Qualitative-II test score, the Social Science-II and Turkish-II sections are the most important.

First, I estimate the gender gap for the three main test scores, which are calculated for all applicants, so that gender gap estimates will not be exposed to any bias due to sorting into high school track subjects. Estimation results are reported in Table 9, where

[22] Results are available upon request.

[23] Every four incorrect answers cancels out one correct answer.

high school type, track subject, and city fixed effects are included, controlling for other individual characteristics such as retaking, private tutoring, and working status as well as parents' education status. The first three columns report results for the whole sample, where the dependent variables are Equally Weighted-I, Quantitative-I, and Qualitative-I test scores, respectively. A significant gender gap in favor of females is found for Equally Weighted-I and Qualitative-I test scores by 1.66 and 3.19 points, respectively, while males outperform, on average, on Quantitative-I test scores by 2.39 points. Once I estimate the gender gap by excluding retakers who had taken the test more than once before, the gender gap in favor of females for Qualitative-I and Equally Weighted-I becomes larger in magnitude, and male outperformance on Quantitative-I loses significance.

On the other hand, the gender gap in test scores reverses once it is estimated conditional on high school GPA. Table 10 shows the same specifications as Table 9, in which the only difference is the addition of high school GPA as a control in the estimations. There is a significant gender gap in all test scores in favor of males, with particularly high magnitude in quantitative scores, and results do not seem to change significantly on the subsample of first-time takers.

Second, I estimate the gender gap in subject-specific test scores and report the results in Table 11. The first three columns report results for the sample of applicants with their corresponding high school tracks, while the last three columns consider only first- and second-time takers of these samples. Similar to the main subject test scores, I find a significant gender gap in favor of females for Qualitative-II and Equally Weighted-II test scores, while there is no significant difference in Quantitative-II test scores. The gender gap in favor of females is 6.52 and 5.97 points in Equally-Weighted-II and Qualitative-II test scores, respectively, where male outperformance is not significantly different from zero, as indicated by the positive and insignificant coefficient. Again, once I exclude the retakers who took the OSS test more than once before, the significant gender gap estimates in favor of females become slightly larger in magnitude, but this difference seems to be negligible.

The gender gap in subject-specific test scores is also found to be reversing once I condition on high school GPA. Table 12 shows the same specifications as Table 11, with the addition of high school GPA in the control variables. Once high school GPA is controlled for, the gender gap in subject-specific test scores favors males and is significant in all subjects, with a particularly high gap in magnitude in the Quantitative-II score. Once retakers are excluded, male outperformance loses significance for the Qualitative-II and Equally Weighted-II scores, but the gap in the Quantitative-II score remains significant and the magnitude remains unaffected.

It seems that there is clearly significant male outperformance in both main and subject-specific test scores in all subjects, and the magnitude of the gap is especially large when it comes to quantitative scores.

I also used a quantile estimation method for the main test scores on the full sample and for the subject-specific test scores on the subsamples of applicants with relevant high school tracks. Results are reported in Tables 13 and 14, respectively. As for the gender gap in main test scores, I find a significant gap in favor of males for all quantiles, with an increasing gap at higher quantiles of the test score distributions. The highest gap is found to be 9.48 points in the highest quintile of the quantitative test scores, while the lowest significant gap is 2.04 points in the lowest quartile of the qualitative score distribution[24]. Table 14 shows that the gap in subject-specific test scores exhibits similar patterns, with an even larger magnitude in quantitative scores. It is also important to underline that these subject-specific assignment scores are the relevant scores for top majors, such as medical school, law school, engineering, economics, sciences, etc. For instance, the Quantitative-II test score is obtained from the more sophisticated sections of the test, compared to the Quantitative-I test score —and is the relevant score for medical school admission— while the Quantitative-I test score is required for 2-year vocational programs or 4-year majors associated with lower paying jobs. This implies that the gap in standardized test scores is not only larger at higher quintiles, but also higher in scores that are relevant for highly ranked majors.

5 Interpretation of Results and Conclusion

In this paper, I compare the gender differences in educational outcomes based on different student assessment methods. High school GPAs and standardized test scores are used jointly to evaluate students in a centralized college admissions system in Turkey. Using administrative data, I show that female students outperform male students in terms of high school GPA, both on average and at all quantiles of the distributions. I also estimate

[24]The gap is not significant in the lowest quintile of the Qualitative-I and Equally Weighted-I scores distributions.

the gender gap in standardized test scores in different subjects, both on average and at different quantiles of the test score distribution. Conditional on high school GPA, I find that the gender gap in favor of females reverses in test scores and becomes especially large in the higher quantiles of the quantitative score distribution, while I find mostly absolute female outperformance on high school GPA across the distribution. Comparing these findings, I argue that the gender gap is affected by the student assessment method used in a centralized system of college admissions.

With careful analysis of the gender gap using administrative data, these results provide evidence for potential gender bias in the use of standardized tests as an assessment method. This evidence is crucial, given previous findings suggesting that high school GPAs are better predictors of college performance than standardized test scores (Easton et al. 2017). The findings of this paper are also consistent with the literature on gender differences in social preferences and attitudes toward competition. Female students outperform males strongly in terms of high school GPA, which is an average of all grades obtained during high school education from mostly essay-type exams, while they fall behind when it comes to a 3-hour standardized test taken under the pressure of losing an entire year if they do not score high enough. This evidence is consistent with findings from previous literature suggesting that females might underperform when the assessment is conducted under pressure and characterized by high competition, especially in quantitative subjects.

Given previous findings showing that standardized tests are less predictive of college success, this difference in gender gap in high school GPA and test scores could create inefficiencies. Moreover, since centralized college admissions in Turkey place a disproportionate weight on standardized test scores compared to high school GPA, this seems to penalize females, who have a tendency to perform worse under pressure, by creating unequal opportunities to access highly ranked majors and universities. Looking at these findings, it is possible to argue that standardized tests might be responsible for part of the gender gap due to their competitive nature combined with the pressure of the centralized system. On the other hand, it is possible to propose other channels that might be consistent with these findings, in particular female outperformance on high school GPA. One possibility is that high school GPA is less objective than standardized tests and there might be a gender bias in favor of female students, especially in male-dominated subjects (Breda and Ly, 2015). Duckworth and Seligman (2005) show that self-discipline predicts academic performance in school. If female students are more self-disciplined, and self-discipline is rewarded by teachers on GPA more than the positive effect of self-discipline on test performance, GPA could possibly advantage females. Another potential explanation for the lower GPA of males could be an economic model in which individuals derive utility from both academic performance and popularity among peers, the latter being more negatively correlated with academic performance for males (the social stigma of being a "nerd", or "masculinity" being negatively associated with GPA) (DiPrete and Buchmann, 2013)[25]. Yet it is difficult to argue that these alternative channels could drive these results, considering the significantly large magnitude of female outperformance on high school GPA that reverses to become a gender gap in favor of males in even larger magnitude.

While distinguishing between the different hypotheses is important, it is not possible to test these alternative hypotheses in this study. Rather, this paper is a step toward understanding the potential gender bias driven by standardized tests in a centralized system. Given that decentralized admissions in college applications have been increasingly replaced by centralized admissions in many countries, empirical evidence on topics that are usually understudied, such as gender bias, becomes particularly vital[26]. Standardized test scores in decentralized systems[27] are not the only determinant of college admissions, and therefore the lesser importance of standardized test scores might be associated with a lower or reversing gender gap in college enrollment. Studying the case of Turkey as an extreme example also opens channels for further investigation of whether the gender bias would have less impact on college enrollment in decentralized systems.

[25]In Turkey, students know that high school GPA, even if with a low weight, will impact college admissions, and therefore it is possible to argue that the impact of popularity's being negatively correlated with performance could be relatively lower.

[26]Machado and Szerman (2016) study transition in the Brazilian higher education market and investigate the impacts on student sorting, migration, and enrollment. Hafalir et al. (2017) provide a theoretical comparison of centralized college admissions to decentralized ones in terms of the efficiency of allocation of abilities.

[27]In the United States, students not only take centralized exams like the Scholastic Aptitude Test (SAT), but also complete college-specific requirements such as essays.

References

Azmat, C. Calsamiglia and N. Iriberri 2014. Gender differences in response to big stakes. CEP Discussion Papers, CEPDP1314. Centre for Economic Performance, London School of Economics and Political Science, London, UK.

Baldiga, K. 2013. Gender Differences in Willingness to Guess, Management Science 60(2), 434 - 448.

Balinski M. and T. Sonmez, 1999. A Tale of Two Mechanisms: Student Placement, Journal of Economic Theory 84(1), 73-94.

Ben-Shakhar, G. and Y. Sinai, 1991. Gender Differences in Multiple-Choice Tests: The Role of Differential Guessing Tendencies, Journal of Educational Measurement 28(1), 23-35.

Breda, T. and Ly, S. T., 2015. Professors in Core Science Fields Are Not Always Biased against Women: Evidence from France, American Economic Journal: Applied Economics 7(4): 53-75.

Buser, T., M. Niederle, and H. Oosterbeek, 2014. Gender, Competitiveness and Career Choices, The Quarterly Journal of Economics, 1409-1447.

Connor K. and E. Vargyas, 1992. The Legal Implications of Gender Bias in Standardized Testing, Berkeley Women's Law Journal.

Croson, R, and Gneezy, U., 2009. Gender Differences in Preferences, Journal of Economic Literature 47(2): 448-474.

DiPrete T. A. and Buchmann C., 2013. Rise of Women, The: The Growing Gender Gap in Education and What it Means for American Schools, Russell Sage Foundation.

Duckworth A. L., Seligman M. E. P., 2005. Self-discipline outdoes IQ in predicting academic performance of adolescents. Psychological Science, 16: 939-944.

Easton, J.Q., Johnson, E., and Sartain, L. 2017. The predictive power of ninth-grade GPA. Chicago, IL: University of Chicago Consortium on School Research.

Gneezy, U., M. Niederle, and A. Rustichini, 2003. Performance in Competitive Environments: Gender Differences, Quarterly Journal of Economics 118(3), 1049-1074.

Hafalir, Isa E., R. Hakimov, D. Kbler, and M. Kurino, 2017. College Admissions with Entrance Exams: Centralized versus Decentralized, Unpublished manuscript.

Helms R. M., 2008. University Admissions Worldwide, World Bank, Education Working Paper Series Number 15

Machado C. and C. Szerman, 2016. Centralized Admission and the Student-College Match, Unpublished manuscript.

N. Medina, and D. Neill., 1990. Fallout From the Testing Explosion, National Center for Fair and Open Testing.

Niederle, M., and L.Vesterlund, 2007. Do Women Shy away from Competition? Do Men Compete too Much?, Quarterly Journal of Economics 122(3), 1067-1101.

Niederle, M., and L.Vesterlund, 2010. Explaining the Gender Gap in Math Test Scores: The Role of Competition, Journal of Economic Perspectives, 24(2), 129-144.

Niederle, M., and L.Vesterlund, 2011. Gender and Competition, Annual Review in Economics, 3, 601-630.

OECD, 2010. PISA 2009 at a Glance, OECD Publishing, Paris.

OECD, 2015. Education at a Glance 2015: OECD Indicators, OECD Publishing, Paris.

OECD, 2017. Schoolwork-related anxiety, in PISA 2015 Results (Volume III): Students' Well-Being, OECD Publishing, Paris.

Ors, E., F. Palomino, E.A. Peyrache, 2013. Performance Gender-Gap: Does Competition Matter?, Journal of Labor Economics 31(3), 443-499.

Paserman, M. D., 2010. Gender Differences in Performance in Competitive Environments: Evidence from Professional Tennis Players, Mimeo, Boston University and Hebrew University.

Rosser, P., 1989. The SAT the gender gap: Identifying the Causes, Center for Women Policy Studies.

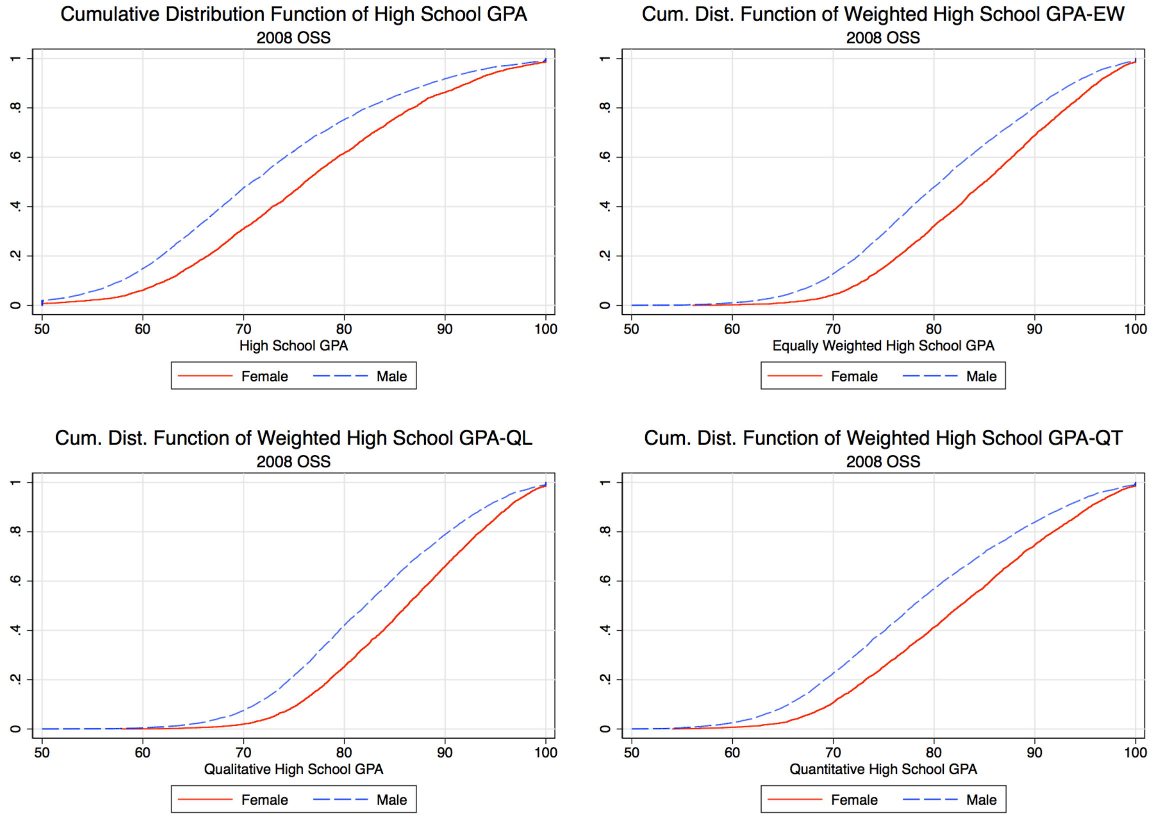
The College Board, 2012. SAT Report on College & Career Readiness.

Saygin, P.O. 2016. Gender Differences in Preferences for Taking Risk in College Applications, Economics of Education Review, 52, 120-133.

Shurchkov, O., 2012. Under Pressure: Gender Differences in Output Quality and Quantity Under Competition and Time Constraints, Journal of the European Economic Association 10(5): 1189-1213.

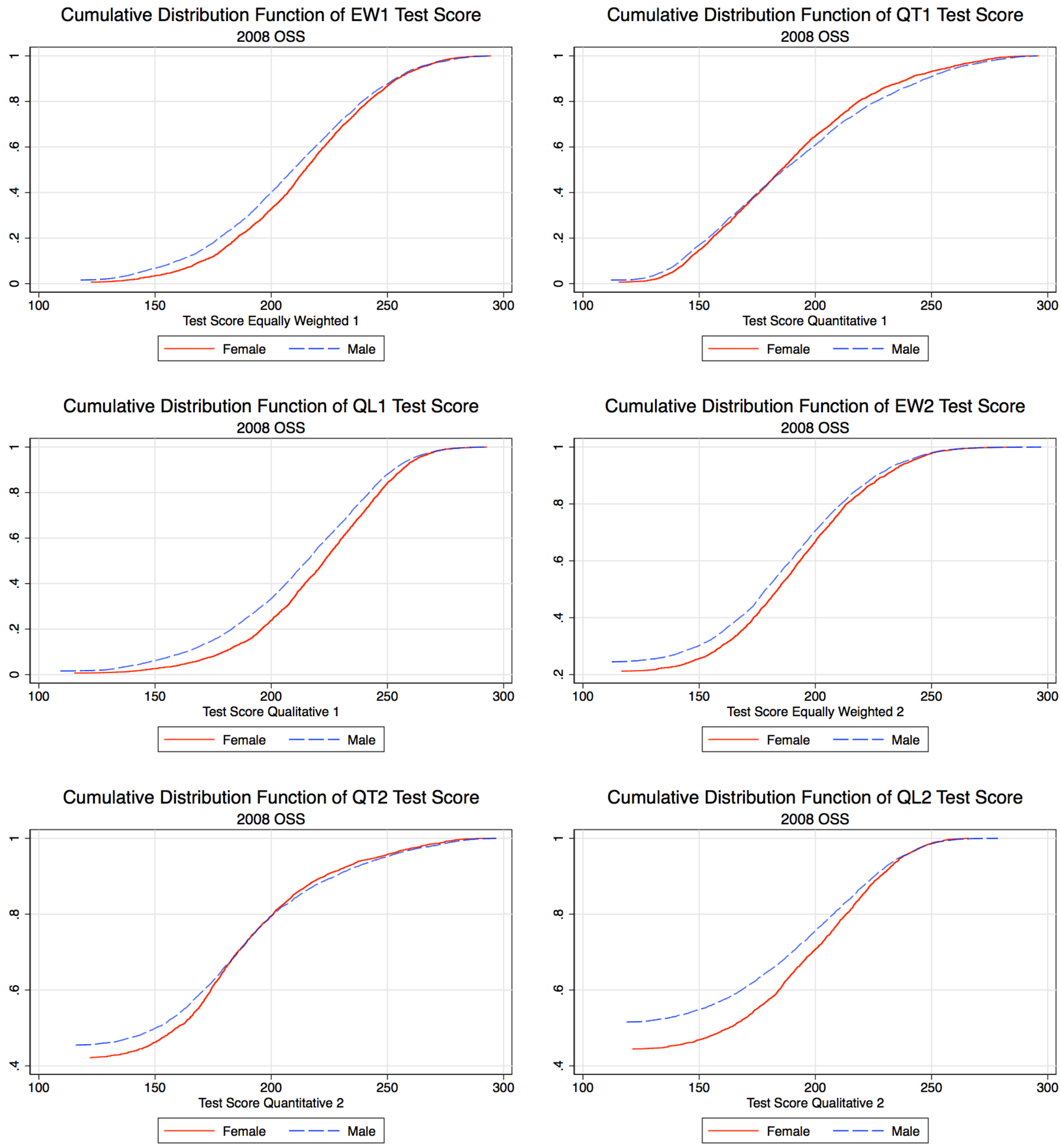
A Figures and Tables

Figure 1: Cumulative Distribution Functions: High School GPA



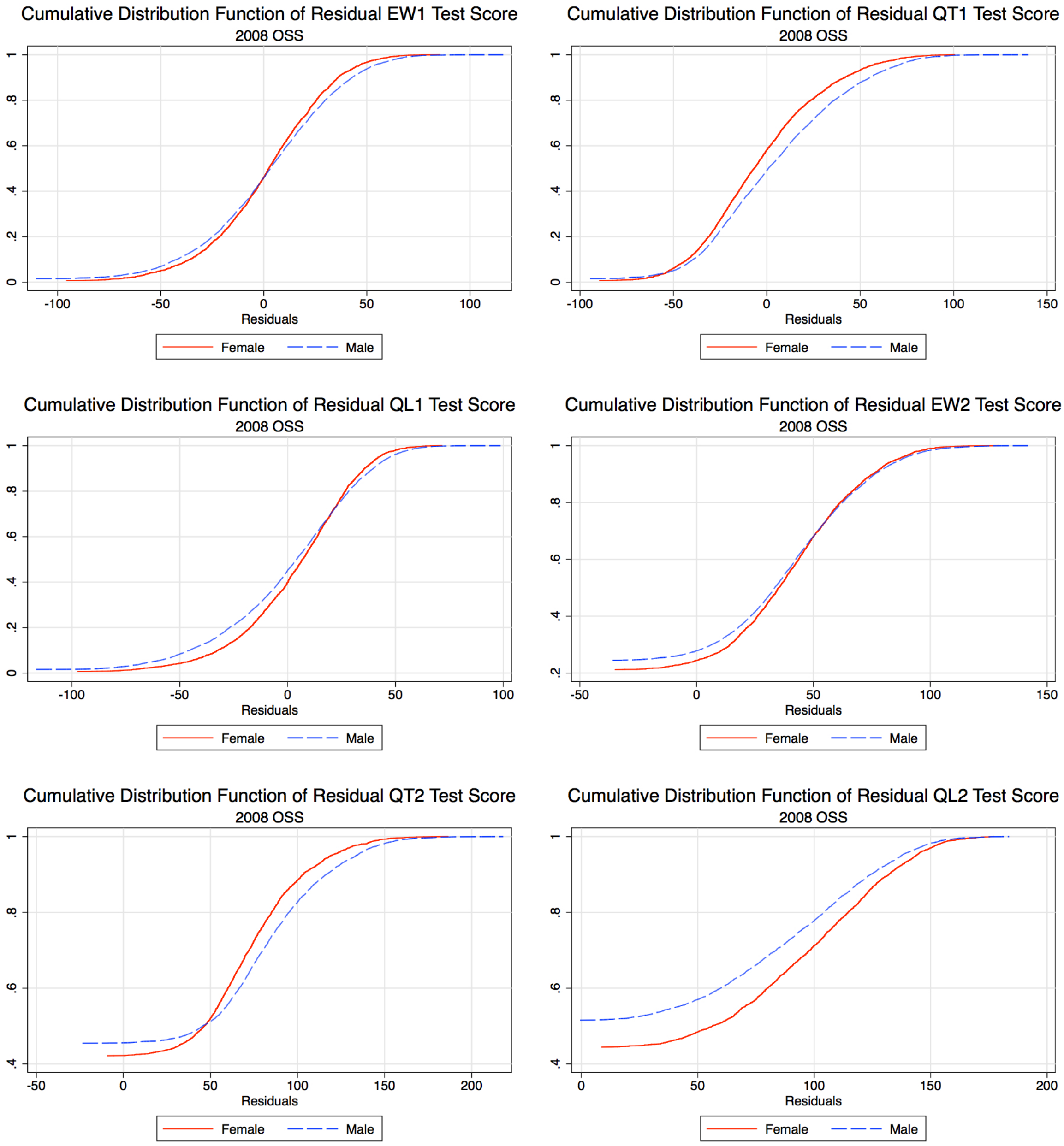
Note: The top left graph shows the cumulative distribution functions of high school GPA of female and male applicants. The top right graph shows the cumulative distribution functions of the Equally Weighted Type (EW) of weighted high school GPA scores of female and male applicants. The bottom left graph shows the cumulative distribution functions of the Qualitative Type (QL) of weighted high school GPA scores of female and male applicants. The bottom right graph shows the cumulative distribution functions of the Quantitative Type (QT) of weighted high school GPA scores of female and male applicants.

Figure 2: Cumulative Distribution Functions: Test Scores



Note: All graphs show the cumulative distribution functions of standardized test scores for female and male applicants in different subjects. EW, QT, and QL indicate Equally Weighted, Quantitative, and Qualitative, respectively. EW1, QT1, and QL1 are the types of test scores calculated based on achievement on less sophisticated sections of the test, while EW2, QT2, and QL2 indicate the types of test scores for more advanced sections.

Figure 3: Cumulative Distribution Functions: Test Scores Conditional on GPA



Note: All graphs show the cumulative distribution functions of standardized test scores for female and male applicants in different subjects conditional on high school GPA. EW, QT, and QL indicate Equally Weighted, Quantitative, and Qualitative, respectively. EW1, QT1, and QL1 are the types of test scores calculated based on achievement on less sophisticated sections of the test, while EW2, QT2, and QL2 indicate the types of test scores for more advanced sections.

Table 1: Achievements by Gender on 2008 University Entrance Tests

	Female	Male	All sample	FT Female	FT Male	All FT
High School GPA	76.53	72.03	73.63	78.85	72.44	75.19
	(11.21)	(11.58)	(11.65)	(12.66)	(13.61)	(13.58)
QT Weighted GPA Score	82.44	78.53	79.92	87.12	82.58	84.53
	(9.63)	(10.26)	(10.22)	(10.06)	(11.84)	(11.34)
QL Weighted GPA Score	85.89	82.23	83.53	90.00	85.90	87.65
	(7.89)	(8.68)	(8.59)	(7.96)	(9.90)	(9.34)
EW Weighted GPA Score	84.69	80.89	82.24	89.24	84.96	86.80
	(8.69)	(9.44)	(9.36)	(8.82)	(10.83)	(10.24)
Test Score EW 1	212.55	206.03	208.34	226.25	215.98	220.38
	(35.90)	(42.80)	(40.60)	(37.92)	(50.79)	(45.99)
Test Score EW 2	153.68	145.22	148.22	160.89	150.27	154.82
	(83.63)	(86.58)	(85.64)	(92.75)	(95.40)	(94.40)
Test Score QT-1	188.20	188.75	188.55	204.08	201.86	202.82
	(38.71)	(45.26)	(43.04)	(41.82)	(53.99)	(49.15)
Test Score QL-1	219.11	209.58	212.96	230.16	217.15	222.72
	(34.24)	(42.05)	(39.72)	(35.38)	(48.30)	(43.70)
Test Score QT-2	111.46	106.15	108.04	133.93	127.82	130.44
	(98.32)	(100.30)	(99.63)	(104.54)	(109.53)	(107.43)
Test Score QL-2	111.57	96.25	101.69	93.62	71.46	80.96
	(101.90)	(101.46)	(101.87)	(107.29)	(99.37)	(103.39)
Birth year	1988.23	1987.68	1987.88	1989.77	1989.65	1989.70
	(2.55)	(2.99)	(2.85)	(1.14)	(1.36)	(1.27)
OSS exam retake	0.78	0.84	0.82			
	(0.41)	(0.37)	(0.38)			
Previously Assigned Retaker	0.24	0.32	0.29			
	(0.43)	(0.47)	(0.46)			
Assigned to College	0.63	0.62	0.62	0.67	0.61	0.64
	(0.48)	(0.49)	(0.49)	(0.47)	(0.49)	(0.48)

Source: OSYM08 Administrative Dataset, own calculations.
Note: EW, QT, and QL indicate Equally Weighted, Quantitative, and Qualitative, respectively. Columns 4 to 6 show descriptive statistics for first-time taker (FT) subsamples.

Table 2: Family Characteristics of OSS 2008 Applicants by Gender

	Female	Male	All sample
If working	0.19	0.34	0.29
	(0.40)	(0.47)	(0.45)
House Index	7.29	6.92	7.05
	(1.21)	(1.45)	(1.38)
Adult Support Index	2.62	2.57	2.59
	(0.85)	(0.81)	(0.82)
Mother Education Not Reported	0.00	0.01	0.01
	(0.06)	(0.09)	(0.08)
Mother No School	0.11	0.23	0.19
	(0.32)	(0.42)	(0.39)
Mother Primary School	0.47	0.43	0.44
	(0.50)	(0.49)	(0.50)
Mother Middle School	0.12	0.11	0.11
	(0.32)	(0.31)	(0.32)
Mother High School	0.20	0.15	0.17
	(0.40)	(0.36)	(0.37)
Mother College or Beyond	0.10	0.07	0.08
	(0.29)	(0.25)	(0.27)
Father Education Not Reported	0.02	0.03	0.02
	(0.14)	(0.16)	(0.16)
Father No School	0.03	0.07	0.06
	(0.18)	(0.26)	(0.23)
Father Primary School	0.29	0.32	0.31
	(0.45)	(0.46)	(0.46)
Father Middle School	0.16	0.14	0.15
	(0.37)	(0.35)	(0.36)
Father High School	0.27	0.25	0.26
	(0.45)	(0.43)	(0.44)
Father College or Beyond	0.22	0.19	0.20
	(0.42)	(0.39)	(0.40)

Table 3: High School Type and Subject by Gender

	Female	Male	All sample	FT Female	FT Male	All FT
HS Type						
Anatolian HS	0.12	0.11	0.11	0.30	0.27	0.28
	(0.32)	(0.31)	(0.31)	(0.46)	(0.45)	(0.45)
Scientific HS	0.01	0.01	0.01	0.02	0.03	0.02
	(0.10)	(0.11)	(0.10)	(0.13)	(0.17)	(0.15)
General HS	0.45	0.49	0.48	0.08	0.16	0.12
	(0.50)	(0.50)	(0.50)	(0.27)	(0.36)	(0.33)
Foreign Language HS	0.15	0.08	0.11	0.32	0.19	0.24
	(0.36)	(0.27)	(0.31)	(0.46)	(0.39)	(0.43)
Vocational HS	0.24	0.27	0.26	0.25	0.31	0.28
	(0.43)	(0.45)	(0.44)	(0.43)	(0.46)	(0.45)
HS Subject						
Science	0.29	0.34	0.32	0.36	0.41	0.39
	(0.45)	(0.47)	(0.47)	(0.48)	(0.49)	(0.49)
Social	0.12	0.14	0.13	0.10	0.11	0.10
	(0.32)	(0.35)	(0.34)	(0.30)	(0.31)	(0.31)
Math and Social Sciences	0.36	0.28	0.31	0.31	0.23	0.26
	(0.48)	(0.45)	(0.46)	(0.46)	(0.42)	(0.44)
Others	0.23	0.23	0.23	0.23	0.25	0.24
	(0.42)	(0.42)	(0.42)	(0.42)	(0.43)	(0.43)

Source: OSYM08 Administrative Dataset, own calculations.
Note: HS indicates high school. Columns 4 to 6 show descriptive statistics for first-time taker (FT) subsamples.

Table 4: High School GPA Estimations

	(1)	(2)	(3)	(4)
Male	-4.76	-5.60	-5.26	-5.75
	(.25)***	(.37)***	(.63)***	(.38)***
Second Takers	.04	1.13		.72
	(.24)	(.40)***		(.43)*
Enrollment in Private Tutoring Instituion	2.79	3.72	4.45	3.35
	(.27)***	(.46)***	(1.00)***	(.52)***
Taking One-to-One Private Tutoring	-2.24	-2.76	-3.37	-2.72
	(.29)***	(.41)***	(.72)***	(.43)***
If working	-2.02	-2.29	-1.61	-2.28
	(.26)***	(.46)***	(.92)*	(.52)***
Obs.	9983	4991	1792	3966
F statistic	6.9	5.44	4.37	8.41

Source: OSYM08 Administrative Dataset, own calculations.
Note: The dependent variable is high school GPA in all columns. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as a rich covariate set. I introduce indicator variables for working status and attending private tutoring. Household controls include mother and father education categorical variables as well as an index of the availability of opportunities in the applicant's household. This index is created based on access to the internet, one's own room in the house, buying a daily newspaper, number of books, etc. The first column reports results from the full sample of 9,983 applicants. The second column excludes retakers who had taken the exam more than once before. The third column includes only first-time taker applicants. The last column considers applicants only from the three main high school track subjects, excluding also retakers who had taken the exam more than once before.

Table 5: Equally Weighted High School GPA Estimations

	(1)	(2)	(3)	(4)	(5)
Male	-3.02	-3.15	-2.40	-3.16	-3.66
	(.17)***	(.23)***	(.36)***	(.23)***	(.26)***
Second Takers	.99	1.54		1.30	1.17
	(.17)***	(.26)***		(.26)***	(.26)***
Enrollment in Private Tutoring Instituion	2.30	2.97	2.92	2.70	1.80
	(.19)***	(.29)***	(.56)***	(.31)***	(.30)***
Taking One-to-One Private Tutoring	-1.30	-1.51	-1.47	-1.36	-1.18
	(.20)***	(.26)***	(.41)***	(.26)***	(.30)***
If working	-1.59	-1.66	-1.31	-1.56	-1.64
	(.18)***	(.29)***	(.52)**	(.31)***	(.30)***
Obs.	9983	4991	1792	3966	3118
F statistic	21.78	18.37	14.53	34.83	70.33

Source: OSYM08 Administrative Dataset, own calculations.
Note: The dependent variable is Equally Weighted type of high school GPA score in all columns. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. The first column reports the results from the full sample of 9,983 applicants. The second column excludes retakers who had taken the exam more than once before. The third column takes only first-time taker applicants. The fourth column takes applicants only from the three main high school track subjects excluding also retakers who had taken the exam more than once before. The last column has all applicants in Equally-Weighted subject track.

Table 6: Quantitative High School GPA Estimations

	(1)	(2)	(3)	(4)	(5)
Male	-3.43	-3.65	-2.82	-3.68	-2.56
	(.19)***	(.27)***	(.42)***	(.27)***	(.31)***
Second Takers	.66	1.41		1.13	.61
	(.19)***	(.29)***		(.30)***	(.30)**
Enrollment in Private Tutoring Instituion	2.48	3.25	3.26	2.95	3.58
	(.21)***	(.33)***	(.66)***	(.36)***	(.44)***
Taking One-to-One Private Tutoring	-1.51	-1.76	-1.75	-1.60	-1.53
	(.22)***	(.30)***	(.47)***	(.30)***	(.35)***
If working	-1.74	-1.85	-1.46	-1.74	-2.08
	(.20)***	(.34)***	(.61)**	(.36)***	(.37)***
Obs.	9983	4991	1792	3966	3227
F statistic	19.05	16.21	12.31	30.98	17.87

Source: OSYM08 Administrative Dataset, own calculations.
Note: The dependent variable is Quantitative type of high school GPA score in all columns. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. The first column reports the results from the full sample of 9,983 applicants. The second column excludes retakers who had taken the exam more than once before. The third column takes only first-time taker applicants. The fourth column takes applicants only from the three main high school track subjects excluding also retakers who had taken the exam more than once before. The last column has all applicants in Quantitative (Science and Math) subject track.

Table 7: Qualitative High School GPA Estimations

	(1)	(2)	(3)	(4)	(5)
Male	-2.83	-2.98	-2.29	-2.98	-2.18
	(.16)***	(.22)***	(.33)***	(.21)***	(.42)***
Second Takers	.52	1.19		.95	.31
	(.15)***	(.24)***		(.24)***	(.40)
Enrollment in Private Tutoring Instituion	2.14	2.80	2.75	2.54	1.05
	(.18)***	(.27)***	(.52)***	(.29)***	(.40)***
Taking One-to-One Private Tutoring	-1.21	-1.42	-1.38	-1.29	-.86
	(.19)***	(.25)***	(.38)***	(.24)***	(.54)
If working	-1.42	-1.56	-1.22	-1.48	-1.11
	(.17)***	(.28)***	(.48)**	(.29)***	(.41)***
Obs.	9983	4991	1792	3966	1332
F statistic	20.24	17.59	13.8	32.47	4.54

Source: OSYM08 Administrative Dataset, own calculations.
Note: The dependent variable is Qualitative type of high school GPA score in all columns. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. The first column reports the results from the full sample of 9,983 applicants. The second column excludes retakers who had taken the exam more than once before. The third column takes only first-time taker applicants. The fourth column takes applicants only from the three main high school track subjects excluding also retakers who had taken the exam more than once before. The last column has all applicants in Qualitative (Social Sciences) subject track.

Table 8: High School GPA: OLS and Quantile Regression with High School Type and City Fixed Effects

	OLS	Q(0.10)	Q(0.25)	Q(0.50)	Q(0.75)	Q(0.90)
Overall High School GPA						
Male	-4.766***	-4.361***	-4.850***	-5.470***	-5.031***	-4.015***
	(-19.14)	(-13.56)	(-15.51)	(-16.14)	(-14.06)	(-9.47)
N	9983	9983	9983	9983	9983	9983
Equally Weighted High School GPA						
Male	-3.683***	-3.276***	-3.364***	-3.905***	-4.170***	-3.251***
	(-14.31)	(-8.99)	(-11.07)	(-12.11)	(-11.48)	(-7.65)
N	3118	3118	3118	3118	3118	3118
Quantitative High School GPA						
Male	-2.563***	-2.051***	-3.053***	-2.865***	-2.465***	-2.228***
	(-8.17)	(-4.84)	(-7.05)	(-7.26)	(-6.05)	(-5.41)
N	3227	3227	3227	3227	3227	3227
Qualitative High School GPA						
Male	-3.280***	-3.289***	-2.956***	-3.242***	-3.485***	-3.271***
	(-16.10)	(-10.13)	(-12.15)	(-12.00)	(-11.25)	(-8.07)
N	4450	4450	4450	4450	4450	4450

Source: OSYM08 Administrative Dataset, own calculations.
Note: The first column shows the OLS results with robust standard errors and the following columns shows the quantile regressions results for corresponding quantiles. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. t statistics are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. High school GPA is estimated on the full sample, while subject-weighted GPA scores are estimated on the sample of students with corresponding high school subject tracks, respectively.

Table 9: Main Subjects Test Score Estimations

	EW1	QT1	QL1	EW1	QT1	QL1
Male	-1.66	2.39	-3.19	-2.96	1.02	-4.14
	(.75)**	(.70)***	(.78)***	(.95)***	(.90)	(1.00)***
Second Takers	4.53	3.79	4.68	8.92	7.94	8.94
	(1.06)***	(.99)***	(1.10)***	(1.04)***	(.98)***	(1.09)***
Third Takers	7.05	4.83	7.57			
	(1.09)***	(1.02)***	(1.14)***			
Fourth Takers	6.55	2.60	7.81			
	(1.41)***	(1.32)**	(1.47)***			
Enrollment in Private Tutoring Instituion	9.07	8.62	7.77	14.05	12.56	12.47
	(.82)***	(.76)***	(.85)***	(1.18)***	(1.12)***	(1.24)***
Taking One-to-One Private Tutoring	-6.90	-6.72	-6.69	-7.46	-7.09	-7.80
	(.87)***	(.81)***	(.90)***	(1.08)***	(1.02)***	(1.13)***
If working	-12.28	-11.33	-11.67	-11.18	-9.90	-11.14
	(.81)***	(.76)***	(.84)***	(1.20)***	(1.14)***	(1.26)***
Obs.	9983	9983	9983	4991	4991	4991
F statistic	22.11	38.33	15.27	22.69	36.14	15.69

Source: OSYM08 Administrative Dataset, own calculations.
Note: *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. The first three columns include test scores estimations for the three main category of test scores. Dependent variables are Equally Weighted 1 (EW1) test scores, Quantitative 1 (QT1) test scores, and Qualitative 1 (QL1) test scores, respectively, for the full sample of 9,983 applicants. The last three columns repeat the same estimations, but exclude the retakers who had taken the exam more than once before.

Table 10: Main Subjects Test Score Estimations Conditional on High School GPA

	EW1	QT1	QL1	EW1	QT1	QL1
Male	4.00	7.95	2.00	4.23	8.07	2.57
	(.70)***	(.65)***	(.74)***	(.85)***	(.79)***	(.92)***
High School GPA	1.18	1.16	1.08	1.28	1.26	1.20
	(.03)***	(.03)***	(.03)***	(.03)***	(.03)***	(.04)***
Second Takers	4.22	3.49	4.40	7.47	6.51	7.58
	(.97)***	(.90)***	(1.04)***	(.91)***	(.85)***	(.98)***
Third Takers	6.17	3.97	6.77			
	(1.00)***	(.93)***	(1.07)***			
Fourth Takers	8.25	4.27	9.38			
	(1.29)***	(1.20)***	(1.37)***			
Enrollment in Private Tutoring Instituion	5.80	5.40	4.77	9.28	7.88	8.02
	(.75)***	(.70)***	(.80)***	(1.04)***	(.97)***	(1.12)***
Taking One-to-One Private Tutoring	-4.24	-4.10	-4.25	-3.92	-3.61	-4.50
	(.80)***	(.74)***	(.85)***	(.94)***	(.88)***	(1.02)***
If working	-10.19	-9.27	-9.75	-8.23	-7.01	-8.39
	(.74)***	(.69)***	(.79)***	(1.05)***	(.98)***	(1.13)***
Obs.	9983	9983	9983	4991	4991	4991
F statistic	32.56	53.38	22.11	36.67	56.34	24.44

Source: OSYM08 Administrative Dataset, own calculations.
Note: *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. All estimations are conditioned on high school GPA. The first three columns include test scores estimations for the three main categories of test scores. Dependent variables are Equally Weighted 1 (EW1) test scores, Quantitative 1 (QT1) test scores, and Qualitative 1 (QL1) test scores, respectively, for the full sample of 9,983 applicants. The last three columns repeat the same estimations, but exclude retakers who had taken the exam more than once before.

Table 11: Subject-Weighted Test Scores

	EW2	QT2	QL2	EW2	QT2	QL2
Male	-6.52	3.50	-5.97	-10.46	1.77	-10.24
	(1.81)***	(2.38)	(1.92)***	(2.33)***	(2.53)	(2.44)***
Second Takers	7.61	.14	8.78	11.98	6.98	12.60
	(2.85)***	(3.20)	(3.02)***	(2.77)***	(2.76)**	(2.90)***
Third Takers	6.03	-12.43	8.89			
	(2.95)**	(3.35)***	(3.13)***			
Fourth Takers	-.67	-30.14	.91			
	(3.84)	(4.66)***	(4.08)			
Enrollment in Private Tutoring Instituion	10.25	14.25	10.88	19.01	24.75	19.42
	(1.96)***	(3.35)***	(2.08)***	(2.76)***	(4.80)***	(2.88)***
Taking One-to-One Private Tutoring	-6.04	-3.82	-6.03	-3.59	-6.80	-4.13
	(2.13)***	(2.69)	(2.26)***	(2.68)	(2.87)**	(2.79)
If working	-18.08	-19.54	-18.81	-12.36	-15.00	-11.99
	(2.01)***	(2.90)***	(2.14)***	(3.04)***	(3.72)***	(3.17)***
Obs.	4450	3227	4450	2198	1768	2198
F statistic	7.31	9.87	5.24	7.53	8.74	5.15

Source: OSYM08 Administrative Dataset, own calculations.
Note: *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are in parentheses. All estimations include high school type, subject, and city fixed effects as well as the rich covariate set described in Table 4. The first three columns include test scores estimations for the three advanced categories of test scores. Dependent variables are Equally Weighted 2 (EW2) test scores, Quantitative 2 (QT2) test scores, and Qualitative 2 (QL2) test scores, respectively, for the full sample of 9,983 applicants. The last three columns repeat the same estimations on the subsample of applicants with the corresponding highs school track subject excluding the retakers who had taken the exam more than once before.

Table 12: Subject-Weighted Test Scores Conditional on GPA

	EW2	QT2	QL2	EW2	QT2	QL2
Male	3.27	11.32	3.37	2.04	11.10	1.25
	(1.75)*	(2.25)***	(1.88)*	(2.22)	(2.29)***	(2.37)
High School GPA	1.90	1.90	1.81	1.93	1.91	1.78
	(.08)***	(.09)***	(.09)***	(.10)***	(.09)***	(.10)***
Second Takers	5.10	2.97	6.39	7.89	8.47	8.85
	(2.68)*	(2.99)	(2.88)**	(2.55)***	(2.45)***	(2.72)***
Third Takers	2.89	-9.44	5.89			
	(2.78)	(3.13)***	(2.98)**			
Fourth Takers	-.08	-26.05	1.48			
	(3.61)	(4.35)***	(3.88)			
Enrollment in Private Tutoring Instituion	6.98	6.55	7.77	14.06	15.90	14.86
	(1.85)***	(3.15)**	(1.98)***	(2.54)***	(4.27)***	(2.71)***
Taking One-to-One Private Tutoring	-2.57	1.12	-2.72	.07	.37	-.76
	(2.01)	(2.52)	(2.16)	(2.45)	(2.57)	(2.62)
If working	-14.89	-15.09	-15.77	-9.03	-9.80	-8.93
	(1.90)***	(2.72)***	(2.04)***	(2.78)***	(3.31)***	(2.97)***
Obs.	4450	3227	4450	2198	1768	2198
F statistic	13.23	15.41	9.7	12.73	15.22	8.67

Source: OSYM08 Administrative Dataset, own calculations.
Note: *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. All estimations are conditioned on high school GPA. The first three columns include test score estimations for the three advanced categories of test scores. Dependent variables are Equally Weighted 2 (EW2) test scores, Quantitative 2 (QT2) test scores, and Qualitative 2 (QL2) test scores, respectively, for the full sample of 9,983 applicants. The last three columns repeat the same estimations on the subsample of applicants with the corresponding highs school track subject excluding the retakers who had taken the exam more than once before.

Table 13: Main Test Scores: OLS and Quantile Regression Conditional on GPA

EW1 Test Score						
	OLS	Q(0.10)	Q(0.25)	Q(0.50)	Q(0.75)	Q(0.90)
Male	4.006***	1.828	3.194***	4.570***	5.410***	5.699***
	(6.37)	(1.59)	(3.93)	(7.11)	(8.11)	(6.68)
N	9983	9983	9983	9983	9983	9983
QT1 Test Score						
	OLS	Q(0.10)	Q(0.25)	Q(0.50)	Q(0.75)	Q(0.90)
Male	7.960***	5.480***	6.753***	7.762***	8.679***	9.483***
	(13.63)	(5.97)	(10.31)	(12.46)	(12.62)	(12.06)
N	9983	9983	9983	9983	9983	9983
QL1 Test Score						
	OLS	Q(0.10)	Q(0.25)	Q(0.50)	Q(0.75)	Q(0.90)
Male	2.005**	-0.595	2.045*	3.614***	4.225***	3.411***
	(2.99)	(-0.50)	(2.33)	(4.97)	(6.24)	(4.64)
N	9983	9983	9983	9983	9983	9983

Source: OSYM08 Administrative Dataset, own calculations.
Note: The first column shows the OLS results with robust standard errors and the following columns show the quantile regressions results for corresponding quantiles. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. The t statistics are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. Dependent variables are Equally Weighted 1 (EW1) test scores, Quantitative 1 (QT1) test scores, and Qualitative 1 (QL1) test scores, respectively, for the full sample of 9,983 applicants.

Table 14: Subject-Specific Test Scores: OLS and Quantile Regression Conditional on GPA

	OLS	Q(0.25)	Q(0.50)	Q(0.75)
EW2 Test Score				
Male	3.294*	5.147***	5.805***	6.978***
	(1.94)	(3.57)	(6.26)	(7.77)
N	4450	4450	4450	4450
QT2 Test Score				
Male	10.16***	9.027***	9.433***	12.36***
	(3.43)	(3.31)	(6.85)	(7.83)
N	3118	3227	3227	3227
QL2 Test Score				
Male	3.389*	6.066***	6.724***	6.839***
	(1.86)	(4.04)	(6.31)	(7.07)
N	4450	4450	4450	4450

Source: OSYM08 Administrative Dataset, own calculations.
Note: The first column shows the OLS results with robust standard errors and the following columns show the quantile regressions results for corresponding quantiles. *,**,*** indicate significance at the 10%, 5%, and 1% level, respectively. The t statistics are in parentheses. All estimations include high school type, subject of track, and city fixed effects as well as the rich covariate set described in Table 4. Dependent variables are Equally Weighted 2 (EW2) test scores, Quantitative 2 (QT2) test scores, and Qualitative 2 (QL2) test scores, respectively, for the subsamples of applicants from the corresponding high school tracks.

A Appendix

A.1 Sample Selection

The dataset employed in this study was obtained from a merge of the 2008 OSS (Student Selection Examination) dataset and the 2008 Survey of OSS Applicants and Higher Education Programs dataset. The OSS dataset provides administrative individual information for 1,646,376 applicants, while the Survey of OSS Applicants is conducted by OSYM and asks applicants about the socioeconomic characteristics of their household, their high school achievements, expenditures on private tutorials, and their views on high school education and private tutorials. The survey is conducted online, and 62,775 applicants answered survey questions in 2008. I have access to only a random sample of about 16%, with 9,983 observations.

OSYM has a report showing that the sample that answered the survey is representative of the whole population of university applicants in 2008; this report is only available upon request from OSYM. Therefore, I present here some descriptive statistics from the subsample studied in this paper and the 2008 OSYM statistics published online[28]. In the reports that are available online, we have access to the number of applicants, retaking status, passing threshold[29], and placement outcome. In Table A.1, I provide the share of applicants by these characteristics in order to compare the sample to the population of OSS applicants in 2008 in Turkey.

The share of applicants that obtained a test score that satisfied the threshold for at least one of the test scores is around 93% for our subsample, while the population share seems to be slightly higher. Out of the total 1,646,376 applicants, 950,802 applicants have been assigned to a university program, according to the report published by OSYM in 2008[30]. Therefore the share of assigned students does not seem to be substantially different in the subsample with respect to the population. Also, the share of first-time takers in the subsample seems to be equal to the share in the population. Finally, it also seems that the shares of applicants who are honor graduates from their high schools are similar for the subsample and the population.

[28] http://osym.gov.tr/belge/1-10386/2008-ogrenci-secme-ve-yerlestirme-sistemi-osys-2008-osy-.html

[29] Applicants are required to achieve certain test score to be eligible to submit a choice list for a placement.

[30] See the table at http://osym.gov.tr/dosya/1-48259/h/ozet1.pdf

Table A.1: Sample Selection

	Sample	Population
Number of observations (Applicants)	9,983	1,646,376
Passed threshold	0.927	0.957
Placed	0.619	0.578
First taker	0.18	0.174
Honor degree student	0.004	0.003

Note: Own calculations from numbers published by OSYM.