Strategic Decisions have "Major" Consequences: Gender Differences in College Major Choices

Catalina Franco* Amelia Hawkins†

September 25, 2021

Abstract

Using rich administrative data from the universe of applicants to the largest public university in Colombia, we study the college major choices of female and male applicants who just miss the cutoff to enroll in their most preferred major. We find that female applicants with scores just below the cutoff (1) submit a longer list of less preferred majors, and (2) enroll in a less preferred major in the first admission cycle in our data relative to similar men, who are more likely to reapply for admission in subsequent cycles. Based on the college majors that applicants just below the cutoff enroll in, females ultimately have a 6-8% earnings potential disadvantage compared to males, despite there being no gender difference in the potential earnings of preferred majors. Our findings imply that gender gaps in education and the labor market are not only determined by unconstrained preferences, as previous work has suggested, but that they can be magnified by strategic decisions.

JEL classification: D81, I21, I23, I25, J16, J31

Keywords: college majors, gender, marginal students, strategic decision making

*Norwegian School of Economics, Department of Economics and FAIR, Helleveien 30, 5042 Bergen, Norway. Email: catalina.franco@nhh.no

†Department of Economics, Brandeis University. Email: aaehawki@brandeis.edu

‡We thank Universidad Nacional de Colombia for generously sharing their administrative data with us. We obtained useful valuable feedback from Kjetil Bjorvatn, Sandy Black, Siri Isaksson, Amma Panin, Tanya Rosenblat, Bertil Tungodden, Melanie Wasserman, Basit Zafar and participants at the NHH and University of Stavanger department seminars. This paper is part of a project financially supported by the FAIR and Småforsk grants at the Norwegian School of Economics.

1 Introduction

College major choice is one of the main contributing factors to the gender pay gap and occupational segregation among highly-educated workers (Black et al., 2008). Field of study affects future payoffs and earnings, possibly as much as the decision to enroll in college or not (Kirkeboen, Leuven, & Mogstad, 2016). Despite men and women's college major choices becoming increasingly similar over time, women still choose majors with lower income potential than men, and these choices strongly predict gender wage gaps early in the working career of college graduates (Sloane et al., 2019).

Previous literature has investigated which student characteristics affect students' college major choice. Existing research finds that gender differences in college majors are determined by gender differences in field of study preferences and tastes (Zafar, 2013), competitiveness (Buser et al., 2014), ability (Paglin & Rufolo, 1990; Turner & Bowen, 1999; Arcidiacono, 2004), and expected earnings (Wiswall & Zafar, 2015; Arcidiacono et al., 2012). In the previous research, students' most preferred major can be chosen from their choice set. However, many students are not able to choose their preferred major due to different types of institutional constraints.

Little is known about the gender gap in college major decision making when students cannot choose their most preferred major. Previous work examines the long-term consequences of just failing to pass a high-stakes exam (Machin, McNally, & Ruiz-Valenzuela, 2020). Another strand of recent work highlights the importance of gender differences in strategic behaviors in college applications (Saygin, 2016; Delaney & Devereux, 2021), and in the reaction to losing a competition (Buser & Yuan, 2016). However, there is no causal evidence showing that just failing a cutoff for admission to one's preferred major contributes to gender gaps in college major choices and the earnings potential of these choices.

In this paper, we fill this research gap and show that when students cannot enroll in their most preferred major because they just miss the admission's cutoff, men and women make different decisions which ultimately contribute to the gender gap in college majors and to the gender salary gap. We study the academic choices of applicants to the largest public university in Colombia. In this setting, capacity constraints limit the number slots for each major, and applicants' college entrance exam score solely determines admission. Therefore, applicants' scores and the demand for slots together endogenously determine the major-specific cutoff score above which applicants are admitted.

We use discontinuities generated by the slot allocation mechanism at this university to investigate the impacts of marginally failing to gain admission to one's most preferred major. We compare the choices made by male and female applicants who just miss the cutoff for

their preferred major who must decide whether to seek a slot in a less preferred major or drop out of the admissions process. Specifically, we ask the following research questions: (i) Does being marginal affect applicants' subsequent decisions in the application process and do these decisions differ by gender? (ii) Does being marginal ultimately affect the gender gap in enrolled majors, and (iii) Does being marginal ultimately affect the gender gap in earnings potential?

Our identification strategy leverages the fact that scoring just below or just above the preferred major-specific cutoffs is essentially random. We first report regression discontinuity (RD) estimates separately by gender and then pool all applicants to estimate the "RD gender gap," or the discontinuity in the gender gap at the cutoff, from OLS local linear regressions. Our rich administrative data includes applicants' exam scores, pre-exam college major preference, post-exam ranking of major preferences, and enrollment data for applicants who sought admission in the January 2020 cohort. We follow those who do not enroll in that admission cycle over three additional admission cycles up to the second semester of 2021. To study gender gaps in potential earnings, we use survey data reporting the first salary after graduation for recent graduates of every major at this university.

First, we show that the gender gap in male and female applicants' most preferred major does not jump discontinuously at the admissions score cutoff. When registering to take the entrance exam, the university asks applicants to report their most preferred major which we take as their true top field of study preference. This preference is unconstrained and nonbinding as after the entrance exam applicants can choose from available majors. We find no discontinuity at the cutoff in the gender differences in selectivity of or earnings potential of applicants' most preferred major.

Second, we find that marginal female applicants are more likely to enroll *sooner, in earlier admissions cycle,* in a less preferred major than marginal men. In the January 2020 admission cycle, almost 60% of the marginal female applicants while only 40% of the male marginal applicants enroll in a less preferred major. We estimate the RD gender gap to be 22 percentage points. This result is robust to controlling for ability and for applicants' most preferred major.

Next we investigate the mechanisms that could generate this result, a discontinuity in enrollment gender gap at the cutoff. We first find that marginal women choose less selective majors for consideration after being barred entry to their most preferred major. Second, we find that marginal female applicants stay in the application process longer than marginal male applicants submitting a larger number of majors for consideration in each admission cycle. On average, the gender gap in number of majors submitted for consideration increases discontinuously by 0.38 at the cutoff, indicating that marginal women list more majors than

marginal men.

Third, we look time at the three subsequent admission cycles to see if the enrollment gender gap discontinuity persists and find that it disappears. We show that marginal men, who were less likely to enroll in the first admission cycle in our data, are more likely to reapply for admission and eventually enroll. Overall, marginal women tend to enroll in a major the first observed cycle, while men tend to wait, retake the exam, and enroll at a later period. However, even though marginal male applicants are more likely to reapply, they are ultimately no more successful at enrolling in their most preferred major after three admission cycles than marginal women. In fact, only about 20% of marginal applicants, regardless of gender, eventually enroll in their preferred major.

Lastly, we use survey data of recent college graduates to characterize the types of majors that applicants ultimately enroll in after three admissions cycles. We find that marginal women ultimately enroll into majors with lower earnings potential compared to men. Using data from a survey of recent graduates, we use reported salaries as a measure of potential earnings for each major applicants eventually enroll in. We find no evidence of a gender gap in the potential salary of applicants with scores just above the cutoff, (i.e., those who could enroll in their most preferred major), but a large gender gap in potential salaries emerges just below the cutoff. We find that marginal women enroll in majors with potential salaries about 6-8% lower than the majors marginal men eventually enroll in. These results are robust to controlling for ability and applicants most preferred major. Taken at face value, the 6-8% gender wage gap in potential earnings would imply that over half of the gender earnings gap for workers with tertiary education in Colombia, estimated at 11.8% (National Ministry of Education, 2017), is explained by gender differences in strategic college major decisions.[1]

To shed light on the possible mechanisms behind the gender gap in academic decisions, we formulate a conceptual framework in which risk averse applicants trade off higher future potential returns from enrollment with higher certainty of enrollment. Since marginal applicants are not admitted to their preferred major by definition, their enrollment depends on their ranking of major choices. We propose as potential mechanisms gender differences in: outside options, risk aversion, costs associated with being denied enrollment such as social, psychological, and time costs, confidence and belief updating to the feedback received in the application process.

We make three main contributions to the literature. First, we provide causal evidence

[1]Of course this estimate is simply "back of the envelope." We cannot extrapolate to inframarginal applicants and students applying to other universities. The most prestigious universities in Colombia commonly use cutoff scores as part of admission processes.

using an RD design that uncertainty and constrained choice lead to gender differences in college major choice. Our results suggest that the college major gender gap arises from strategic decisions rather than from unconstrained top preferences. Two previous papers present descriptive analyses of gender differences in strategies, with women being more likely than men to diversify the quality of colleges listed in their application (Delaney & Devereux, 2021) and to list a larger number of safe choices (Saygin, 2016). We build on these papers by showing that this "diversification" strategy emerges only for marginal female applicants who fail to qualify for their most preferred major.

Second, we contribute to the recent literature documenting gender differences in the timing of labor market and human capital decisions such as accepting a job offer or enrolling into a prestigious graduate program. A survey of graduates from a masters in business program in the US reveals that women tend to accept job offers earlier than men, which leads to an early career earnings disadvantage but higher job market satisfaction (Cortés, Pan, Pilossoph, & Zafar, 2021). Women just below the cutoff for admission to prestigious science schools are less likely than men to retake a standardized test that could allow them to access these more prestigious schools (Landaud & Maurin, 2020). We show that marginal women enroll sooner, retake the entrance exam less often, and change their field of study when marginally failing to enroll in their most preferred major.

Third, our findings suggest that college major choice and the gender earnings gap are not only determined by unconstrained preferences and student characteristics, as previous work has suggested, but that these gender gaps can be magnified by strategic decisions made under uncertainty and constrained choice. Even in a setting with no gender discrimination and no initial gender differences in the selectivity or potential earnings of students' most preferred major, we find that, ultimately after three admissions cycles, marginal women enroll in majors with lower earnings potential than marginal men.

2 Institutional Background

The higher education system in Colombia consists of public and private institutions, with the latter outnumbering the former by a ratio of 2.6.[2] Private universities admissions usually assess applicants using the score in the national standardized exam along with interviews. Typically, admissions at public and private institutions takes place twice a year. Many public

[2]There are 83 public and 213 private institutions including vocational and technical institutions, and "university foundations" (fundaciones/corporaciones universitarias in Spanish). These foundations are a cheaper alternative to private universities but usually offer lower-quality programs than universities. The count of private and public institution can be found: https://www.universidad.edu.co/ya-va-en-296-el-numero-de-ies-en-colombia/.

universities have their own college entrance exam (CEE) and solely base admissions on the performance in that exam. Colombian high schools do not stream o track students, so all students take the same national standardized exam or CEE for public universities. Private universities charge a fixed tuition per semester while public universities subsidize tuition according to the household income of the student. Given their affordability and prestige, thousands of students, particularly those from low and middle socioeconomic status (SES) families, seek a college slot at a public university.

Our sample and data come from Universidad Nacional de Colombia, the largest and most prestigious public university in the country whose admission system involves a CEE and the ranking of college major preferences by applicants. The CEE is the only requirement for admission to this university. Of around 90,000 students graduating from a high school in a typical year in the city of Bogotá, where the university has its largest campus, about a third take the Universidad Nacional de Colombia CEE.[3] Most students take the CEE in the year they graduate high school. There are many applicants who take the exam in a later semester for reasons such as failing in previous attempts and taking preparatory courses for the exam. Students can take the CEE as many times as they wish provided they cover the small registration fee and are not currently students at this university.

Capacity constrains access to college slots in Colombia as few universities offer affordable and high quality higher education. This generates a high level of competition for the limited supply of slots that increases the stakes of the CEE for students, especially those from less privileged backgrounds. Universidad Nacional de Colombia offers less than 3,000 slots for over 40,000 applicants per semester in the Bogotá Campus.

2.1 College Entrance Exam and Slot Allocation Timeline

The CEE and admissions at Universidad Nacional de Colombia take place two times per year (March and September). Up to one month before the CEE takes place, applicants pay the application fee and register for the exam. At this stage, an applicant reports her *ex-ante most preferred* or *intended* major. These ex-ante preferences are nonbinding as students can change their mind and select any available major at the time of enrollment. We take this report as students' unconstrained preference since they have no incentive to lie; their report is not used in any way by administrators or in the admissions process, and their report is made before they take the CEE and therefore independent of their CEE score. Applicants

[3]According to socioeconomic stratification in the datasets from the Institute for Higher Education (ICFES), about 52% of students graduating from high school belong to strata 1 and 2 (low SES), and 43% to strata 3 and 4 (medium SES). The composition of applicants to Universidad Nacional, Bogotá Campus is similar with 54% belonging to low SES families and 44% to medium SES families.

are given a time and date to take the CEE in person on paper. The exam does not differ by the applicants' intended major and no other university uses the score or has access to the questions in the CEE.[4]

The exam lasts three hours and 30 minutes and contains multiple choice questions in mathematics (25 questions), natural sciences (25 questions), social sciences (25 questions), text analysis (25 questions), and image analysis (20 questions), for a total of 120 questions.[5] The exam is graded by scantron machines, and there is no opportunity for score revisions; so there is no possibility for ex-post score manipulation. The final score, a sum of all exam components, is standardized with a mean of 500 and a standard deviation (SD) of 100. The university usually releases the exam results within two weeks. At that time, applicants learn their individual score in each exam component, overall score, their ranking within the campus they are applying to and among all applicants in Colombia, and their admission priority group.

The university assigns applicants who score at least 600 points (1 SD above the mean) into four admission priority groups. This group determines the level of priority to select slots on the university's online platform. In the Bogotá Campus, group 1 contains applicants scoring at least 700 (2 SDs above the mean), group 2 contains applicants with scores between 650 and 700, group 3 contains applicants between 625 and 650, and group 4 applicants between 600 and 625. Applicants log into an online platform and select up to two majors that they wish to be considered for and the university assigns slots as described below. The slot allocation ends when all slots are successfully filled. Students start college a few months after this process.[6] Once an applicant receives a slot in a major, her choice is binding. The university has a penalty preventing an applicant from participating in the following two admission cycles for applicants obtaining a slot and nor enrolling. It is also hard to switch majors once enrolled.

2.2 College Major Selection and Slot Allocation Mechanism

Applicants select majors according to their priority group. Applicants enter an online platform anytime within the 24 hours allocated to their priority group and select up to two major choices (first choice and second choice). After 24 hours, the system closes and the Ad-

[4]The university has a committee of professors in charge of designing the exam questions. The national standardized exam (prueba SABER) is administered by the Ministry of Education and has no bearing in the admission process at this university. Students who perform well in the CEE tend to perform at the highest level in the national standardized exam.

[5]Text analysis is equivalent to reading comprehension. Image analysis contains problems similar to abstract reasoning tasks.

[6]For example, the CEE for admission to the 2020-1 semester took place in September 2019. New students started classes in February 2020.

missions Directorate admits students following a Serial Dictatorship mechanism described in detail below. The likelihood of getting admitted to a slot in a student's preferred major will depend on her performance on the CEE, the demand for the same major by other applicants, and her score rank among applicants selecting the same major.

When applicants access the platform, they can see: (i) how many slots are left for each major since the last group was admitted,[7] (ii) their score, and (iii) their score rank. Applicants do not know how many other applicants are in their priority group, the preferences of other applicants in their group or which CEE score will determine the cutoff for each major in the current admission cycle. The CEE score that determines the cutoff for each major is determined endogenously by the score of the applicant admitted to the last slot in each major.[8] Tables 1 and 2 show the cutoffs and number of slots for every major in the admission cycle one year before the cycle we study (2019 first semester) and the cycle we study in this paper (2020 first semester).

The university follows a Serial Dictatorship mechanism for allocating slots within admission priority group. Once the results from the CEE are known, the university prioritizes slots for students first by scores and then by stated preferences. Hence, students with higher scores whose top ranked majors has been filled will be admitted to their second ranked major before a lower scoring student no matter the lower scoring student's ranking. However, if an applicant has a score high enough to be admitted to her two major options, she will be given a slot in the major she listed as her first choice. If an applicant is not admitted to any of the majors she ranks or does not select any majors within the assigned 24 hours, she can access the system with applicants in the next priority group. However, some majors may no longer available and removed from the online platform because all the slots were taken by the previous group. Table 3 shows how many applicants in our data are in each priority group and how many majors they rank in each 24-hour period they have access to.

To illustrate how obtaining the highest possible score matters, for the 2020-1 cycle almost 80% of the slots in the Bogotá Campus were taken by applicants in groups 1 and 2, and only 2.5% were available for students in group 4. The slots for majors with the highest demand are usually taken by applicants in group 1. Table 4 shows four examples of applicants' choices and whether they are admitted or not.

[7] The overall number of slots is predetermined by the university and is public information available in the Admissions Directorate website.

[8] Applicants may get an idea of what the likely cutoffs could be based on cutoffs from previous admission cycles. These statistics are published in the Admissions Directorate website and are commonly discussed in student blogs and Facebook groups, as well as at CEE preparation courses.

2.3 Constraints and Strategic Decisions

Applicants to this university face three constraints. First, there is a capacity constraint given that the university offers only a few slots for every major which are oversubscribed given the large number of applicants in any given admission cycle. Second, the score obtained in the CEE constrains applicants' options since being assigned to a lower priority admission group will limit the choice set shown as available in the online platform and even within admission group a lower scoring student will be less likely to be admitted to a slot in the Serial Dictatorship mechanism. Third, the demand for slots from other higher-scoring applicants in higher priority admission groups will determine which slots an individual sees as available in the online platform.

Given the constraints, applicants logging into the online platform in the 24 hours designated for each admission group will decide (i) the selectivity of the majors they rank (or the mean cutoff score for those majors), (ii) the difference in selectivity of these two choices and (iii) whether to retake the CEE in a future admission cycle. So for example, an applicant may decide to not report their ex-ante most preferred major to the university's online platform, but instead choose less preferred majors for the two choices they rank in the platform if they think they will not be able to obtain a slot in their ex-ante preferred major. Applicants could also report their ex-ante preferred major as their first choice (or a even more selective major) but list a safe option as their second ranked choice in order to improve their chances at a slot. Alternatively, if an applicant is not admitted to any major in their admission priority group, she is moved to the next priority group with a chance to select up to two new majors, and so on.[9] Finally, applicants can decide to reapply in a future admission cycle. Those who reapply can retake the CEE with the aim of improving their score. However, it is also possible to save one's current score and use the highest between the current score and the new score to participate in a future admissions process. Enrolling in a less preferred major and then transferring to one's ex-ante preferred major is almost impossible given the university rules.[10]

3 Data Sources and Sample

We use two main sources of data in this paper. The main data source is administrative records from Universidad Nacional de Colombia of the universe of applicants for the 2020 first semester (2020-1) admission cycle. We focus our analyses on applicants to the Bo-

[9] An applicant who is assigned to the top priority admission group can select up to 8 majors in total if she lists two majors in each of the admission priority groups.

[10] These rules are specified: http://www.legal.unal.edu.co/rlunal/home/doc.jsp?d_i=66330#0.

gotá Campus, which is located in the capital and largest city in Colombia. Bogotá has a population around 10 million inhabitants in the metropolitan area. With over 25,000 undergraduate students, the Bogotá campus is the largest of the five university campuses and the one offering the majors with the lowest admission rates.[11] The largest share, about 80% of the 53,000 applicants to the 2020-1 semester, applied to the Bogotá Campus.

We obtained administrative records from the university that include information from every applicant's registration to the CEE, performance in the exam, and college major preferences. For the registration to the CEE data we obtain their unconstrained college major preference, sociodemographic characteristics, high school information, and graduation dates. The CEE data contains their score in each exam component, overall score, and whether they were admitted and to which major. Major preferences are only available for applicants who were assigned to an admission group (scored at least 600). In some cases, we observe preferences across different groups in the case applicants are not admitted to any of their choices in the best group they were assigned to and decide to report preferences in the subsequent group they are assigned to (see Table 3). We are able to observe applicants who do not enroll in the first admission cycle in our data over subsequent admission cycles if they reapply. We complement the administrative records with publicly available information of cutoffs and numbers of slots for every major.[12]

To look into the potential consequences of the decisions applicants make regarding their college major choices, we use data from surveys of graduates conducted by the Ministry of Education.[13] Specifically, we use data on the reported salary from recent graduates from Universidad Nacional de Colombia who were surveyed about their employment status and salary. We obtain average salaries for every major in our sample for students who graduated between 2014 and 2016 and use these salaries as a measure of the potential earnings of each major.

One last word about how much we can say about the longer-term prospect of applicants in our sample. We cannot follow students over time because there is no unified registry of people in Colombia. In addition, applicants in our sample started college in 2020 or later (if they gained admission at a later period or decided to enroll at a different institution), so it is not possible for us to have a detailed account of their labor prospects as they will finish education in 2025 or later.

[11] Statistics about the Bogotá Campus can be found here: http://planeacion.bogota.unal.edu.co/cifras.html.

[12] This information can be found for every admission cycle since 2007 at https://admisiones.unal.edu.co/servicios-en-linea/estadisticas-del-proceso-de-admision/.

[13] The data and publication from the Labor Market Observatory for Education can be found here: https://ole.mineducacion.gov.co/portal/.

We plan to complement the administrative data with survey and experimental data obtained from current students at or applicants to Universidad Nacional de Colombia. The data will be obtained from the same applicants in our sample who are now students at the university. The survey and experiment will help shedding light on the potential mechanisms behind our results (see section 7).

4 Econometric Strategy

In the main analysis we use a regression discontinuity design (RDD) using the cutoffs determined in the first admission cycle in our data for each applicant's preferred college major. Our running variable is the applicant's standardized score in the CEE centered at the cutoff for her ex-ante preferred major as stated in the registration form before taking the CEE. By construction, the running variable being equal to zero represents the score that an applicant would need to obtain to take the last slot in her preferred major. At the time of taking the CEE, the applicants would not know precisely where this cutoff is going to be but might know where the cutoff ended up being for previous admission cycles. Hence, this setting generates a sharp RD where applicants at or to the right of the cutoff could enroll in their preferred major should they report that major to the online platform, while those marginal students to the left of the cutoff could not enroll should they report that major. However, marginal students may still choose other majors that have slots available.

We leverage that applicants just below and above the major-specific cutoffs are as good as randomly distributed. The validity of the RD design relies on the potential outcomes evolving smoothly across the cutoffs to identify the effect of being a marginal applicant on college major choices. We present RD estimates and standard errors separately by gender using the econometric methods and bandwidth selection from Calonico, Cattaneo, and Titiunik (2014) (CCFT). We further quantify the extent of gender differences using the following specification:

$$\begin{aligned} Y_i = \alpha_0 + \beta_0(Below_i \times Female_i) + \beta_1(Below_i \times Score_i) + \beta_2(Female_i \times Score_i) + \\ \beta_3(Below_i \times Female_i \times Score_i) + \beta_4 Below_i + \beta_5 Female_i + \beta_6 Score_i + \gamma_g + \varepsilon_i \quad (1) \end{aligned}$$

The outcomes Y_i include measures of the selectivity of preferred majors, number of selected majors, an indicator for enrolling in any major, and the mean salary of enrolled majors. $Below_i$ is an indicator of whether the applicant's score is below the cutoff of her preferred major. $Female_i$ is an indicator for whether the applicant is a female. And $Score_i$ is the applicant's CEE score centered at the cutoff of her preferred major.

The coefficient of interest is β_0, which measures the additional effect on Y_i of being a marginal female applicant relative to a male marginal applicant. The specification is linear. We only use observations within the bandwidth the CCFT procedure chose for the gender specific regressions. In the regression pooling genders, we use the larger of the two gender-specific CCFT bandwidths.[14] Standard errors for the pooled regressions are Eicker-Huber-White.

Two main features of this setting make it interesting to analyze gender differences in the behavior of marginal applicants. First, applicants do not know the demand for each major nor the exact score they need to be admitted. The applicants may be strategic about what majors to choose or how many majors to report in the online platform. Second, the choices they report are binding since there are penalties for applicants who do not enroll in the slot assigned to them. Hence, applicants must be fully aware of the choices they make.

4.1 RD validity

We present two pieces of evidence for the validity of our RD design. First, Figure 1 plots the density of the running variable for female and male applicants. There are no visual discontinuities in these densities. In addition, we statistically test for a discontinuity in the density of test scores at the cutoff using the methods proposed by Cattaneo, Jansson, and Ma (2020). We fail to reject the null hypothesis of no discontinuity with p-values of 0.16 and 0.75 for the density of female and male applicants, respectively. Second, we obtain RD estimates for a group of baseline covariates including sociodemographic, high school, and parental characteristics. Figures 2 and 3 show that no evidence of discontinuities in any of the 10 covariates.

5 Results

We find large differences in the strategies followed by marginal male and female applicants. Women seem to play a diversification strategy by listing a larger number of majors in their application and being more likely to enroll in any other major when they marginally fail to obtain a slot in their preferred major than men. Over time, when we look at the behavior over three additional admission cycles, we see that the enrollment gender gap decreases substantially because both men and women applicants who did not enroll in the first admission cycle retake the exam and eventually earn a college slot. The cost of the strategy followed by marginal women is the lower earnings potential of the majors they end up enrolling in

[14] These two bandwidths do not usually differ by much.

relative to marginal men.

Our main results are in Figures 6 to 12, and Tables 5 to 9. Each figure plots the outcomes separately for male and female applicants within the gender-specific bandwidth chosen by the CCFT procedure. The fitted line is obtained from a polynomial of degree one and weighting observations using a triangular kernel. The results in the tables follow specification 1, use a uniform kernel, and are local linear regressions run within the largest gender-specific bandwidth among the two we obtain using the CCFT procedure.

5.1 Gender differences in preferred majors

We first look at whether there are preexisting differences in preferences for majors among male and female applicants. Figure 4 and Figure 6 indicate that there do not seem to be differences in terms of cutoffs and selectivity of the majors men and women intend before they take the CEE. In Figure 4 we present a scatterplot that shows the cutoff (score of the last admitted applicant) against the admission rate (available slots over applicants intending each major) for every major in our sample. The color coding shows whether there is a larger fraction of women or men intending the major. If we were to see large differences in the types of majors men and women would like to enroll in, we would see concentration of majors with the same color. However, we see great overlap suggesting that there are no sharp differences in the preferred majors.[15]

Figure 6 plots whether applicants' preferred major is in the top quartile of admission rates, i.e., majors with high demand and low admission rates. Around 50% of applicants near the cutoff, regardless of gender, intend one of the very selective majors, and there is no statistically significant discontinuity at the major-specific cutoffs.

5.2 Marginal women follow a "diversification" strategy

Women tend to perform worse in this CEE than men as has been found in several papers examining gender gaps in the performance in high-stakes, competitive settings (Ors et al., 2013; Azmat et al., 2016; Cai et al., 2016) (see the overall distribution of scores in Appendix Figure A.1). Because we are looking at the top of the distribution, even if an applicant fails to score high enough to obtain a slot in her preferred major, applicants in the first, second and third admission group can still choose among other majors. Hence, there could be some strategies involving the number of majors reported and the selectivity of those majors. For instance, an applicant can list a "safe" major for which she knows the likelihood of obtaining

[15]There is a cluster of engineering majors (dark red dots with high cutoffs and relatively low admission rates), but other than those there are not large differences in the major preferences of women and men.

admission is high. Also, when an applicant in the top priority admission groups lists two majors and is not admitted into any, she still has the chance of reporting majors in the next admission group.

We find that women tend to follow a diversification strategy by ranking "safer" majors and ranking a larger number of majors than men. Figure 7 displays the minimum cutoff of the majors ranked in the online platform by women and men. While there are no discontinuities at the cutoff within gender, visually it is clear that women rank majors that have lower cutoffs than men. Figure 8 shows that there is no discontinuity in the number of majors reported by male applicants; male applicants report 1.5 majors of average out of two possible in each admission group's 24 hour window. Females just to the left of the major-specific cutoff, on the other hand, report a larger number of majors than women at or above the cutoff and than men. Table 5 quantifies these gender differences. The "safe" major that women above and below the cutoff rank is about 6 standardized points lower than the major with the lowest cutoff ranked by men (columns 1-3). Marginal women report 0.38 more majors than marginal men over the course of all four 24-hour windows they have access to (columns 4-6).

These result is in line with previous descriptive findings that women tend to list more lower quality colleges in their application, which has been attributed to risk aversion (Delaney & Devereux, 2021). In our setting we do not have an unlimited number of majors that applicants can list, but we still find that women overall are more likely than men to list a safe major. What we can identify with our design is that women also diversify by listing a larger number of options. This is however not a strategy followed by *all* women but only by *marginal* women. Women just above the cutoff rank a safe major but list on average fewer majors than men just above the cutoff. Women just below the cutoff rank a safe major and a larger number of majors than men just below the cutoff.

5.3 Gender differences in enrolled majors

The "diversification" strategy followed by marginal women increases the likelihood of enrolling in a major in our first observed admission cycle. Figure 9 shows the likelihood of enrolling in any major at the Universidad Nacional de Colombia in this cycle. About 80% of applicants of both genders who score at or above the cutoff for their preferred major enroll in a major (most likely their preferred major - see Figure 11 and Table 7).[16] Applicants to

[16]Given that these applicants are to the right of the cutoff, they could in principle enroll in their most preferred major. However, they do not know that they will be to the right of the cutoff since it is determined endogenously by the admissions process. It is possible that some applicants do not rank their preferred major in the online platform if they think their score will not be high enough for that major. In fact, the cutoffs from the admission cycle that took place one year before were higher for most majors relative to the current cycle.

the left of the cutoff cannot enroll in their preferred major but may enroll in other majors as discussed previously. We find that almost 60% of marginal women but only 40% of marginal men decide to enroll in another —ex-ante less preferred—major. Table 6 quantifies this gender difference at 22 pp.

Over time, when we look at the behavior over three additional admission cycles, those who do not enroll initially reapply and we see that the enrollment gender gap decreases substantially. Figure 10 shows the likelihood of enrolling in any major including applications to all subsequent admission cycles up to the cycle corresponding to applicants starting college in August 2021. There is no longer a discontinuity in enrollment at the cutoff in the case of female applicants, and it is reduced from 40 pp when looking at the first admission cycle only to 8 pp in the case of men. Column 1 in Table 7 indicates that, across all admission cycles, 88% of male applicants at or to the right of the cutoff enroll in a major at this university, and there is a small difference with respect to females at or to the right of the cutoff. Below the cutoff, marginal men are 6.7 pp less likely to have enrolled than men above the cutoff, and the difference between marginal men and women is no longer statistically significant.

Overall, our findings indicate that the initial gender gaps in enrollment decrease over time and are consistent with both men and women who did not enroll in our first observed admission cycle reapplying in the following cycles and eventually enrolling in a major. The main difference is that women who cannot enroll in their preferred major are much more likely to enroll in a less preferred major in the first admission cycle we observe, while many men seem to decide to reapply in a future semester instead. In fact, marginal men are more likely to reapply in subsequent periods as we show in Appendix Figure A.2 and as has been documented in other work (Landaud & Maurin, 2020).

5.4 Consequences of gender differences in strategies

We first look at whether marginal applicants end up enrolling in their preferred major within the four admission cycles we study. Recall that, by definition, in the first admission cycle we observe, marginal applicants cannot enroll into their preferred major because they score below the applicant who took the last slot in that major. However, applicants who decide to reapply, could potentially get a slot in that major in a subsequent admission cycle. If this is the case, we would see marginal men being more successful in entering their preferred major over time as they reapply. Overall, within four admission cycles 76% of men at or above the cutoff enroll in their preferred major while women above the cutoff are slightly less likely to do so (columns 4-6 in Table 7).[17] Below the cutoff, Figure 11 and Table 7 show

[17] One possible explanation for the gender difference at or above the cutoff is that women ex-post choose a major that is not their ex-ante most preferred one because they erroneously think their score is not going

that ultimately about 20% of marginal applicants enroll in their preferred major within four admission cycles. However, there is no gender difference in this proportion.

We next look to see if the types of majors marginal women ultimately enroll in over four admissions cycles differ substantially from the types of majors marginal men enroll in. We use the average annual salary of graduates from a survey of Universidad Nacional de Colombia alumni to generate a "potential" salary measure by major. We find no evidence of a discontinuity around the cutoff of the potential salary of majors men enroll ultimately enroll in after four admission cycles (Figure 12). However, we find a clear discontinuity at the cutoff in the potential salaries of the majors that women ultimately enroll in. The RD estimate for female applicants is 0.3, which means that the potential salary of majors that women who score just below the cutoff ultimately enroll in is 0.3 million pesos less than the potential salary of majors that women who score just above the cutoff enroll in. For reference, the monthly minimum wage in Colombia in 2020 was around 900,000 pesos, so they are forgoing a third of a minimum wage per month and about 15% of the potential salary for non-marginal women.

Table 8 reports the gender differences in potential salaries for different applicants' college major choices from equation 1. The results suggest that reapplying is a potential salary enhacing strategy for marginal applicants. Marginal men who enroll in the first observed cycle (columns 1-3) end up selecting majors that have considerably lower income than men with scores at or above the cutoff. This discontinuity disappears, nevertheless, when looking at enrollments over all admission cycles (column 4-6). The RD gender gap coefficient, which estimates a discontinuity in the gender gap at the cutoff, is negative and statistically significant, indicating that a gender gap in potential salaries at the cutoff exists in the first admission cycle (e.g. marginal women who enroll will potentially earn less than men who enroll in that first admission cycle), and this difference remains even after four admission cycles.

In sum, both male and female marginal applicants who enroll in the first admission cycle face a potential salary penalty, although it is higher for women, but the penalty dissapears for marginal men who end up with the same potential salary level as men who were initially above the cutoff. We estimate the RD gender gap in potential salaries at 110,000- 169,000 pesos per month, which is equivalent to a gender wage gap of 5-8% among marginal applicants. More importantly, there was no gender wage gap among marginal applicants if we look at the preferred major or the first choice ranked in the online platform (Table 9). The gender

to be high enough for their top choice. In fact, Table **??** shows that the cutoffs for most majors were lower in the 2020-1 than the equivalent period in 2019 but there is no way that applicants could anticipate that this would be the case.

pay parity in preferred majors and first choices allows us to conclude that a gender pay gap emerges as a result of gender differences in the strategies followed by marginal applicants. For reference, the gender pay gap among workers with college education in Colombia is estimated at 11.8% (National Ministry of Education, 2017).

6 Conceptual Framework

We use a simple theoretical framework to describe the possible mechanisms driving our results. We abstract from students' decision to take the college entrance exam (CEE) to Universidad Nacional de Colombia assuming that for all high scoring students the cost of test taking is so low that all will take the CEE. After taking the CEE, applicants receive their CEE score (s_i) and are assigned to an admission priority group $a = 1, 2, 3, 4$ based on s_i.[18] Each priority group is assigned a 24-hour period to log into an online platform. When applicants log in, we assume they know (i) previous cycles' cutoff scores for admission to each major, (ii) their CEE score, and (iii) their admission priority group.[19] Once in the online platform, applicants can see the number of slots still available in each major. They list up to two majors for which they would like to be considered. At the end of the 24-hour period, the university assigns the slots using the Serial Dictatorship mechanism. The university updates the online platform between each priority group to show the new number of available slots per major.

Each cycle after seeing their choice set, applicants must first decide whether or not to list any majors. Applicants who list no majors drop out of the admissions process and instead take their outside option. Assume that the return from the outside option, denoted h_i, is a personal trait which is randomly assigned from the cumulative distribution $H(\cdot)$ before each admission cycle begins. Students who decide to list majors face an uncertain stream of returns from the admission process, described in more detail below. Denote r_i as the per admission cycle certainty equivalent of the uncertain stream of returns from the admissions process. The student will decide to start (or restart) the admission process so long as the per cycle certainty equivalent of the uncertain stream of returns from the process outweighs the return from their outside option; that is $h_i \leq r_i$. The probability of starting the admissions process is $H(r_i)$.

Next, applicants who decide not to drop out of the process must decide which two majors

[18] As described previously, only applicants with a score of 600 or higher (1 SD above the mean) are classified into a priority group. Applicants retaking the CEE can apply using their current score or their previous cycle score, whichever is higher.

[19] The first is publicly available through the university website and applicant online blogs. The other two are directly provided by the university to each applicant.

to select in the platform to be considered for enrollment. Within 24-hour periods and among applicants who select at least one major, 78% of male applicants and 75% of female applicants select two majors. If an applicant is accepted for enrollment, they face very strong incentives to follow through with that commitment. If applicants do not enroll after having been admitted by the mechanism, then they are barred from applying to the university for two admission cycles.

If an applicant is not selected for enrollment in either of their two major choices, the applicant has the option of logging into the next 24-hour period or dropping out of the current admission cycle. Therefore, admission priority group 1 applicants could possibly submit up to 8 major choices, 2 in each of the four 24-hour periods. Priority group 2 applicants could submit up to 6 major choices, group 3 up to 4 and group 4 only 2. However, most applicants (97.5%) do not login more than once. Table 3 shows how many applicants per admission priority group listed 0, 1 and 2 majors in every 24-hour period. There are M total majors offered at the university denoted $m = 1, 2, ...M$. The set of majors still available in the four 24-hour periods, denoted A_a with $A_1 = \{1, 2, 3, ...M\} \supset A_2 \supset A_3 \supset A_4$.

Applicants who do not successfully enroll in the current admission cycle can reapply.[20] Overall, about 20% of both male and female applicants who ranked majors in the first admission cycle reapplied in at least one subsequent admission. Correspondingly, among those who did not rank any majors, 51% of the female applicants and 49% of the male applicants reapplied at least once over the next three cycles. Each cycle the decision process begins again.

From the applicants' point of view the as-yet-to-be-determined admissions cutoff for any given major, denoted c_m, is a random variable with a presumably known (from previous cycles) distribution $f_m(\cdot)$ and cumulative distribution $F_m(\cdot)$. Assuming that each major's cutoff distribution is independent, though not necessarily identical, the probability the applicant is enrolled in major m is $Prob(c_m \leq s_i) = F_m(s_i)$. If the student does not select major m for consideration then clearly $F_m(s_i) = 0$. Under the Serial Dictatorship slot assignment mechanism, the probability the applicant is enrolled in one of the two major choices in their priority group is $p_i = F_1(s_i) + (1 - F_1(s_i))F_2(s_i)$. The expected payoff of being enrolled then is $F_1(s_i)w_1 + (1 - F_1(s_i))F_2(s_i)w_2$ with w_m the expected payoff of being enrolled to major m, for example the expected salary of recent major m graduates.

With probability $1 - p_i = (1 - F_1(s_i))(1 - F_2(s_i))$, applicants will not be enrolled into either of their two major choices. Applicants who are not admitted to any major after the four 24-hour periods or who drop out of the admission process altogether can retake the

[20]For admissions after our first admission cycle the university had to use the national standardized test to admit students due to the pandemic.

CEE in the next admission cycle at additional costs.[21] The expected value of starting the admissions process for each applicant is $EV = (1 - p_i)\underline{E} + p_i\bar{E}$ with $\underline{E}$ the return from not being admitted after submitting two majors and $\bar{E}$ the return from being admitted.

7 Mechanisms

7.1 Outside options

If women have fewer outside options, we might expect women to start (or restart) the admissions process and choose to submit majors in the online platform more often than men, all else equal. Because the choice set of remaining major options shrinks for each admission priority group, the payoff from submitting majors falls. Later admissions groups then are more likely to drop out of the admission process by submitting no majors. See Figure 13.

There does not seem to be a gender difference in the likelihood of not submitting any majors in Figure 14, suggesting that marginal men and women may have similar outside options. This plots is for all admission priority groups together but the likelihood of submitting majors may change as the choice set shrinks. We plan to further investigate this by analyzing each of the priority groups separately.

7.2 Risk aversion

Women are more risk averse than men (Croson & Gneezy, 2009). Risk aversion could affect both the students' decision to start the admissions process as well as the applicants' subsequent decision of which two majors to report. To the extent that women are more risk averse than men, female students will have a larger risk premium and lower certainty equivalent r_i compared to male students. If the outside option is certain, even if the outside option produces a lower return, the most risk averse students may choose to not start the admissions process by submitting zero majors.

In addition, among applicants who have decided to start the admissions process, risk aversion may affect *which* two majors the applicants submit within each 24-hour period even if all applicants face the same uncertain stream of returns from every possible major choice. We might expect that female applicants trade off higher future potential returns from enrollment with a higher certainty of enrollment when choosing which two majors to report. Figure 5 shows that indeed majors with higher cutoff thresholds tend to have higher salary

[21] Most applicants (93%) from groups 1, 2 and 3 who do not get enrolled in the first 24-hour period but could login to the next 24-period choose not to so we do not discuss that decision here.

potential. [22] *Within* a 24-hour period, applicants can partially control the probability of being accepted to at least one of their two major choices through the selection of their lowest cutoff major choice. However, since major cutoffs and major salary potential are positively correlated, this increase in certainty is paid for with a decrease in expected return from enrollment [23] (see Figure 15).

7.3 Additional costs of not being enrolled: social costs, psychological costs / exam experience, time costs

Of course men and women may *not* in fact face the *same* stream of uncertain returns from the admission process even conditional on their score, and ex-ante preferences. The additional cost of not being enrolled may be higher for women than for men. Women may face higher social costs when not admitted for example from parental expectations or from gender norms. Women may face higher psychological costs from not being enrolled for example from a negative testing experience and feeling like a failure or from anxiety about retaking the CEE. [24] Women may also have higher time costs waiting to begin their college education for example from not wanting to put off having children to finish college or from being more impatient.[25]

To the extent that women have higher additional costs of not being enrolled than men, female applicants will have a lower expected value of returns from the admissions process and a lower certainty equivalent even if men and women are equally risk averse. We would therefore expect women to decide to start the admissions process at lower rates, and to choose lower-cutoff majors with a higher probability of enrollment compared to men with the same CEE score and ex-ante preferences. We would also expect female applicants to continue logging into the remaining 24-hour periods (rather than dropping out of the current cycle) after being denied admission (see Figure 16).

[22] Correlation weighted by number of students in each major is 0.71

[23] *Across* the four 24-hour periods of an admission cycle, applicants can control their probability of being enrolled in the university by continuing to log into the remaining 24-hour periods (rather than dropping out of the current cycle).

[24] Some costs to not being admitted may be incurred regardless if the applicant decides to retake the CEE while others may only be incurred if the applicant retakes the CEE.

[25] However, the literature has found that boys are less patient than girls (Bettinger & Slonim, 2007).

7.4 Under (over) confidence, pessimistic (wishful) thinking, and asymmetric updating after feedback

We have been treating applicants' CEE score s_i as well as the distribution of major specific cutoffs $f_m(\cdot)$ as given and known. However, applicants may have differing beliefs both about their ability to improve their score by retaking the exam and about the major cutoff distribution that determines their probability of enrollment conditional on their score. Even when men and women face the same payoff from the admissions process, they may have different beliefs about their probability of enrollment p_i even conditional on their exam score.

Men tend to be over confident and women under confident in their ability (Niederle & Vesterlund, 2007). If male applicants are over confident in their ability to improve their score, we might expect male applicants to drop out of the current admission cycle sooner and reapply at higher rates compared to female applicants.

If male applicants tend to believe optimistically that the realized major cutoffs will be lower and therefore their probability of enrollment p_i higher compared to female applicants, we would expect men to perceive the expected value of the uncertain admissions process to be higher than women and therefore their certainty equivalent to also be higher. This difference in beliefs about the likelihood of enrollment could affect men and women's decisions differently even if men and women were equally risk averse and faced the same stream of returns $\underline{E}$ and $\bar{E}$ (see Figure 17).

All else equal, we would expect to see more male applicants starting the admissions process by submitting majors rather than dropping out compared to female applicants. We would also expect to see men choosing majors in the online platform with higher cutoffs and higher earnings potential compared to women. However, over optimistic applications who shoot "too high" should be more likely to be denied admission, and therefore less likely to enroll and more likely to reapply.

Lastly, men and women may exhibit asymmetric updating. The degree to which male and female applicants beliefs about the major cutoff distributions differ could potentially be the result of asymmetric updating after getting their score. Many applicants take the university's official practice exam or take test preparation courses tha include practice test before taking the CEE. Male and female applicants may attribute differences in their exam performance from the practice test to the real test differently to individual versus exam effects and this can affect the decision on whether to submit any majors, and which majors to submit.

8 Conclusion

We provide evidence that gender differences in college major choices are not only a result of pre-determined characteristics such as underlying field of study preferences or ability, as other papers have found, but that they can also emerge as a result of a decision process under uncertainty. In a setting involving capacity constraints in the number of college slots available and a Serial Dictatorship slot allocation mechanism to assign them, university applicants make strategic decisions that affect the college major they ultimately enroll in. Female applicants of essentially the same ability level are much more likely to diversify the majors they would like to be considered for and enroll into a less preferred major than men if they just fail to enter their preferred major.

Our study helps underscoring a new channel behind gender differences in college major choices and the gender pay gap. The strategic decisions regarding college majors come at a cost. Women scoring just below the cutoff ultimately enroll in majors with lower earnings potential than similar women scoring just above the cutoff and compared to men. The gender gap in potential salaries —based on the majors applicants ultimately enroll in —jumps by 5-8 percent at the cutoff of applicants' preferred major. Importantly and contrary to some of the explanations for the gender pay gap, our setting is one with no discrimination. Hence, the salaries that marginal women will face upon graduation solely reflect their choices during the application process.

We focus on one dimension of the costs associated with the strategies followed by marginal women and men in this setting, namely the potential earnings of the majors these applicants decide to enroll in. However, other non-monetary dimensions may be important and they may explain the choices we observe marginal women making in this setting. For example, aspects such as work-life balance and flexibility of work hours may matter more for women than for men. We focus in this paper on the gender pay gap because it has been the subject of study for decades in the economics literature and it is usually correlated with job quality.

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9 Figures

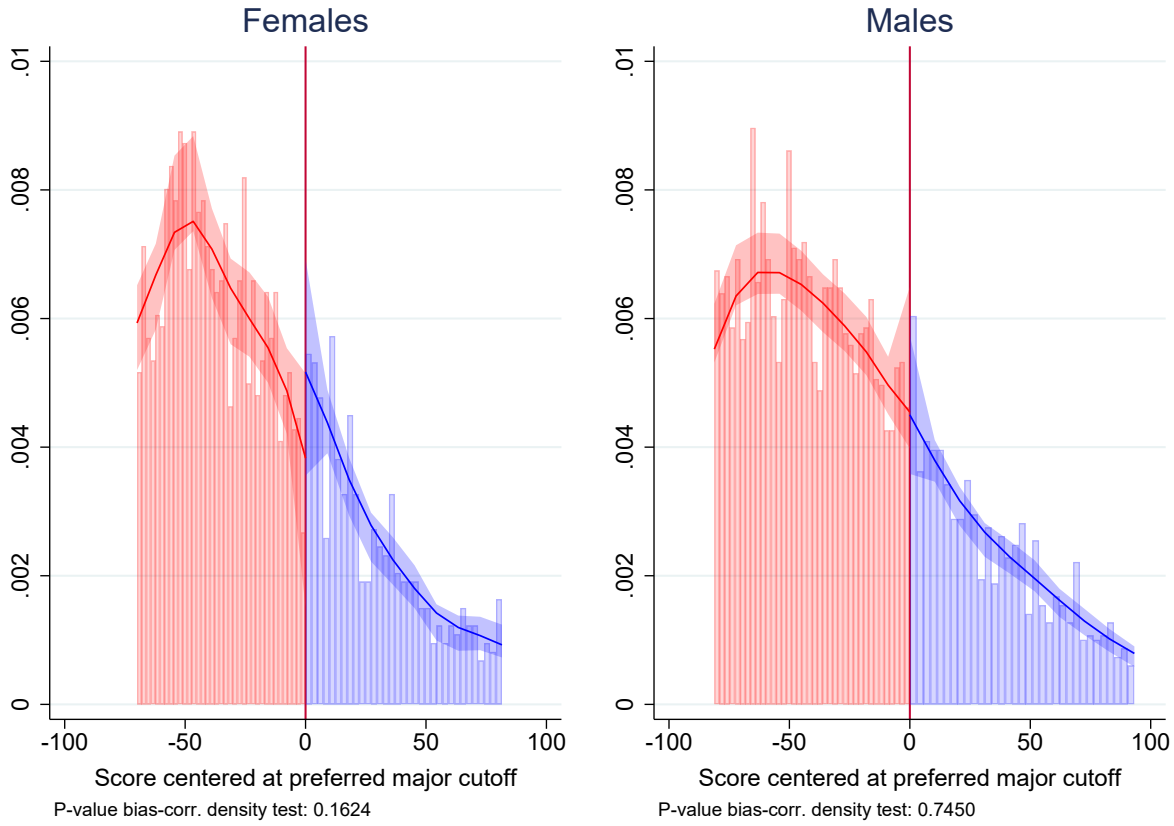
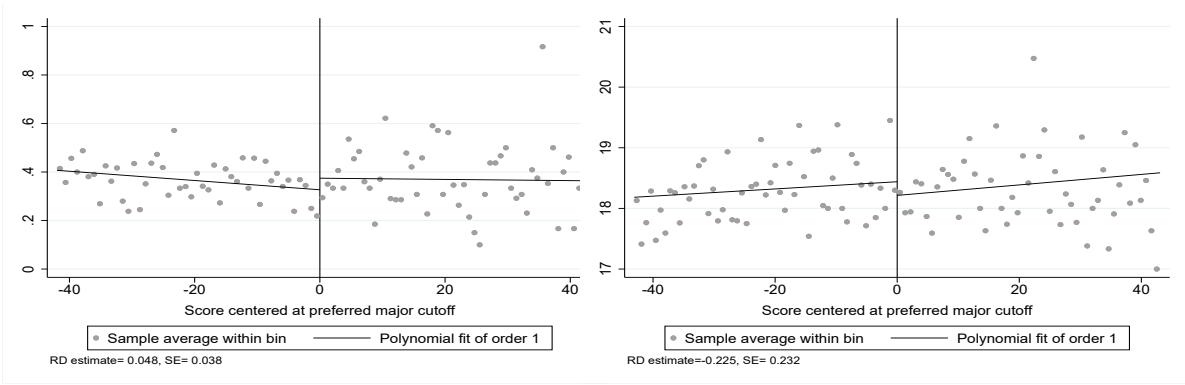


Figure 1: Density of the running variable by gender

Notes: Scores of applicants to the 2020 I semester admission cycle.

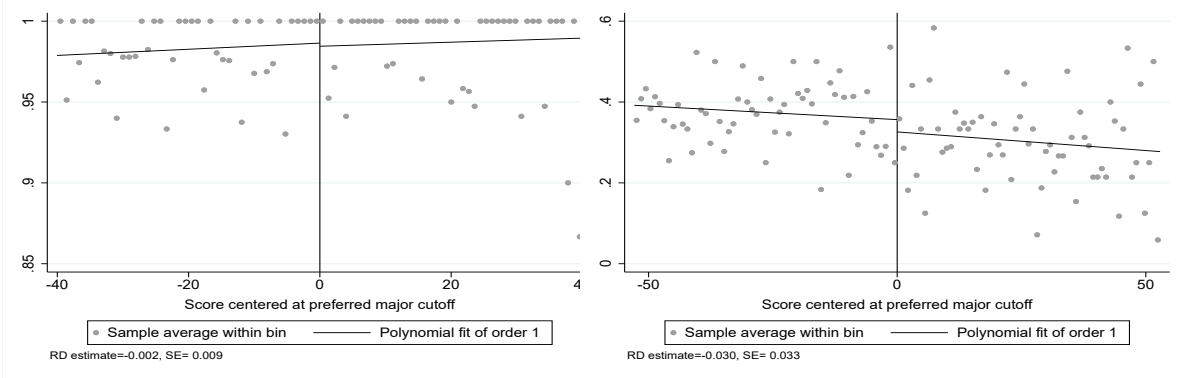
(a) Female

(b) Age



(c) Single

(d) Public high school



(e) Academic high school

(f) Took preparatory course

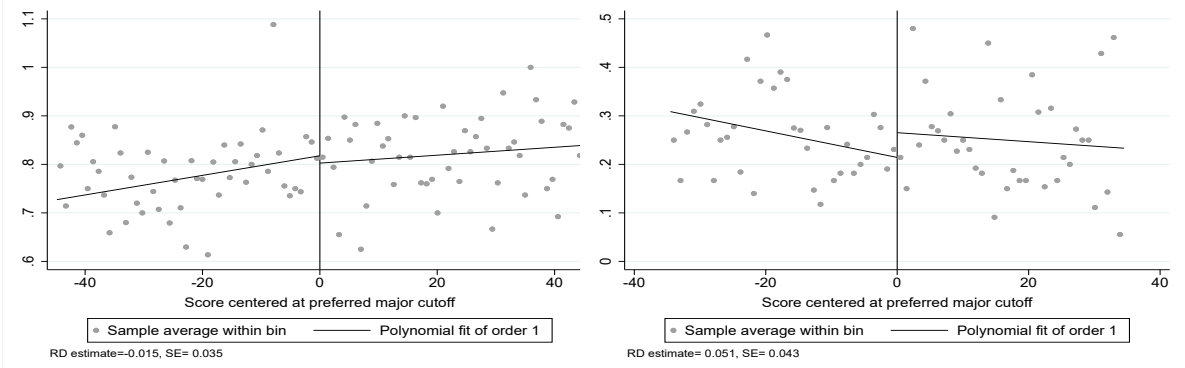
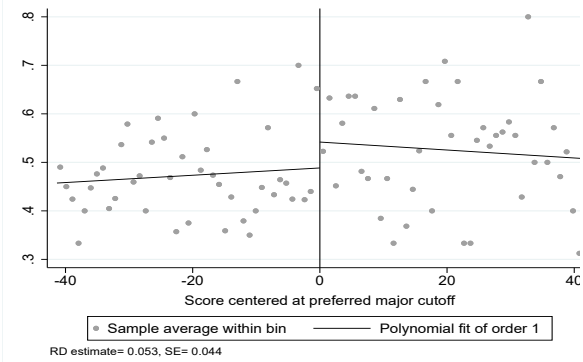


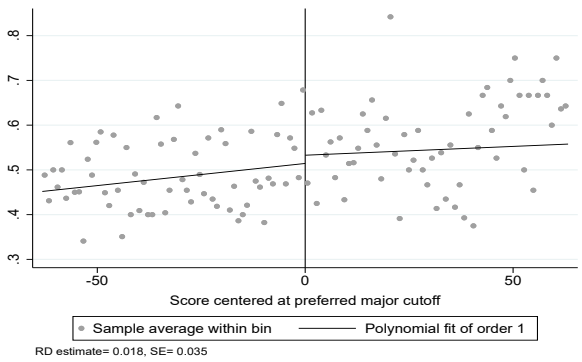
Figure 2: Covariates - applicants' characteristics

Notes:

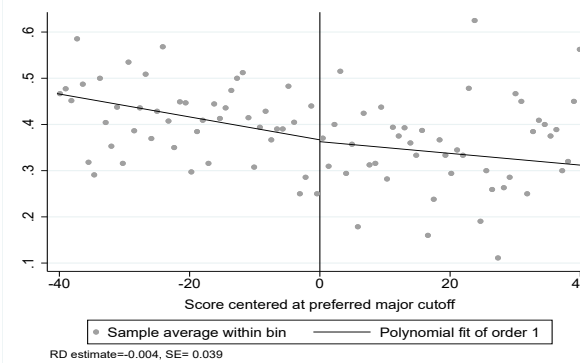
(a) Father with college



(b) Mother with college



(c) Low SES



(d) Lives with mother

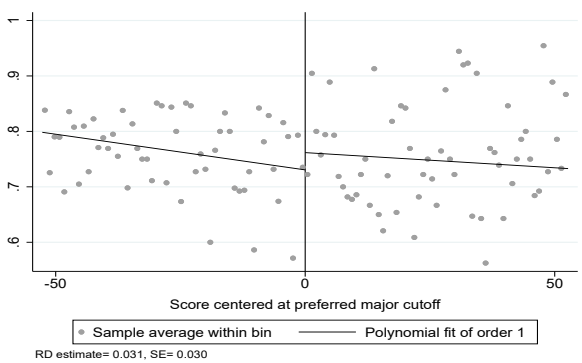


Figure 3: Covariates - parental characteristics

Notes:

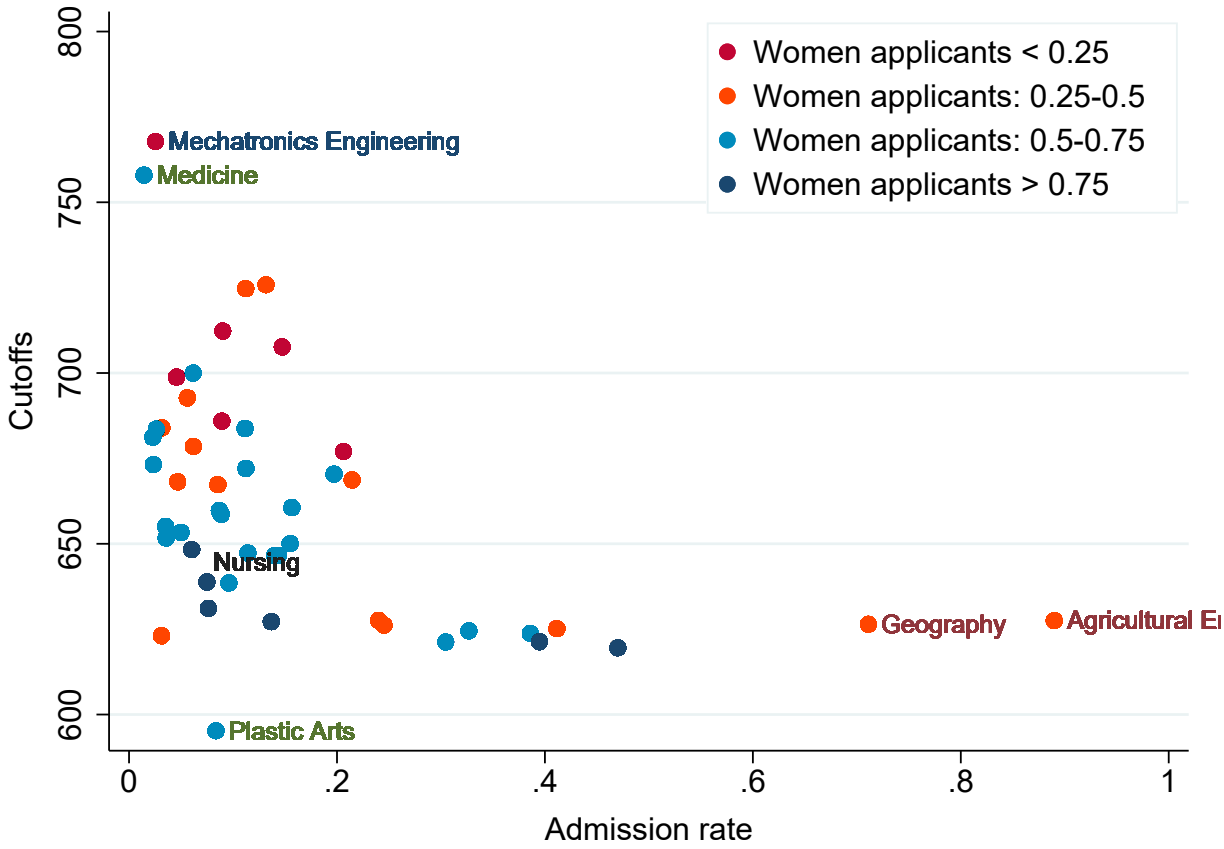


Figure 4: Cutoffs and admission rates by major

Notes: Cutoffs and admission rates for the 2020 I semester admission cycle. Admission rates are calculated based on the number of applicants that state a major is their preferred one in the registration form before the CEE and the number of slots for that major.

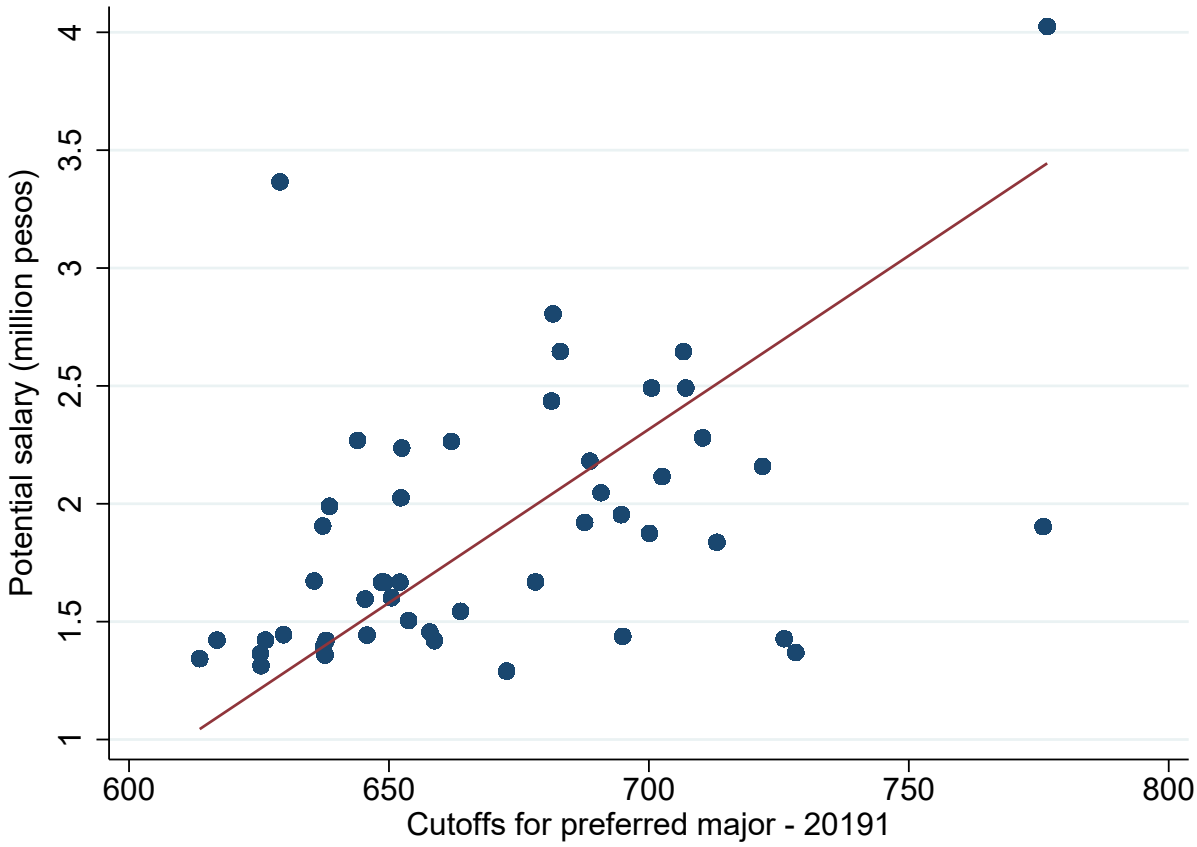


Figure 5: Cutoffs and potental salaries by major

Notes: Cutoffs and potential salaries for the each major offered in the 2020 I semester admission cycle. Potential salaries are an average of the salaries of 2014-2016 graduates from this university for each major.

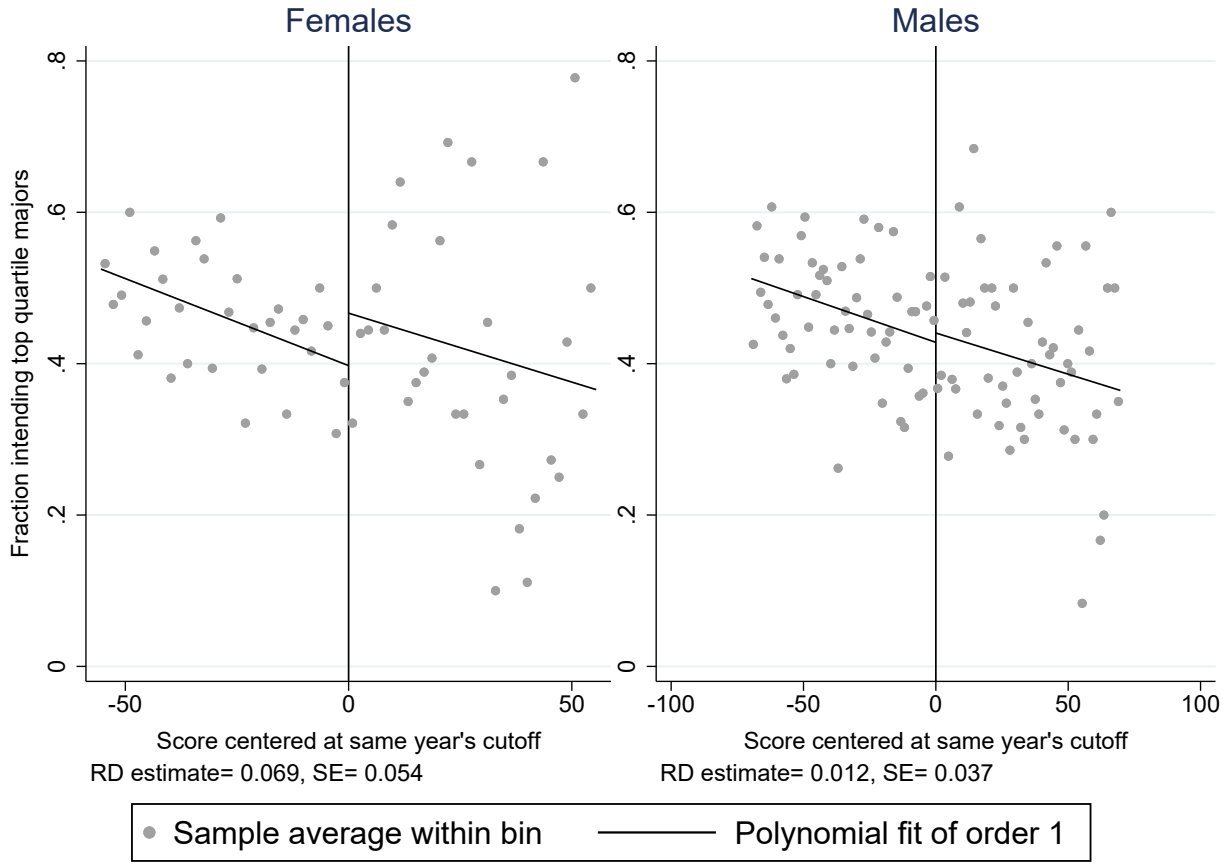


Figure 6: Fraction intending a selective major

Notes: The outcome is an indicator for whether the preferred major is in the top quartile of admission rates, i.e, is one of the majors with the lowest admission rates.

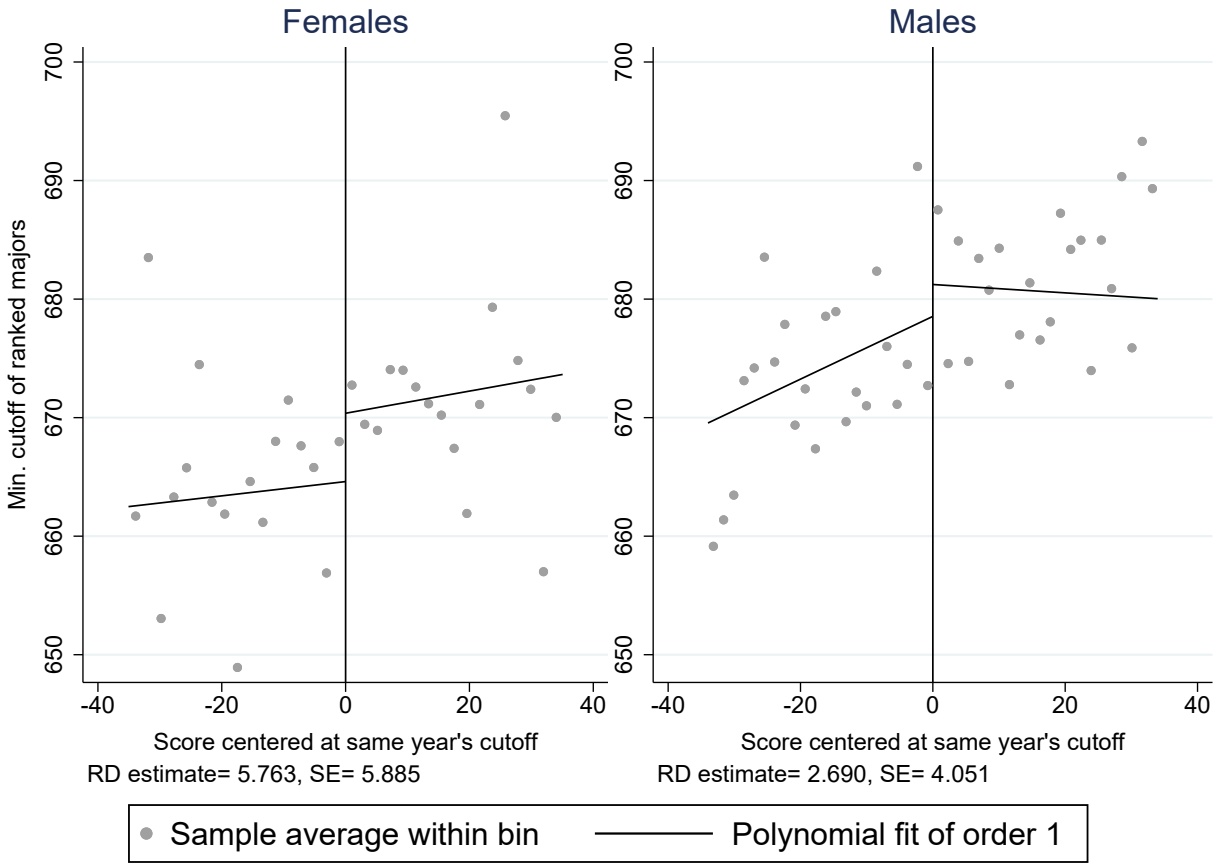


Figure 7: Cutoff of the ranked major with the lowest last year's cutoff

Notes: The outcome takes the lowest cutoff among the majors ranked in the online platform. We take the cutoff from last year's admission cycle because this is the information that the applicants likely know at the time of ranking majors.

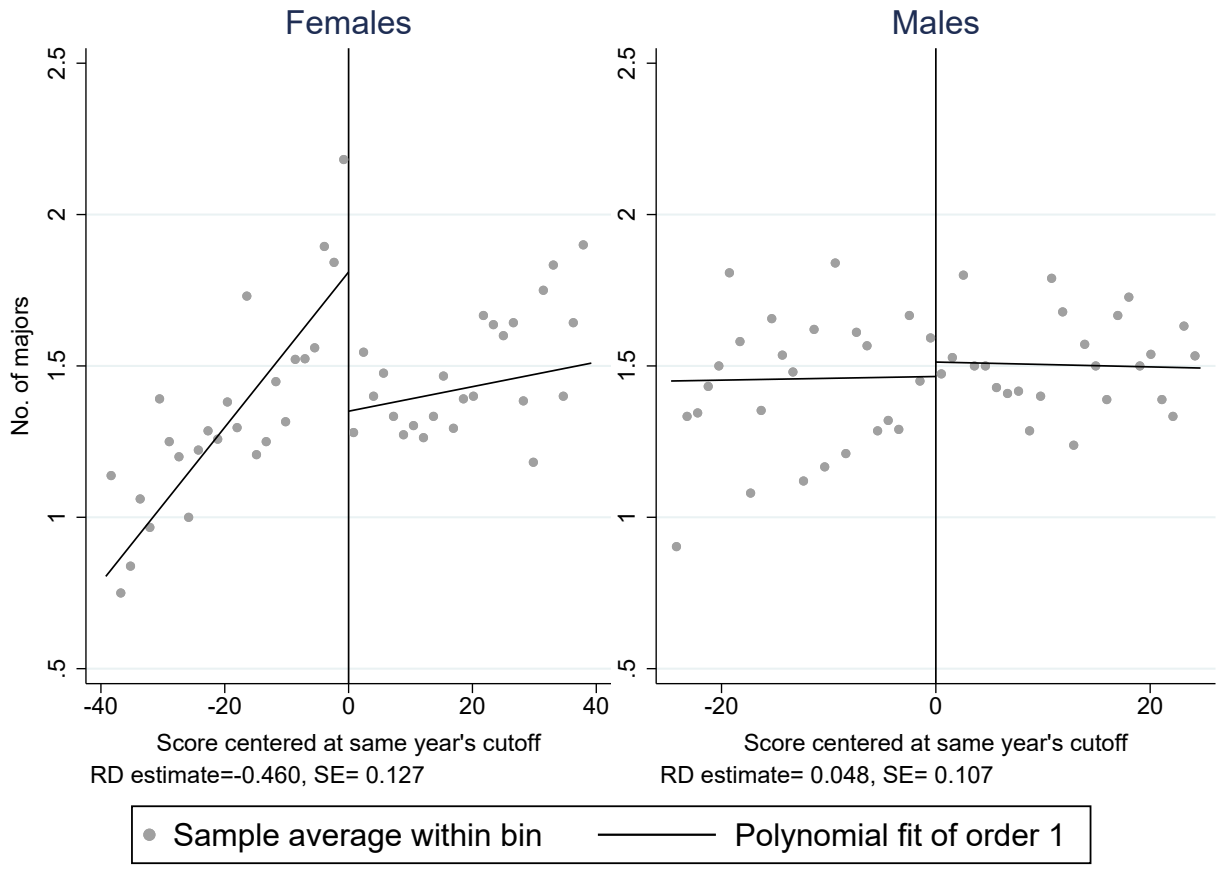


Figure 8: Number of majors ranked

Notes: The outcome sums the number of majors that applicants report in their admission group (priority group to select majors) and any other subsequent admission groups they are classified in.

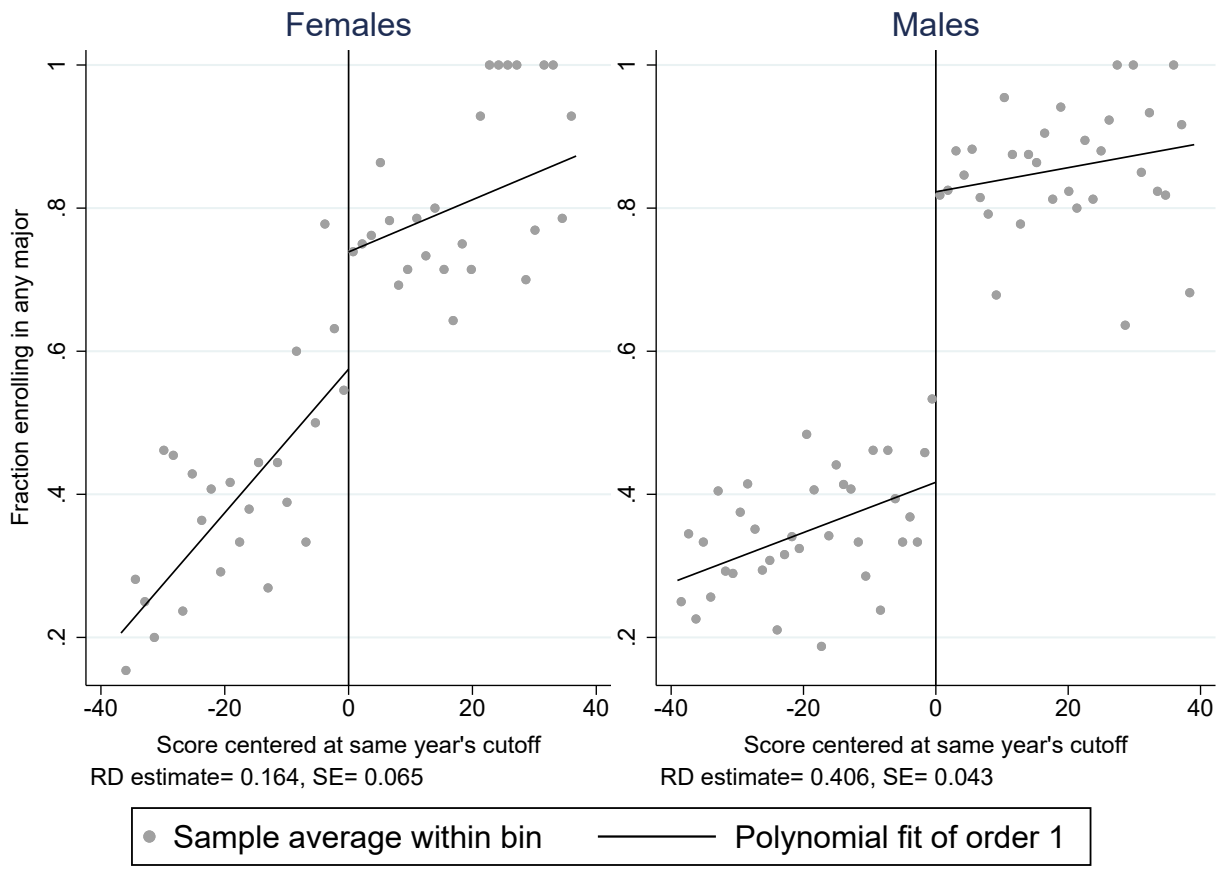


Figure 9: Likelihood of enrolling in *any* major

Notes: The outcome is an indicator of whether the applicant enrolls into any major in the first admission cycle covered by our data. To the left of the major-specific cutoffs, applicants cannot enroll in their preferred major by construction.

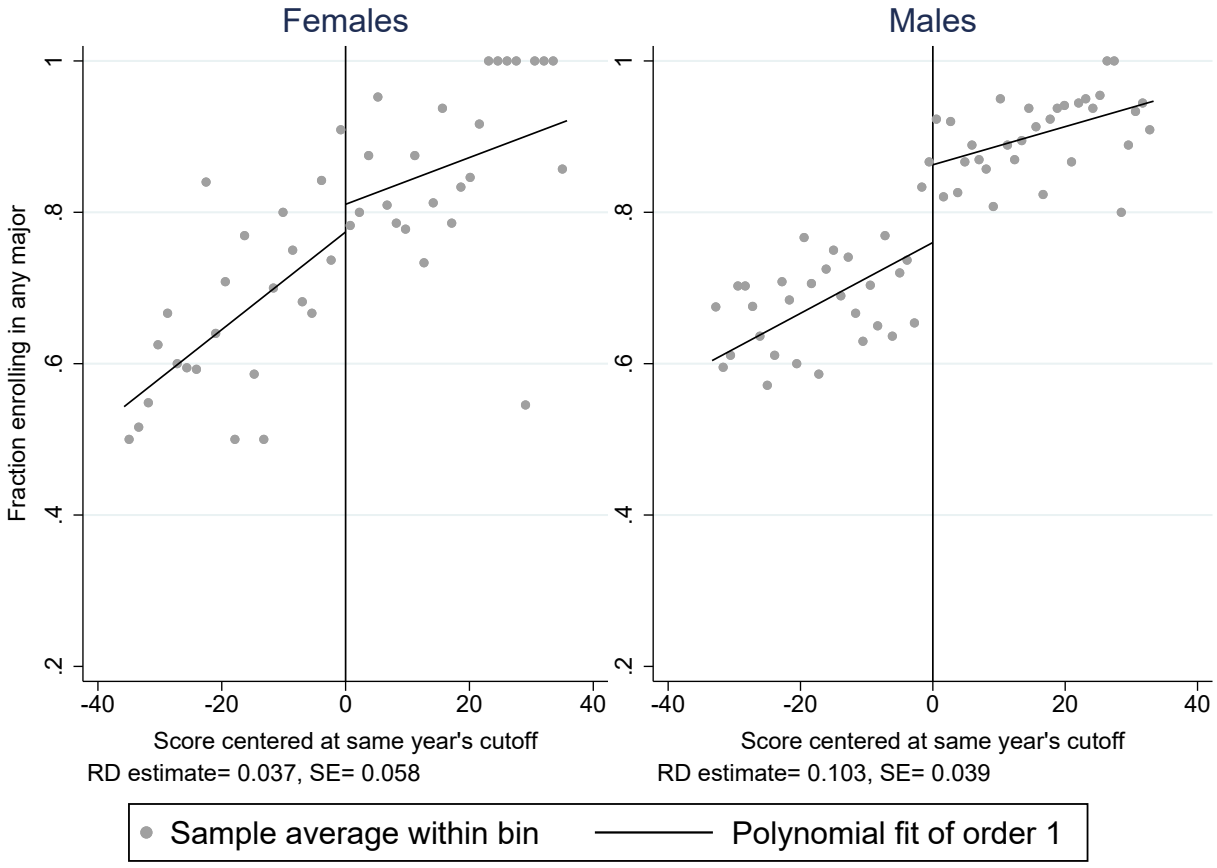


Figure 10: Likelihood of enrolling in *any* major over four admission cycles

Notes: The outcome is an indicator of whether the applicant enrolls into any major in any of the three admission cycles covered by our data.

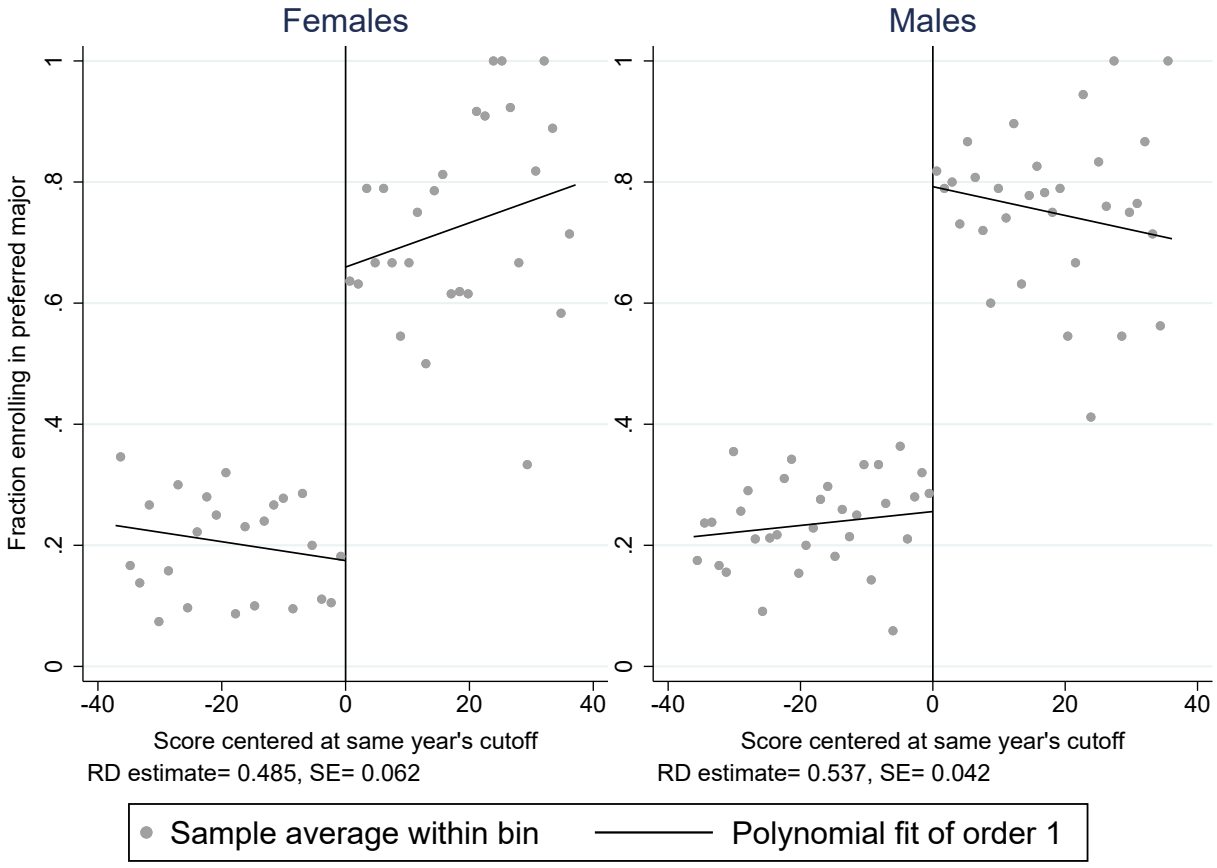


Figure 11: Likelihood of being admitted to their preferred major over three admission cycles

Notes: The outcome measures whether the applicant enrolled in their preferred major —as reported in the registration form for the first admission cycle —in any of the three admission cycles covered by our data.

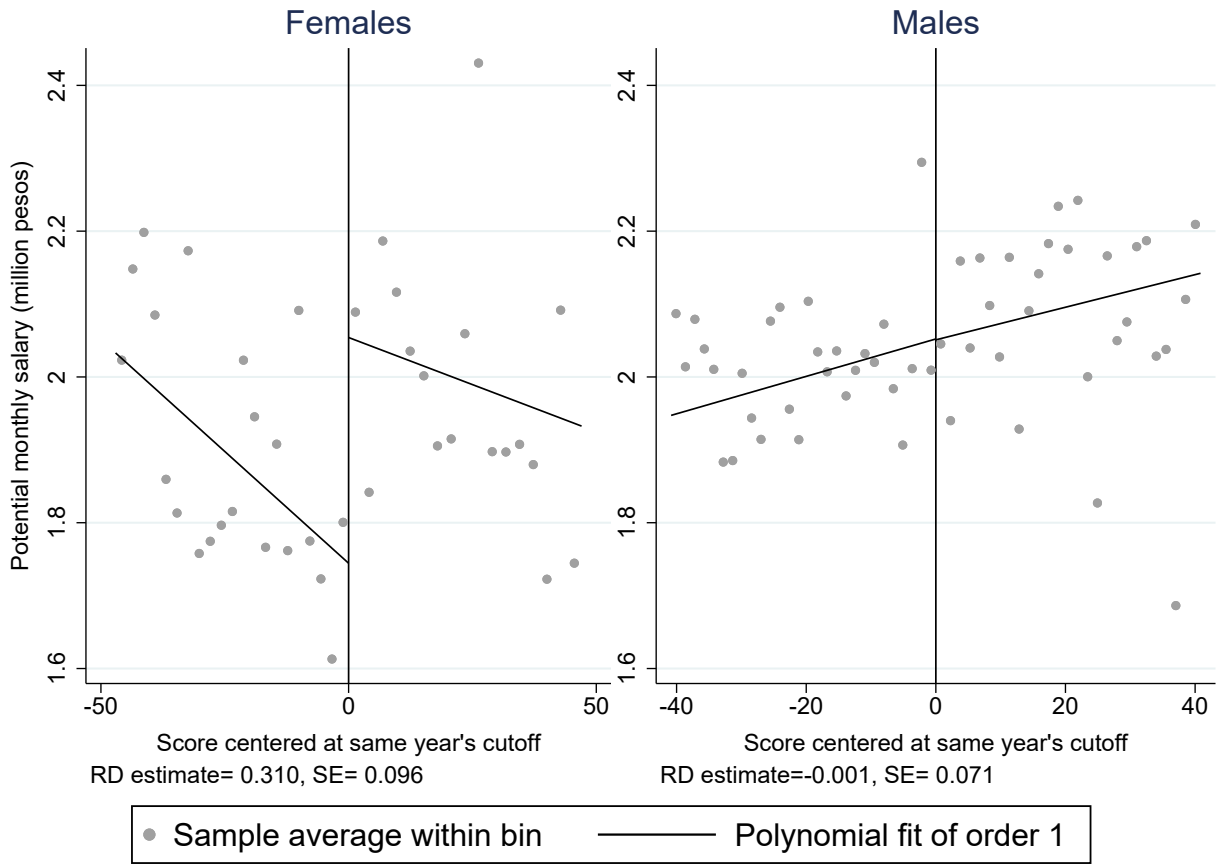


Figure 12: Potential salary of enrolled majors

Notes: The outcomes measures the income potential of enrolled majors based on the average monthly salary of alumni from this university who graduated between 2014 and 2016. The survey data is for one year post-graduation. The salary data is in million pesos and the exchange rate in 2020 fluctuated between 3,300 pesos per dollar to 4,000 pesos per dollar.

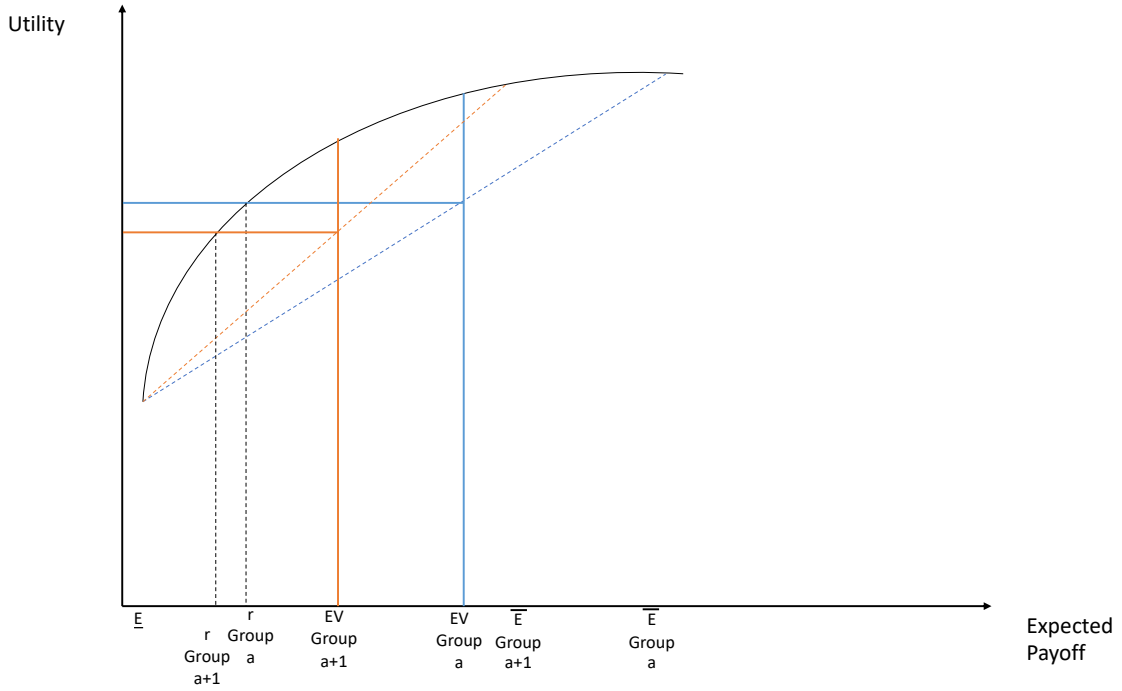


Figure 13: Different Admissions Groups

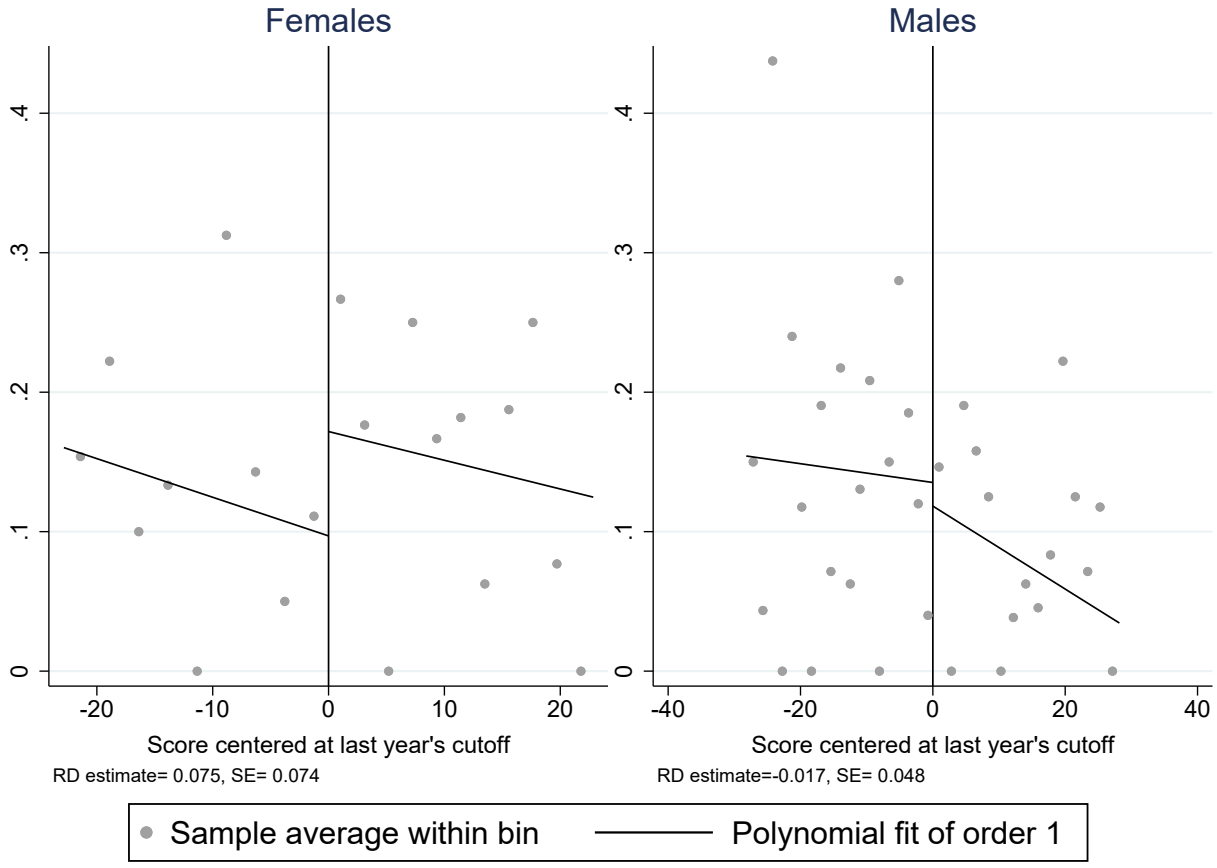


Figure 14: Fraction of applicants submitting no majors

Notes: The outcome measures the fraction of applicants who did not submit any major to be considered for admission across all priority groups.

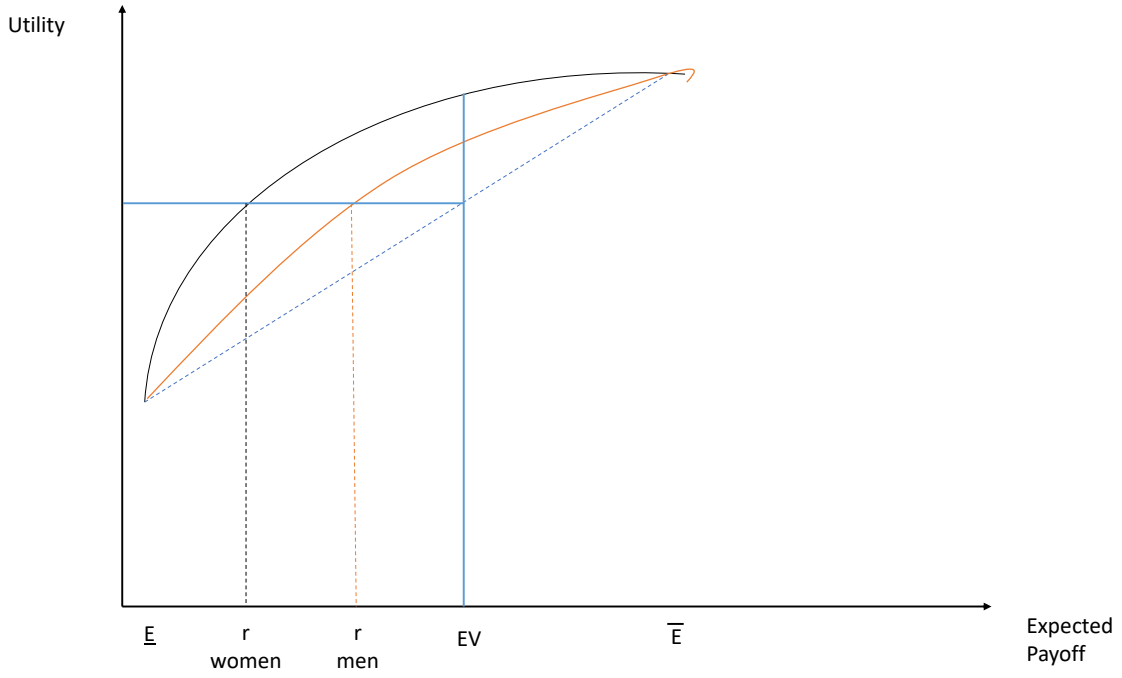


Figure 15: Different Risk Aversion

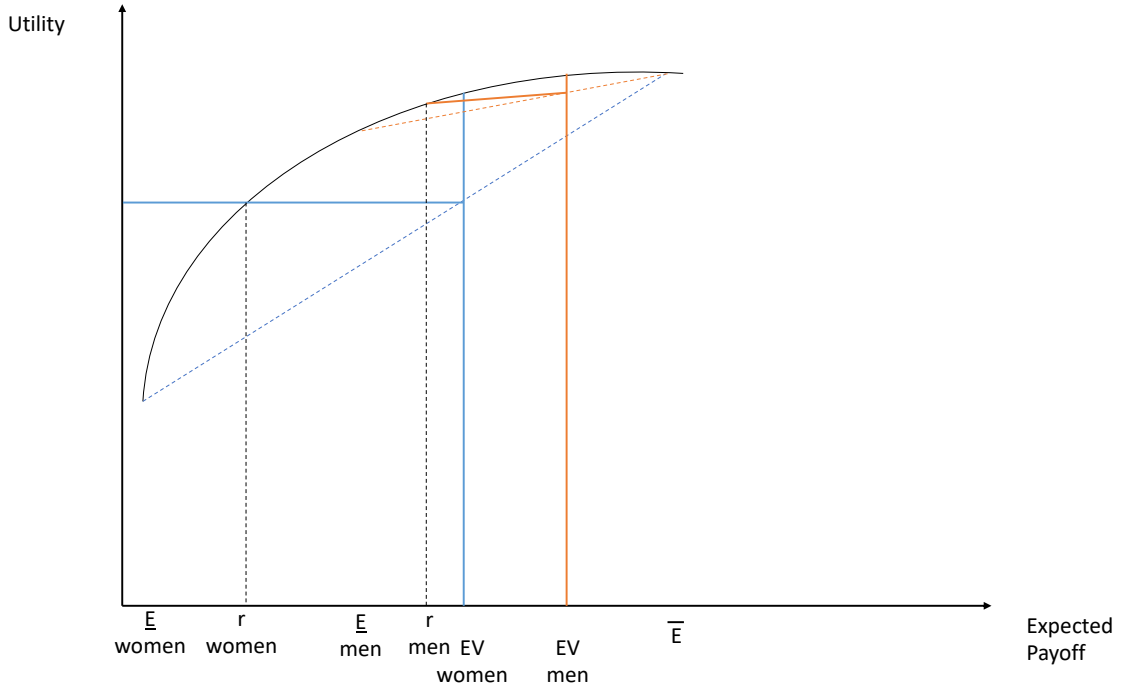


Figure 16: Different Costs of Not Being Admitted

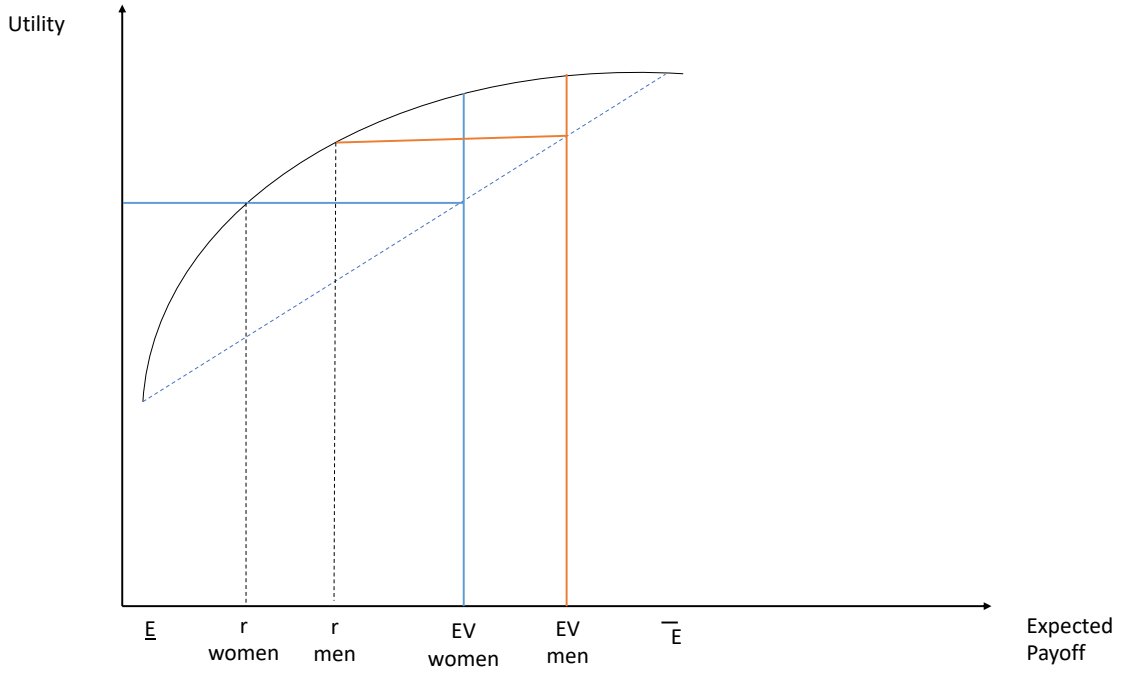


Figure 17: Different Beliefs

10 Tables

Table 1: Cutoffs and number of slots by major (part 1)

College major	Cutoff 2019-1	No. slots 2019-1	Cutoff 2020-1	No. slots 2020-1
Agricultural Engineering	637.8989	106	627.5051	105
Agronomic Engineering	635.624	90	625.1466	100
Anthropology	662.0044	35	658.6011	35
Architecture	694.9775	66	668.1536	82
Biology	728.266	30	699.9824	48
Business Administration	652.3063	120	653.3345	70
Chemical Engineering	687.6607	129	672.054	134
Chemistry	700.1125	75	670.3881	69
Cinema and Television	613.6038	28	623.0564	28
Civil Engineering	694.696	109	678.5037	109
Computer and Systems Engineering	700.5173	100	698.8107	100
Computer's Science	707.0986	33	707.6533	28
Dentistry	638.5678	75	627.1788	90
Economics	681.2656	120	667.314	105
Electric Engineering	690.7929	55	677.0153	60
Electronic Engineering	721.8709	60	712.2769	60
Geography	629.0294	35	626.4404	32
Geology	706.6311	33	692.7388	33
Graphic Design	678.183	32	683.5642	32
History	645.4142	60	627.5738	60
Industrial Design	672.6489	50	659.7461	46
Industrial Engineering	710.3484	44	683.9687	44
Law	688.647	82	681.2057	80
Linguistics	626.2433	45	624.5093	50
Literary Studies	650.4933	43	660.6105	44

Notes: The cutoffs are determined by the score of the applicant taking the last slot for each major every semester. The number of slots is predetermined by the university and announced before every admission cycle. The statistics from every admission cycle since 2007 can be consulted: https://admisiones.unal.edu.co/servicios-en-linea/estadisticas-del-proceso-de-admision/.

Table 2: Cutoffs and number of slots by major (part 2)

College major	Cutoff 2019-1	No. slots 2019-1	Cutoff 2020-1	No. slots 2020-1
Mathematics	713.0775	45	724.7126	32
Mechanical Engineering	702.5432	81	685.9037	81
Mechatronics Engineering	775.8461	45	767.7845	45
Medicine	776.6215	122	757.9305	128
Nursing	643.9633	89	638.8036	79
Nutrition and Diet	652.4565	50	648.2854	46
Occupational Therapy	625.2646	60	619.5499	55
Pharmacy	682.9627	56	683.7646	54
Philology and Languages: English	652.0954	44	651.7011	43
Philology and Languages: French	649.1097	22	646.6024	22
Philology and Languages: German	648.5624	21	650.06	22
Philosophy	645.7763	50	626.1694	50
Physics	726.0368	73	725.8575	89
Plastic Arts	616.9134	25	595.265	32
Political Science	657.8519	90	647.2855	86
Psychology	663.7908	75	673.1798	60
Public Accounting	637.2641	128	638.5212	100
Social Work	637.7145	41	631.1059	42
Sociology	653.783	39	646.568	45
Spanish and Classical Philology	637.3839	40	623.7555	44
Speech Therapy	625.3862	75	621.3111	60
Statistics	681.5716	55	668.7146	47
Veterinary Medicine	658.7451	50	655.1168	50
Zootechnics	629.7345	55	621.2348	60

Notes: The cutoffs are determined by the score of the applicant taking the last slot for each major every semester. The number of slots is predetermined by the university and announced before every admission cycle. The statistics from every admission cycle since 2007 can be consulted: https://admisiones.unal.edu.co/servicios-en-linea/estadisticas-del-proceso-de-admision/.

Table 3: Majors listed by priority group and 24-hour period

		Applicants in priority group:			
		1	2	3	4
Panel A. Major selection and slot allocation					
24h period	**Majors listed**				
	0	180			
1	1	389			
	2	920			
	0	308	532		
2	1	4	335		
	2	29	1,200		
	0	308	1,004	971	
3	1	0	20	139	
	2	0	87	570	
	0	308	1,002	1,134	1,692
4	1	0	1	9	101
	2	0	1	37	543
Panel B. No. of slots and applicants by priority group					
Majors with slots available		49	43	20	7
Total applicants in priority group		1,489	2,067	1,680	2,336
% females		30.6	34.4	36.1	40.2
% males		69.4	65.6	63.9	59.8
Not enrolled at the end of cycle 1		308	1,002	1,135	2,262
% of total females		22.4	45.2	65.6	95.7
% of total males		19.9	50.2	68.7	97.6

Notes: Panel A shows how many majors applicants list in each of the 24-hour periods they have access according to their priority group. Among the reasons why some applicants who do not list any majors are: their preferred major is no longer available and they decide not to select any of the available majors, they may have a access to a slot at another university, or they take the CEE just to know how well they perform. Panel B shows the number of majors with at least one slot available at the time each priority group logs in the online platform. The university offered 64 majors in the 2020-1 semester. If we exclude music majors, which require a specific exam on top of the CEE, applicants have 49 options to choose from.. Panel B also shows the total number of applicants and applicants not enrolled at the end of the process by priority group.

Table 4: Example of preference submission and slot allocation

		Preference rankings		**No. of slots**		**Cutoffs**			
Applicant	*Score*	*Choice 1*	*Choice 2*	*Choice 1*	*Choice 2*	*Choice 1*	*Choice 2*	*Admitted*	*Major enrolled*
A	760	Medicine	Law	128	80	758	681	Yes	Medicine
B	680	Mechanical eng.	Industrial eng.	81	44	686	684	No	
C	650	Zootechnics	Sociology	60	45	621	647	Yes	Zootechnics
D	620	Occup. therapy		55		620		Yes	Occup. therapy

Notes: Scores approximated to the nearest unit. Applicant A obtained a score of 760 points in the CEE and listed medicine and law as her first and second choices. Even though there were more slots for medicine than for law, the cutoffs (score of the last admitted student) is much higher for medicine than for law, suggesting that there is a higher demand for medicine among students scoring high in the CEE. According to the allocation mechanism, the university ranks all students according to their CEE and starts assigning slots. In this case, the score of this applicant allows her to obtain a slot in both majors she listed, and because she gave priority to medicine, she is admitted into that major. Applicant B listed two majors that ended up having higher cutoffs than her score, so she is not admitted. Applicant C's score would be high enough for both choices and her second choice ended up with a higher cutoff that the first. However, she listed Zootechnics first, so this is the slot she receives. Some applicants decide to list only one major as applicant D.

Table 5: Gender differences in diversification of majors

	Min. cutoff of majors ranked			No. of majors ranked		
	(1)	(2)	(3)	(4)	(5)	(6)
Below=1	0.228	0.863	0.831	0.117	0.112	0.075
	(3.755)	(2.682)	(2.022)	(0.081)	(0.079)	(0.078)
Female	-8.923*	-6.293*	-5.942**	-0.177*	-0.149*	-0.187**
	(4.961)	(3.708)	(2.802)	(0.093)	(0.090)	(0.088)
Below=1 × Female	-6.936	-0.669	2.913	0.356**	0.375***	0.382***
	(6.599)	(4.699)	(3.668)	(0.140)	(0.136)	(0.131)
Constant	679.611***	721.851***	680.232***	1.471***	1.541***	2.082***
	(2.771)	(2.827)	(2.383)	(0.055)	(0.061)	(0.086)
Priority group FE	No	Yes	Yes	No	Yes	Yes
Pref. major FE						
Observations	1951	1951	1951	2787	2787	2787

Notes: The table presents estimates of equation 1 for the outcomes in the column headings. The minimum cutoff of the ranked majors is last year's cutoff of the major with the lowest cutoff among all the majors the applicant ranks. The number of majors ranked takes into account all 24-hour periods an applicant participates in. The bandwidth for the pooled regression is chosen based on the largest CCFT bandwidth chosen when obtaining RD estimates separately by gender. The spefication includes an indicator for being below the cutoff, an indicator for being female, a linear polynomial on the running variable, and double and triple interactions between these variables. Column 1 does not inlcude any fixed effects, column 2 adds admission priority group fixed effects, and column 3 adds preferred major fixed effects. EHW standard errors at the student level. *** p<0.01, **p<0.05, * p<0.1.

Table 6: Gender differences in enrolling during the first admission cycle

	Enrolled in any major		
	(1)	(2)	(3)
Below=1	-0.374***	-0.363***	-0.366***
	(0.041)	(0.039)	(0.038)
Female	-0.102**	-0.083*	-0.096**
	(0.047)	(0.044)	(0.042)
Below=1 × Female	0.225***	0.219***	0.214***
	(0.069)	(0.066)	(0.064)
Constant	0.820***	0.924***	0.893***
	(0.027)	(0.030)	(0.040)
Priority group FE	No	Yes	Yes
Pref. major FE	No	No	Yes
Observations	2827	2776	2776

Notes: The table presents estimates of equation 1 which regresses whether applicants enroll in any major during the first admission cycle observed in the data. The bandwidth for the pooled regression is chosen based on the largest CCFT bandwidth chosen when obtaining RD estimates separately by gender. The spefication includes an indicator for being below the cutoff, an indicator for being female, a linear polynomial on the running variable, and double and triple interactions between these variables. Column 1 does not inlcude any fixed effects, column 2 adds admission priority group fixed effects, and column 3 adds preferred major fixed effects. EHW standard errors at the student level. *** p<0.01, **p<0.05, * p<0.1.

Table 7: Gender differences in enrollement over time

	Enrolled in any major (admission cycles 1-4)			Enrolled in preferred major (admission cycles 1-4)		
	(1)	(2)	(3)	(4)	(5)	(6)
Below=1	-0.067**	-0.078***	-0.084***	-0.458***	-0.457***	-0.465***
	(0.027)	(0.026)	(0.026)	(0.030)	(0.030)	(0.029)
Female	-0.058*	-0.034	-0.041	-0.075*	-0.066	-0.062
	(0.033)	(0.030)	(0.029)	(0.041)	(0.040)	(0.038)
Below=1 × Female	0.004	0.022	0.011	0.007	0.017	0.009
	(0.047)	(0.045)	(0.044)	(0.050)	(0.050)	(0.048)
Constant	0.882***	0.985***	0.937***	0.762***	0.853***	0.792***
	(0.019)	(0.021)	(0.025)	(0.024)	(0.027)	(0.030)
Priority group FE	No	Yes	Yes	No	Yes	Yes
Pref. major FE	No	No	Yes	No	No	Yes
Observations	5448	4752	4752	5893	5015	5015

Notes: The table presents estimates of equation 1 which regresses the outcomes in the column headers. The bandwidth for the pooled regression is chosen based on the largest CCFT bandwidth chosen when obtaining RD estimates separately by gender. The spefication includes an indicator for being below the cutoff, an indicator for being female, a linear polynomial on the running variable, and double and triple interactions between these variables. Column 1 does not inlcude any fixed effects, column 2 adds admission priority group fixed effects, and column 3 adds preferred major fixed effects. EHW standard errors at the student level. *** p<0.01, **p<0.05, * p<0.1.

Table 8: Gender differences in potential salaries of enrolled majors

	Mean salary in million pesos (enrolled in admission cycle 1)			Mean salary in million pesos (enrolled in admission cycles 1-4)		
	(1)	(2)	(3)	(4)	(5)	(6)
Below=1	-0.169***	-0.144**	-0.089*	-0.069	-0.032	-0.036
	(0.064)	(0.061)	(0.048)	(0.048)	(0.045)	(0.031)
Female	0.026	0.025	0.005	-0.066	-0.004	-0.023
	(0.092)	(0.084)	(0.048)	(0.069)	(0.064)	(0.036)
Below=1 × Female	-0.222**	-0.180*	-0.141*	-0.110	-0.169**	-0.110**
	(0.110)	(0.102)	(0.078)	(0.086)	(0.079)	(0.055)
Constant	2.078***	2.492***	1.903***	2.081***	2.530***	2.117***
	(0.048)	(0.062)	(0.047)	(0.038)	(0.049)	(0.033)
Priority group FE	No	Yes	Yes	No	Yes	Yes
Pref. major FE	No	No	Yes	No	No	Yes
Observations	1694	1674	1674	3644	3416	3416

Notes: The table presents estimates of equation 1 which regresses the outcomes in the column headers. The bandwidth for the pooled regression is chosen based on the largest CCFT bandwidth chosen when obtaining RD estimates separately by gender. The spefication includes an indicator for being below the cutoff, an indicator for being female, a linear polynomial on the running variable, and double and triple interactions between these variables. Column 1 does not inlcude any fixed effects, column 2 adds admission priority group fixed effects, and column 3 adds preferred major fixed effects. EHW standard errors at the student level. *** p<0.01, **p<0.05, * p<0.1.

Table 9: Gender differences in potential salaries of preferred majors and first choices

	Mean salary in million pesos (preferred major)		Mean salary in million pesos (first choice)		
	(1)	(2)	(3)	(4)	(5)
Below=1	-0.024	-0.034	0.016	0.035	0.043
	(0.045)	(0.041)	(0.064)	(0.060)	(0.032)
Female	-0.026	0.077	-0.015	0.015	-0.041
	(0.064)	(0.057)	(0.091)	(0.081)	(0.033)
Below=1 × Female	-0.034	-0.082	-0.176	-0.095	0.013
	(0.079)	(0.070)	(0.120)	(0.103)	(0.049)
Constant	2.052***	2.719***	2.098***	2.758***	2.085***
	(0.037)	(0.048)	(0.047)	(0.064)	(0.037)
Priority group FE	No	Yes	No	Yes	Yes
Pref. major FE	No	No	No	No	Yes
Observations	6289	5221	2351	2351	2351

Notes: The table presents estimates of equation 1 which regresses the outcomes in the column headers. The bandwidth for the pooled regression is chosen based on the largest CCFT bandwidth chosen when obtaining RD estimates separately by gender. The spefication includes an indicator for being below the cutoff, an indicator for being female, a linear polynomial on the running variable, and double and triple interactions between these variables. Column 1 does not inlcude any fixed effects, column 2 adds admission priority group fixed effects, and column 3 adds preferred major fixed effects. EHW standard errors at the student level. The preferred major fixed effects are collinear with the salary of the preferred majors so only two columns are shown for this outcome. *** p<0.01, **p<0.05, * p<0.1.

A Appendix Figures

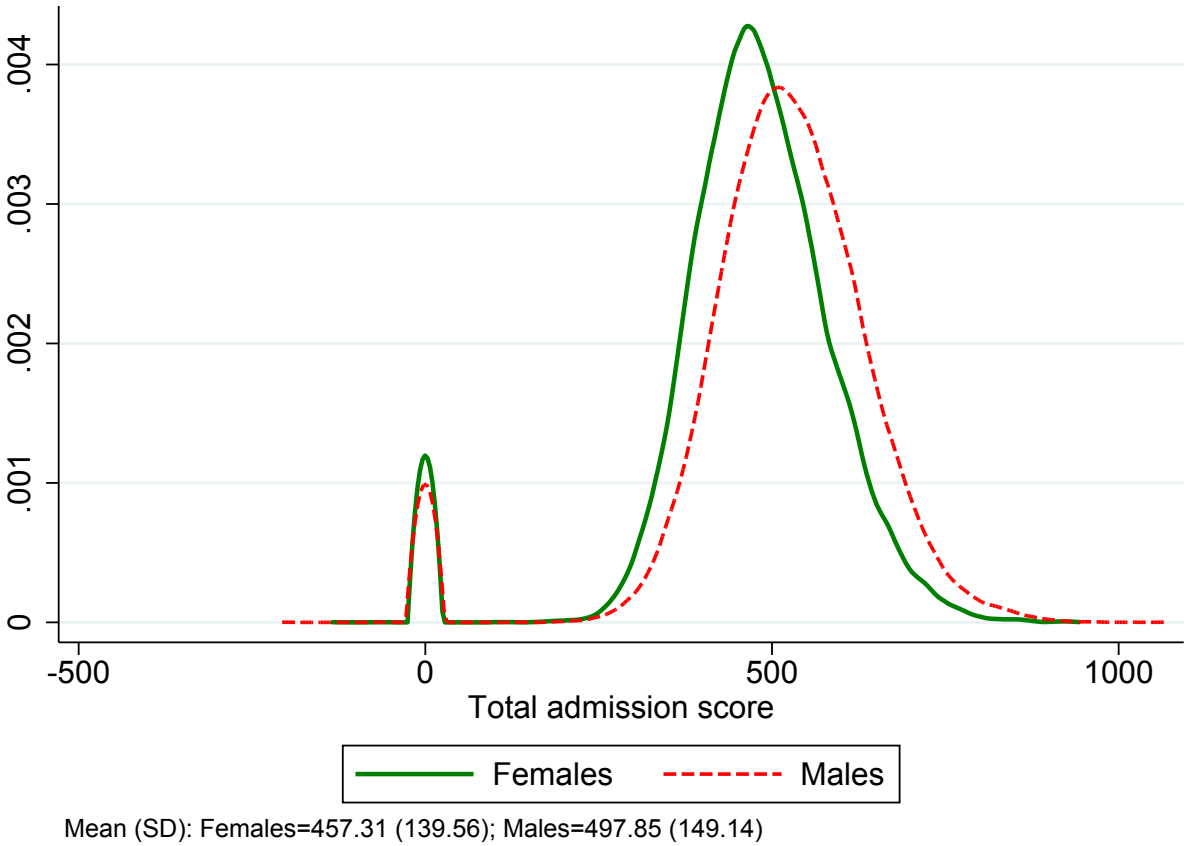


Figure A.1: Distriibution of standardized scores by gender

Notes: Scores of applicants to the 2020 I semester admission cycle.

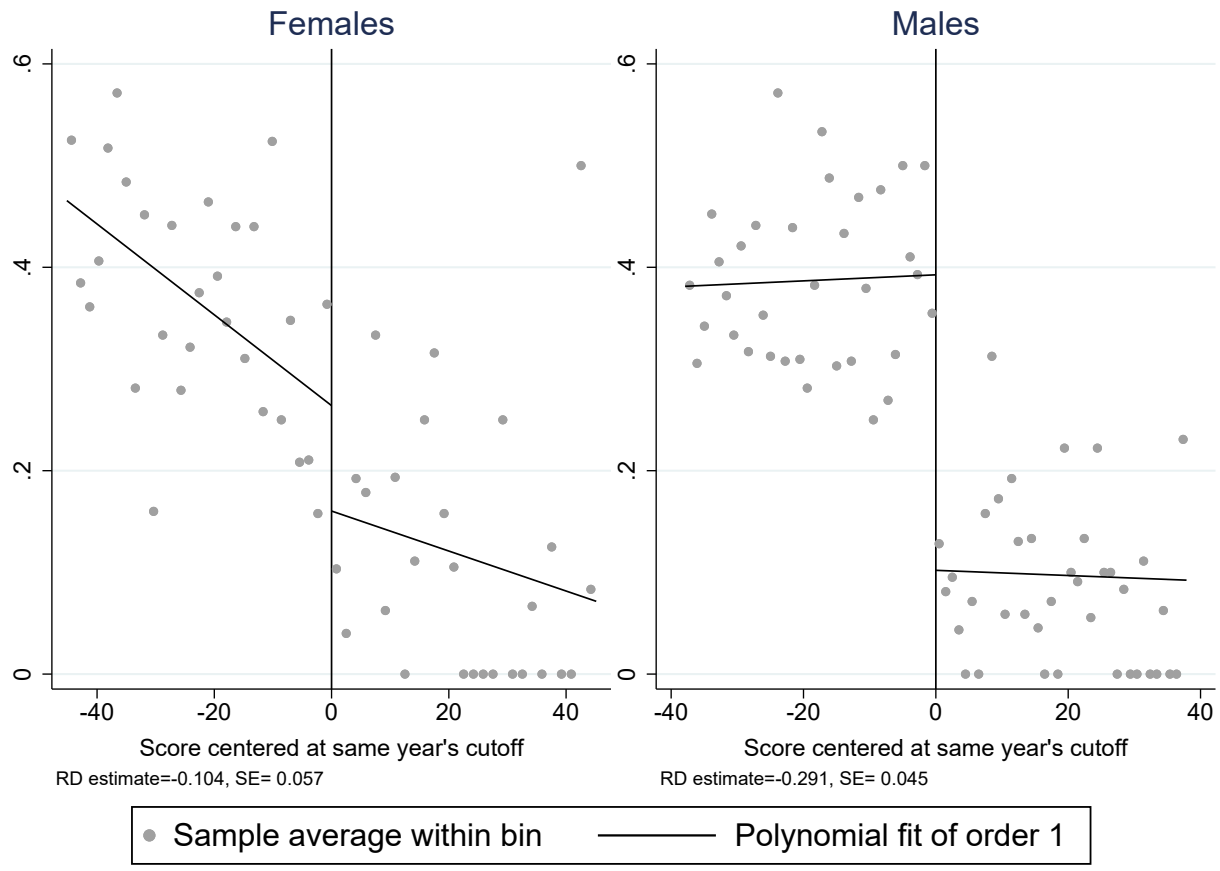


Figure A.2: Likelihood of retaking the CEE in the following two admission cycles

Notes:

B Appendix Tables

Table B.1: Gender differences in intended and reported majors

	Intending a selective major		No. options		
	(1)	(2)	(3)	(4)	(5)
Below=1	-0.024	-0.036	-1.552	-1.728***	-1.446***
	(0.035)	(0.036)	(1.037)	(0.398)	(0.242)
Female	0.030	0.066	-2.434*	-0.972*	-0.549*
	(0.046)	(0.046)	(1.310)	(0.510)	(0.319)
Below=1 × Female	-0.046	-0.071	-2.097	-0.292	-0.031
	(0.059)	(0.059)	(1.778)	(0.646)	(0.386)
Constant	0.450***	0.683***	30.942***	46.870***	36.048***
	(0.028)	(0.032)	(0.746)	(0.308)	(0.393)
Priority group FE	No	Yes	No	Yes	Yes
Pref. major FE	No	No	No	No	Yes
Observations	5561	4826	3819	3569	3569

Notes: The table presents estimates of equation 1 which regresses each outcome in the column headers on an indicator for being below the cutoff, an indicator for being female, a linear polynomial on the running variable, and double and triple interactions between these variables. Admission groups are one of the four priority groups that applicants are assigned into to select majors. EHW standard errors at the student level. *** p<0.01, **p<0.05, * p<0.1.

Table B.2: Gender differences in enrolling in major in the same college during the first admission cycle

	Enrolled in any major		
	(1)	(2)	(3)
Below=1	0.454***	0.443***	0.189***
	(0.068)	(0.070)	(0.069)
Female	0.042	0.045	0.067
	(0.060)	(0.060)	(0.063)
Below=1 × Female	-0.145	-0.135	-0.167*
	(0.103)	(0.103)	(0.093)
Constant	0.024	0.105	0.223**
	(0.045)	(0.065)	(0.088)
Priority group FE	No	Yes	Yes
Pref. major FE	No	No	Yes
Observations	820	816	816

Notes: The table presents estimates of equation 1 which regresses whether applicants enroll in any major in the same college (e.g., another major within the engineering college) during the first admission cycle observed in the data. The bandwidth for the pooled regression is chosen based on the largest CCFT bandwidth chosen when obtaining RD estimates separately by gender. The spefication includes an indicator for being below the cutoff, an indicator for being female, a linear polynomial on the running variable, and double and triple interactions between these variables. Column 1 does not inlcude any fixed effects, column 2 adds admission priority group fixed effects, and column 3 adds preferred major fixed effects. EHW standard errors at the student level. *** p<0.01, **p<0.05, * p<0.1.