

Strategic decisions have “major” consequences: Gender differences in college major choices

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Abstract

We study the academic choices of applicants to the largest public university in Colombia. In this setting, access to public university college slots is limited by capacity constraints, admissions are solely based on a college entrance exam score, and cutoffs for every major are determined endogenously by applicants’ scores and the demand for slots in different majors. We use rich administrative data on applicants’ exam scores, ranking of preferences and enrollment data to leverage the fact that applicants just below and above the major-specific cutoffs have essentially identical characteristics. We perform a RD-DD analysis to study gender differentials in college major choices comparing the choices made by applicants who just miss the cutoff for their top choice major —i.e., marginal applicants. We find that marginal women follow diversification and rush in strategies consisting in reporting a larger number of college options to be considered for in the slot allocation mechanism and rushing in to enroll in a less preferred major in the first admission cycle we observe. Marginal men are more likely to retake the exam in two subsequent admission cycles and end up selecting majors that have a better income potential than those selected by marginal women. The gender wage gap of potential income in our sample is about 7%, which suggests that strategic decisions in college major choices could explain over half of the gender wage gap among college educated workers in Colombia. Together, our findings suggest that occupational segregation and the gender wage gap are not only determined by unconstrained preferences, as previous work has suggested, but that it can be magnified by strategic decisions, even when there are no initial substantial gender differences in stated preference ranking of majors.

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1 Introduction

College major choices is a main contributing factor to the gender pay gap and occupational segregation among highly-educated workers (Black et al., 2008). Gender differences in college major choices have been found to be related to differences in preferences and tastes (Zafar, 2013), competitiveness (Niederle & Vesterlund, 2007; Buser et al., 2014), ability (Paglin & Rufolo, 1990; Turner & Bowen, 1999; Arcidiacono, 2004), and expected earnings (Wiswall & Zafar, 2015; Arcidiacono et al., 2012). Despite a recent trend toward convergence in college major choices, women still choose majors with lower income potential than men, and these choices strongly predict gender wage gaps in the labor market (Sloane et al., 2019).

Besides student pre-determined characteristics —the focus of the previous literature —, context and strategic decisions can also play a role in selecting college majors. In many countries, access to the most selective universities and college programs is determined by performance in a single exam and entails making constrained choices within a slot allocation mechanism. Previous work has found that females’ underperform in such high stakes exams relative to men (Ors et al., 2013; Azmat et al., 2016; Cai et al., 2016) and that the college admission gender gap is twice as large at the top of the academic ability distribution than at the bottom (Jurajda & Munich, 2011). Such settings could exacerbate preexisting gender differences in college major preferences if women follow different strategies relative to men.

Little is known about the gender gap in college major choices and the consequences of those choices in settings where students cannot access their most preferred majors but may strategize which majors to enroll in. The standard selection procedure at many higher education institutions is to define a cutoff based on scores in a standardized test. Students whose score is above the cutoff are admitted to their chosen college major or university.

Students below the cutoff are not admitted to their preferred option but may have access to other, a priori, less desirable options. While recent literature highlights the importance of gender differences in strategic behaviors in college applications (Saygin, 2016; Delaney & Devereux, 2021), there is no causal evidence that marginally failing to reach a cutoff could magnify gender gaps in students' choices.

We study the academic choices of applicants to the largest public university in Colombia. In this setting, access to public university college slots is limited by capacity constraints, admissions are solely based on a college entrance exam score, and cutoffs for every major are determined endogenously by applicants' scores and the demand for slots in different majors. Over 42,000 students applied to the Bogotá Campus for admission to the 2020 semester I cycle with an overall acceptance rate around 7 percent. While females are 52 percent of the applicants, they represent only 35 percent of the admitted students. Applicants in our sample are those who obtain a score in a neighborhood of the cutoff for their preferred major, which is an unconditional preference stated at registration before the college entrance exam takes place.

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 preferred major on applicants' academic choices. Specifically, we ask two research questions: (i) How does being marginal affect the gender gap in selected majors, and (ii) What are the consequences of these choices?

We use rich administrative data on applicants' exam scores, ranking of preferences, and enrollment data to leverage the fact that applicants just below and above the major-specific cutoffs have essentially identical characteristics. We report regression discontinuity (RD) estimates separately by gender and perform regression analysis to study gender differentials in college major choices. Our focus is on comparing the choices made by male and female applicants who just miss the cutoff for their top choice major. These marginal applicants must then decide whether to seek a slot in a less preferred major.

We first demonstrate that marginal female applicants follow a “diversification” strategy by reporting a larger number of majors than men for which they want to be considered for in the slot allocation mechanism. On average, marginal women report 0.4 more majors than marginal men. Among applicants above the cutoff, however, there is no gender difference in the number of majors reported. This behavior suggests that not all women follow this type of strategy as previous work has documented (Delaney & Devereux, 2021), but that it is the reaction of women who marginally fail to obtain a slot in their preferred choice.

Second, we document a new type of strategic behavior, which we term “rush in.” Female applicants whose score is high but who just miss the cutoff to enroll into their most preferred major are 23 percentage points more likely to enroll in a less preferred major than marginal male applicants. This gender difference in enrollment is not driven by differences in the selectivity of the college major they initially intend, but result from different strategic decisions involving women selecting majors for which they will be easily admitted.

Over time, looking at data over the two subsequent admission cycles, we observe that practically all applicants are enrolled at this university since our sample of applicants around the major-specific cutoffs contains the top students. Specifically, we provide evidence that marginal men, who were less likely to enroll in the first admission cycle in our data, are more likely to retake the exam and eventually enroll in a major. Hence, the gender difference in enrollment disappears. The rush in strategy involves marginal women rushing to enroll in a major the first cycle we see them applying, while men tend to wait, retake the exam, and enroll at a later period.

Turning to outcomes related to the consequences of the gender differential in choices, we find that the diversification and rush in strategies result in women enrolling into majors with lower income potential. Using data from a survey of recent graduates, we use reported salaries as a measure of potential income for each major. We find that while there is no gender difference in the potential salary of applicants just above the cutoff, i.e., those who can select their preferred major, marginal women select majors with potential salaries about

7% lower than marginal men. We do not find evidence of a gap in the potential income of intended majors, so this gap is a direct consequence of strategic decisions. Taken at face value, the 7% gender wage gap in potential wages would imply that over half of the gender wage gap for workers with tertiary education in Colombia, which is estimated to be 11.8% ([National Ministry of Education, 2017](#)) is explained by gender differences in strategic college major decisions.

To shed light on the possible mechanisms behind the gender gap in academic decisions, we combine administrative, experimental and survey data obtained from applicants and current students. Specifically, we study how gender differences in risk aversion could both explain the differences in retaking behavior and diversification. We also look at the role of information and parental expectations in this setting. We are currently working on the implementation of this part of the study and will have results soon.

Our main contribution is to uncover strategic decisions by college applicants as a new channel explaining gender differences in college major choices. In particular, we provide the first causal evidence that a marginal failure can trigger different female and male students' reactions. 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 providing causal evidence of the “diversification” strategy and show that not all women follow this strategy, but only those who fall just below the major-specific cutoffs required to get access to their preferred major. In addition, we provide the first evidence for the “rush in” strategy that, together with the diversification strategy, make marginal women face worse income prospects than those of marginal men.

Together, our findings suggest that occupational segregation is not only determined by unconstrained preferences, as previous work has suggested, but that it can be magnified by strategic decisions, even when there are no initial substantial gender differences in the stated preference ranking of majors.

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 2.6.¹ Private universities usually use the score in the national standardized exam along with interviews as assessments for admission. Many public universities have their own college entrance exam (CEE) and solely base admissions on the performance in that exam. There are no streams or tracking in Colombian high schools, 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), seek a college slot at a public university.

Our sample and data comes 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 of them take the Universidad Nacional de Colombia CEE.² Besides students graduating from high school in the same year that they take the CEE, there are many applicants who take it at later semester on for reasons such as failing in previous attempts and taking preparatory courses for the exam. Students can take it as many times as they wish provided they cover the small registration fee and are not currently students at this university.

Access to college slots in Colombia is characterized by capacity constraints as there

¹There are 83 public and 213 private institutions including vocational and technical institutions, and “university foundations” (fundaciones o 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/>.

²According 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 and 44% to medium SES.

are few universities offering 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 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 *preferred* or *intended* major. We take this report as a student's unconstrained preference that is independent on the score she will obtain in the CEE. Applicants are given a time and date to take the CEE in person and take the exam on paper. The exam does not differ by the major applicants wish to enroll in and no other universities use the score or have access to the questions in this CEE.³

The duration of the exam is 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.⁴ The exam is graded by scantron machines, so there is little possibility for manipulation, and there is no opportunity for score revisions. The final score including all exam components is standardized with a mean of 500 and a standard deviation (SD) of 100. The exam results are usually released within two weeks. 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 group.

³The 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.

⁴Text analysis is basically reading comprehension. Image analysis contains problems similar to abstract reasoning tasks.

Applicants who score at least 600 points (1 SD above the mean) are assigned into four admission groups that have different levels of priority to select slots. 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. Each group has access to a platform for 24 hours to rank up to two major options they wish to be considered for. All students within the group can access the platform at any time within the 24 hours. If an applicant is not admitted to any of the majors she ranks or does not select any majors, she can access the system with applicants in the next priority group, but it could be the case that some majors are no longer available because all the slots were taken by the previous group. The slot allocation ends when all slots are successfully assigned, and students start college a few months after this process.⁵

2.2 College major selection process and slot allocation mechanism

The likelihood of getting access 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 students, and her score rank among other applicants intending the same major. To report major preferences, applicants enter a platform within the 24 hours allocated to their admission group and select up to two choices. When they access the platform, they can see how many slots are left for each major,⁶ their score, and their score rank. They do not know how many applicants are in their group or what the cutoffs for the majors will be in the current admission cycle since these are determined endogenously by the score of the applicant taking the last slot in each major.⁷ Table ?? shows the cutoffs and number of slots for every major in the 2019 second

⁵For example, the CEE for admission to the 2020-1 semester took place in September 2019. New students started classes in February 2020.

⁶The overall number of slots is predetermined by the university and is public information available in the Admissions Directorate website.

⁷They 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.

semester (2019-2) and 2020 first semester (2020-1) admission cycles.

The university follows a Serial Dictatorship (SD) mechanism for allocating slots within admission group. Once the results from the CEE are known, the university prioritizes slots for students with higher scores and then looks at reported preferences. Hence, students with higher scores will have priority in the majors they select no matter the order in which they list them.⁸ To illustrate how obtaining the highest possible score matters, for the 2020-1 cohort 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 the majors with the highest demand are usually taken by applicants in group 1.

Table 1 shows four examples of applicants' choices and whether they are admitted or not. Applicant A obtained a score of 760 points in the CEE and listed medicine and law as her two college major 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, but 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 than 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.

⁸In the Boston mechanism, which used to be one of the most popular in education, priority is given to reported preferences first and then to score in the CEE. This mechanism has been found to incentivize strategic behavior (not truth-telling), and to be inefficient and unfair (Abdulkadiroğlu & Sönmez, 2003; Ergin & Sönmez, 2006; Kesten, 2006; Calsamiglia et al., 2010; Ma et al., 2016).

3 Data and Descriptive Statistics

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 complement the administrative data with survey and experimental data obtained from current students at or applicants to Universidad Nacional de Colombia. We focus our analyses on applicants to the Bogotá Campus, which is located in the capital and largest city in Colombia, with a population around 10 million inhabitants including the metropolitan area. With over 25,000 undergraduate students, this is the largest of the five university campuses and the one offering the majors with the highest demand.⁹ It also contains the largest share of applicants as 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. We complement the administrative records with publicly available information of cutoffs and numbers of slots for every major.¹⁰

The other major source of information is experimental and survey data obtained from current students and applicants. This data was collected online in May 2021 and is mainly

⁹Statistics about the Bogotá Campus can be found here: <http://planeacion.bogota.unal.edu.co/cifras.html>.

¹⁰This information can be found for every admission cycle since 2007 at <https://admisiones.unal.edu.co/servicios-en-linea/estadisticas-del-proceso-de-admision/>.

used in the section about mechanisms (Section ??).¹¹ The experiment was designed to test whether risk aversion is a potential underlying mechanism for the results we observe with the administrative data (see details in Section ??]. We also collected data on applicants' outside options, their perception of their parents' preferences, income expectations, and the information they had available at the time they make college major choices.

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.¹² 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.

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.

4 Econometric Strategy

In the main analysis we use a regression discontinuity design (RDD) using the cutoffs determined in the 2020-1 admission cycle and each applicant's preferred college major. Our running variable is the applicant's standardized score in the CEE centered at the cutoff for her 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. Hence, this setting generates a

¹¹The experiment and survey were pre-registered in the AEA RCT Registry.

¹²The data and publication from the Labor Market Observatory for Education can be found here: <https://ole.mineducacion.gov.co/portal/>.

sharp RD where applicants at or to the right of the cutoff are able to enroll in their preferred major, while those to the left of the cutoff are not. However, they may still choose other majors that have slots available.

We leverage that applicants just below and above the major-specific cutoffs have essentially identical characteristics to identify the effect of being a marginal applicant on college major choices and their characteristics. We define marginal applicants as those who just miss the cutoff for their most preferred major. We present RD estimates and standard errors separately by gender using the econometric methods and bandwidth selection from [Calonico, Cattaneo, and Titiunik \(2014\)](#). We further quantify the extent of gender differences using the following specification:

$$Y_i = \alpha_0 + \beta_0(Below_i \times Female_i) + \beta_1(Below_i \times Score_i) + \beta_2(Female_i \times Score_i) + \beta_3(Below_i \times Female_i \times Score_i) + \beta_4Below_i + \beta_5Female_i + \beta_6Score_i + \varepsilon_i \quad (1)$$

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 score centered at the cutoff of her preferred major.

The coefficient we are interested in is β_1 , which measures the additional effect on Y_i of being a marginal female applicant relative to a male marginal applicant. The specification is linear since we only use observations within the bandwidth. To avoid choosing a bandwidth that is too small when pooling men and women together in the regression relative to the bandwidth used in the RD plots, we pick the largest bandwidth between the individual estimates for men and women.¹³ Standard errors are Eicker-Huber-White.

Two main features of this setting make it interesting to analyze gender differences in

¹³These two bandwidths do not usually differ by much.

the behavior of marginal applicants. First, as explained before, applicants do not know exactly where the cutoffs in the admission cycle they are participating will be, so they may be strategic about what majors to choose or how many majors to report.¹⁴ It is possible that female and male marginal applicants' choices differ because they have a different perception of their chances of obtaining a slot given their score in the CEE, may have different preferences in terms of securing a slot even if it is not in their preferred major, etc. Second,

4.1 RD validity

We present two pieces of evidence for the validity of our RD design. Figure 3 shows that the score in the CEE is not manipulated as there are no discontinuities in the density of the running variable. We find statistical or visual evidence that the densities are smooth around the cutoff using the methods proposed by Cattaneo, Jansson, and Ma (2020).

We obtain RD estimates for a group of baseline covariates including sociodemographic, high school, and parental characteristics. Figures ?? and ?? show that there is no evidence of discontinuities in any of the 10 covariates.

5 Results

We find large differences in the strategies followed by male and female marginal 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 two additional admission cycles, we see that the enrollment gender gap decreases substantially because students 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 income potential of the majors they end up enrolling in relative to marginal men.

¹⁴Recall that students who do not obtain a slot in their best admission group are given the chance to report majors in the admission groups choosing majors after their best group.

Our main results are in Figures 6 to 11, and Tables 2, 3 and 4. Each figure plots the outcome separately for male and female applicants within a gender-specific bandwidth. 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 and are local linear regressions within the largest gender-specific bandwidth among the two we obtain in the RD plots.

5.1 Gender differences in preferred and reported majors

We first look at whether there are preexisting differences in preferences for majors among male and female applicants. Figure 6 plots whether their preferred major as reported in the registration form before taking the CEE is in the top quartile of admission rates, i.e., majors with high demand and low admission rates. Around 50% of applicants, regardless of gender, intend one of the very selective majors, and there is no statistically significant discontinuity at the major-specific cutoffs. Figure ?? and Figure 6 indicate that there do not seem to be differences in the types of majors men and women intend before they take the CEE.

As mentioned before, women tend to perform worse in this CEE than men as has been found in several papers examining the performance in high-stakes, competitive settings (Ors et al., 2013; Azmat et al., 2016; Cai et al., 2016). 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, she can still choose among other majors. In fact, column 2 of Table 2 shows that marginal students right below the cutoff of their preferred major have about 44 majors to choose from.¹⁵ Hence, there could be some strategies involving the number of majors reported and the quality of those majors. For instance, when an applicant in the top priority admission group 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 reporting a larger

¹⁵The 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 about 49 options to choose from.

number of college majors in their application. Figure 7 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 an applicant is classified in. 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 2 quantifies this gender difference at reporting 0.38 more majors (column 3). This 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, however, we can identify that this is not a strategy followed by *all* women. Female applicants above the cutoff for their preferred major do not behave differently from men. The gender difference emerges among applicants who face a setback when marginally failing to obtain a slot in their preferred major.

5.2 Gender differences in enrolled majors

The “diversification” strategy followed by marginal women increases the likelihood of enrolling in a major in the same cycle they are applying to, and to a lesser extent in the following two admission cycles. Figure 8 shows the likelihood of enrolling in any major at the Universidad Nacional de Colombia in the 2020-1 cycle. About 80% of applicants of both genders who score at or above the cutoff for their preferred major enroll in a major, which most likely would be their preferred major. Applicants to 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—less preferred—major. Table 3 quantifies this gender difference at 22.6 pp (column 1). This difference is only slightly reduced to 18.5 pp when looking at majors that could be close substitutes (column 2). For example, a marginal applicant’s preferred major could be mechatronics engineering but because her score is not high enough for this major, she enrolls in mechanical engineering, which is a close substitute within the engineering college.

Over time, when we look at the behavior over two additional admission cycles, we see that the enrollment gender gap decreases substantially. Figure 9 shows the likelihood of enrolling in any major including applications to the admission cycles 2020-2 and 2021-1 in addition to the first admission cycle we observe (2020-1). There is no longer a discontinuity in enrollment at the cutoff in the case of females, and it is reduced from 40 pp when looking at the first admission cycle only to 12 pp in all three cycles in the case of men. Column 3 in Table 3 indicates that, across all three admission cycles, 98.5% of male applicants at or to the right of the cutoff enroll in a major at this university, and there is no statistical difference with respect to females at or to the right of the cutoff. Below the cutoff, marginal men are 8.4 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 the 2020-1 cycle retaking the exam in the following cycles and eventually enrolling in a major. The main difference is that women are much more likely to do so in the first period we observe, while men seem to take more time to retake the exam and eventually enroll in a major. In fact, marginal men are more likely to retake the CEE in subsequent periods as we show in Appendix Figure A.2 and as has been documented in other work (Landaud & Maurin, 2020).

5.3 Consequences of gender differences in strategies

So far, we have shown large initial gender differences in the propensity of enrolling in a less-than-preferred major among marginal applicants that practically fades away over time as they have the chance of participating in subsequent admission cycles. The question is whether the diversification and rush in strategies is costly for women and if men are better off by waiting.

We first look at whether marginal applicants end up enrolling in their preferred major within the three 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 retake the exam, 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 since they are more likely to retake the exam. Overall, 85% of men at or above the cutoff enroll in their preferred major while similar women are 8 pp less likely to do so (column 4 in Table 3).¹⁶ Below the cutoff, Figure 10 and Table 3 show that about 20% of marginal students end up enrolling in their preferred major and there is no gender difference in this proportion.

Even though marginal women’s strategy is not costly in terms of access to preferred majors, it has a downside in forgone income. We use the average salary of graduates from a survey of Universidad Nacional de Colombia alumni to generate an “potential” salary measure by major. While the potential salary of majors enrolled by men is almost flat around the discontinuity, there is a clear discontinuity in the potential salaries of marginal women and women scoring at or above the cutoff (Figure 11). The RD estimate for females is 0.3, which means that marginal women will earn 0.3 million pesos less than non-marginal women based on the majors they enrolled 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 4 reports the gender differences in potential salaries for different applicants’ college major choices from equation 1 with admission group fixed effects. The first two columns suggest that waiting to retake the exam is a good strategy for marginal applicants. Men who enroll in the 2020-1 cycle (column 2) end up selecting majors that have considerably lower income than men with scores at or above the cutoff. This difference disappears, nevertheless, when looking at enrollments in all three admission cycles (column 1). In the case of women,

¹⁶One possible explanation for the gender difference at or above the cutoff is that women choose a major that is not their preferred one because they think their score is not going 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 not way that applicants could anticipate that this would be the case.

the interaction coefficient in column 1 is still negative and statistically significant, indicating that retaking the exam helped them in terms of the income prospect of the majors they enroll in but not as much as men. There were no differences in the expected salaries of the preferred major (column 3) or the first choice listed at the time of reporting majors (column 4). This last point that the average potential salary of the preferred and first choice majors do not differ by gender or across the cutoff reinforces the point that men and women do not differ in their intended majors but the differences we observe are related to the diversification strategy as women tend to report more majors with lower income potential.

6 Conclusion

We provide evidence that gender differences in college major choices are not only a result of pre-determined characteristics such as underlying preferences or ability, as other papers have found, but that they can also emerge as a result of a complex decision processes. In a setting involving capacity constraints in the number of college slots available and a slot allocation mechanism to assign them, university applicants can make strategic decisions that affect the college major they enroll in. Female applicants of essentially the same ability level are much more likely to follow diversification and rush in strategies when selecting majors if they are just to the left of the cutoff that would allow them to enter their most preferred major than if they are at or to the right. These strategic decisions regarding college majors are costly as women just to the left of the cutoff end up enrolling in majors with lower income potential than similar women above the cutoff and than men.

Many countries in the world have capacity constraints and use slot allocation mechanisms similar to the one we study. To date, it was unclear how applicants who face a failure in their attempt to obtain a college slot in their preferred major would react and what consequences the choices they have. It is important for universities and countries to understand the implications of their policies for assigning college slots as they generate gender differences

that hurt women in the long run, perpetuate inequalities in the labor market and limit the opportunities for women later in life.

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7 Figures

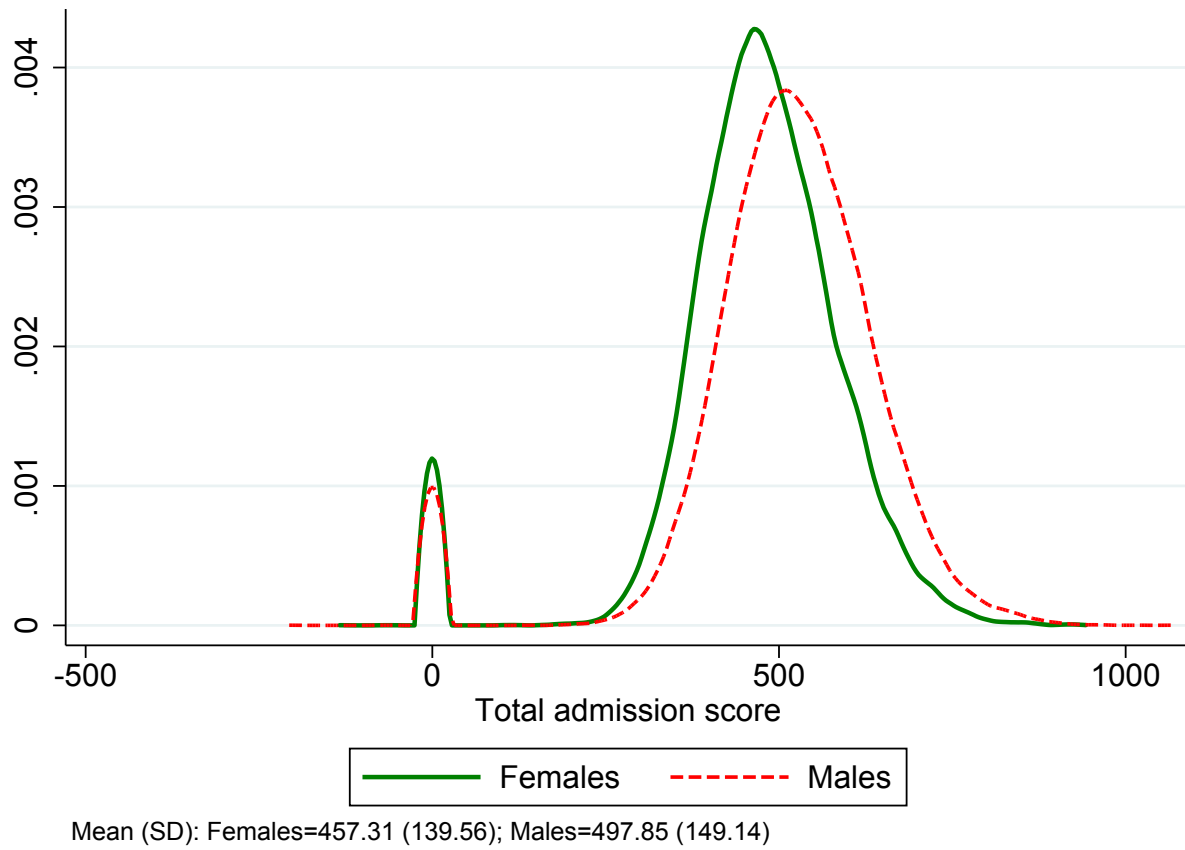


Figure 1: Distribution of standardized scores by gender

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

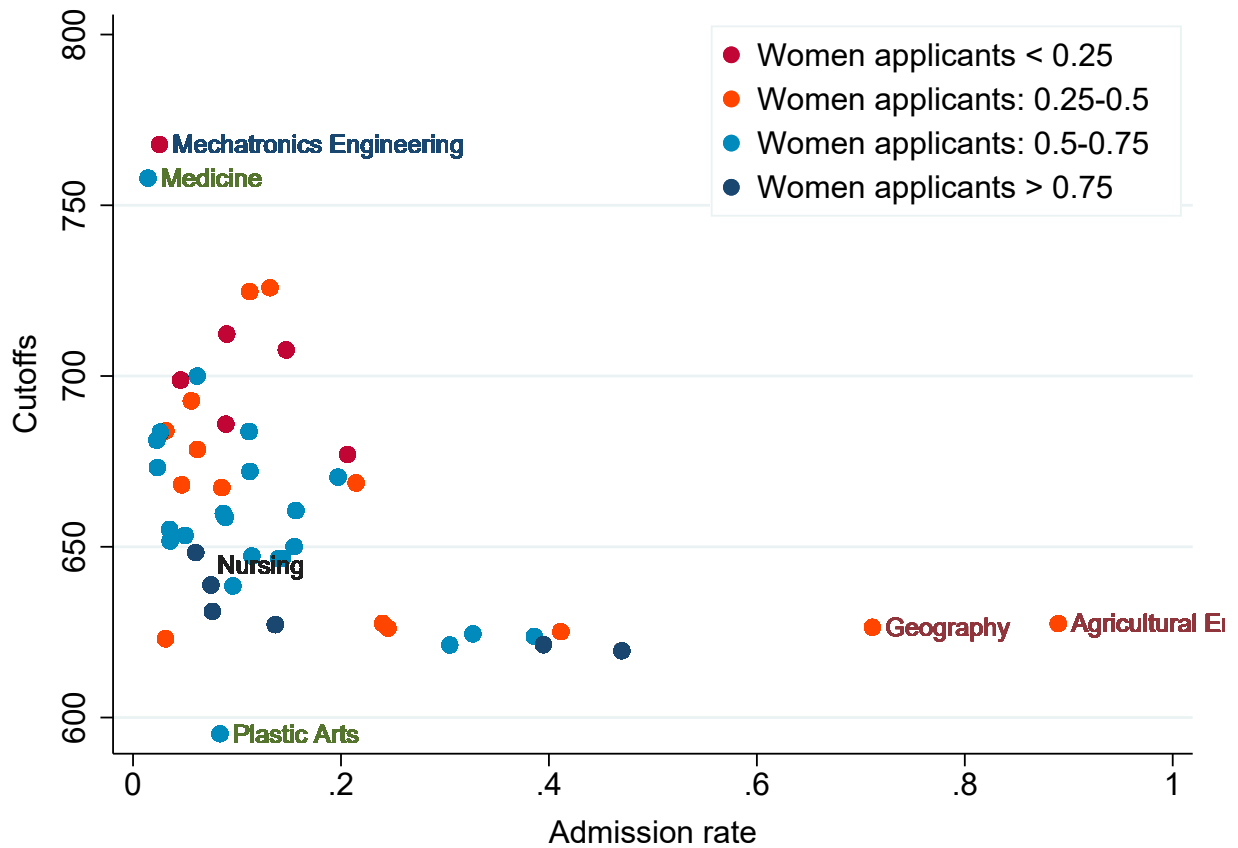


Figure 2: Cutoffs and admission rates by major

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.

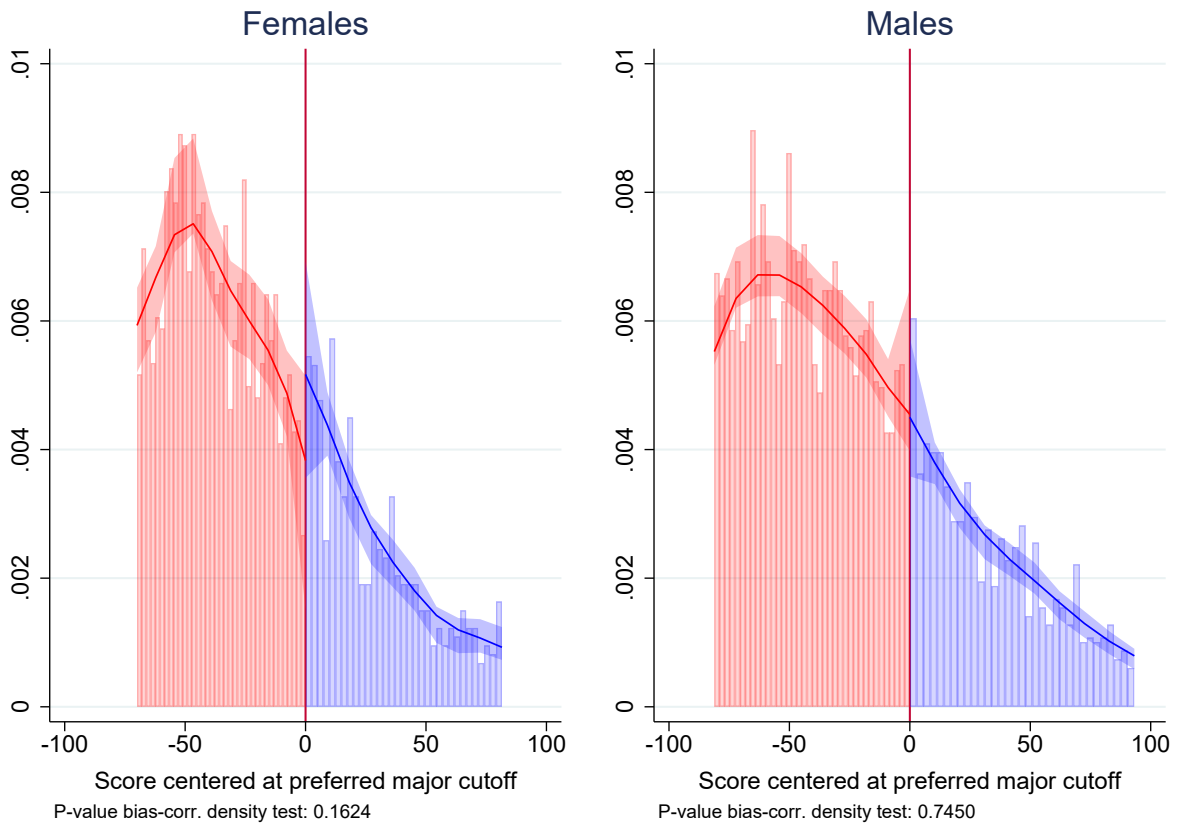


Figure 3: Density of the running variable by gender

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

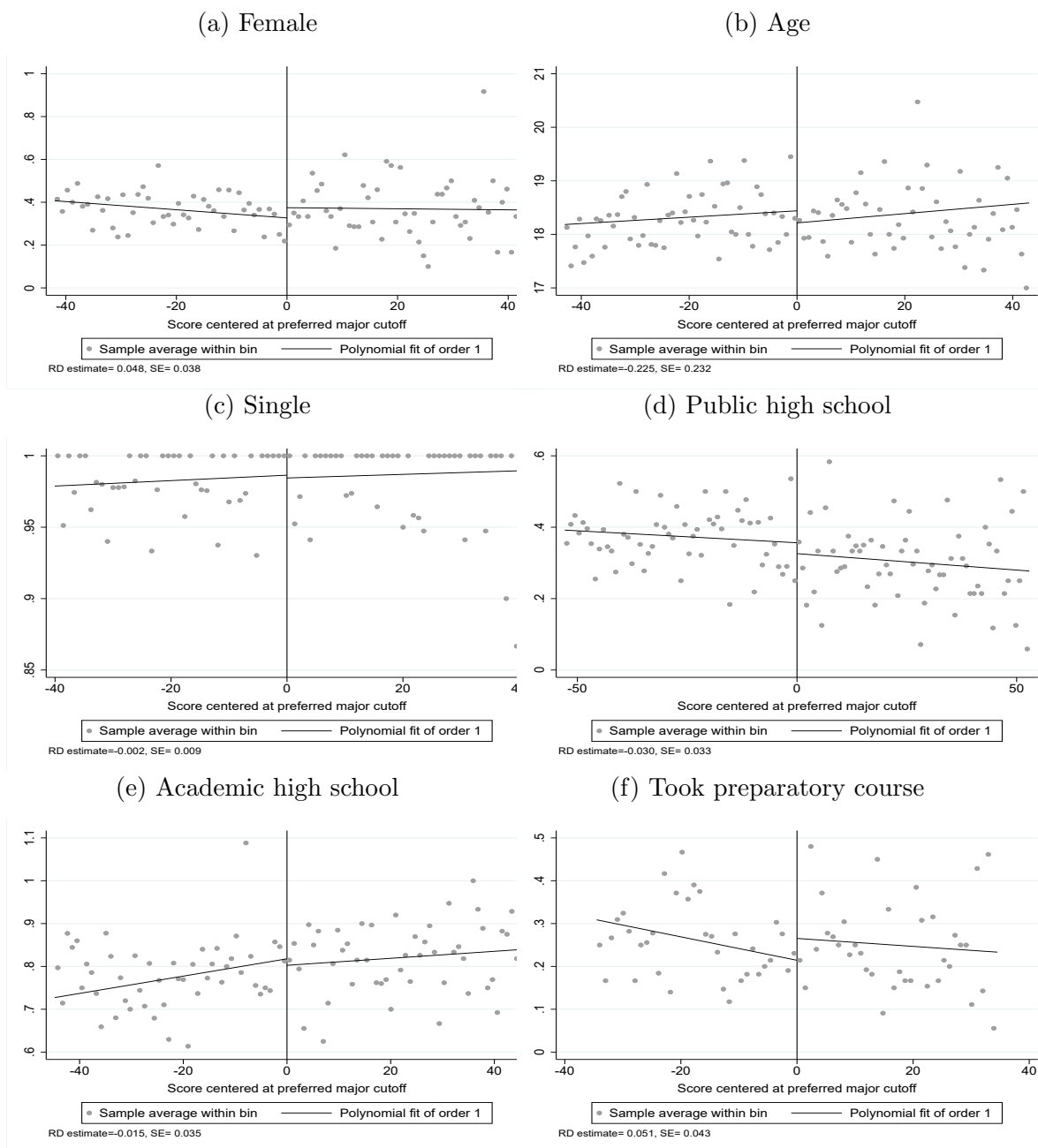


Figure 4: Covariates - applicants' characteristics

Notes:

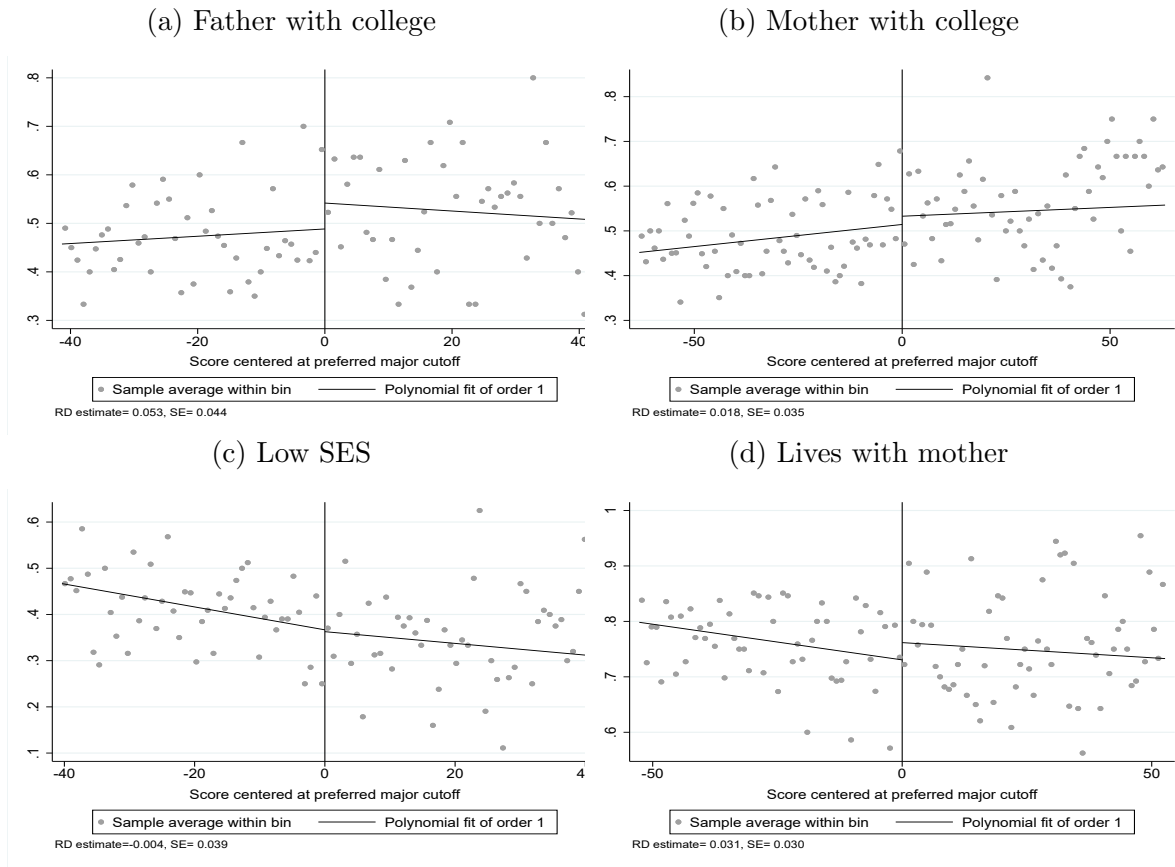


Figure 5: Covariates - parental characteristics

Notes:

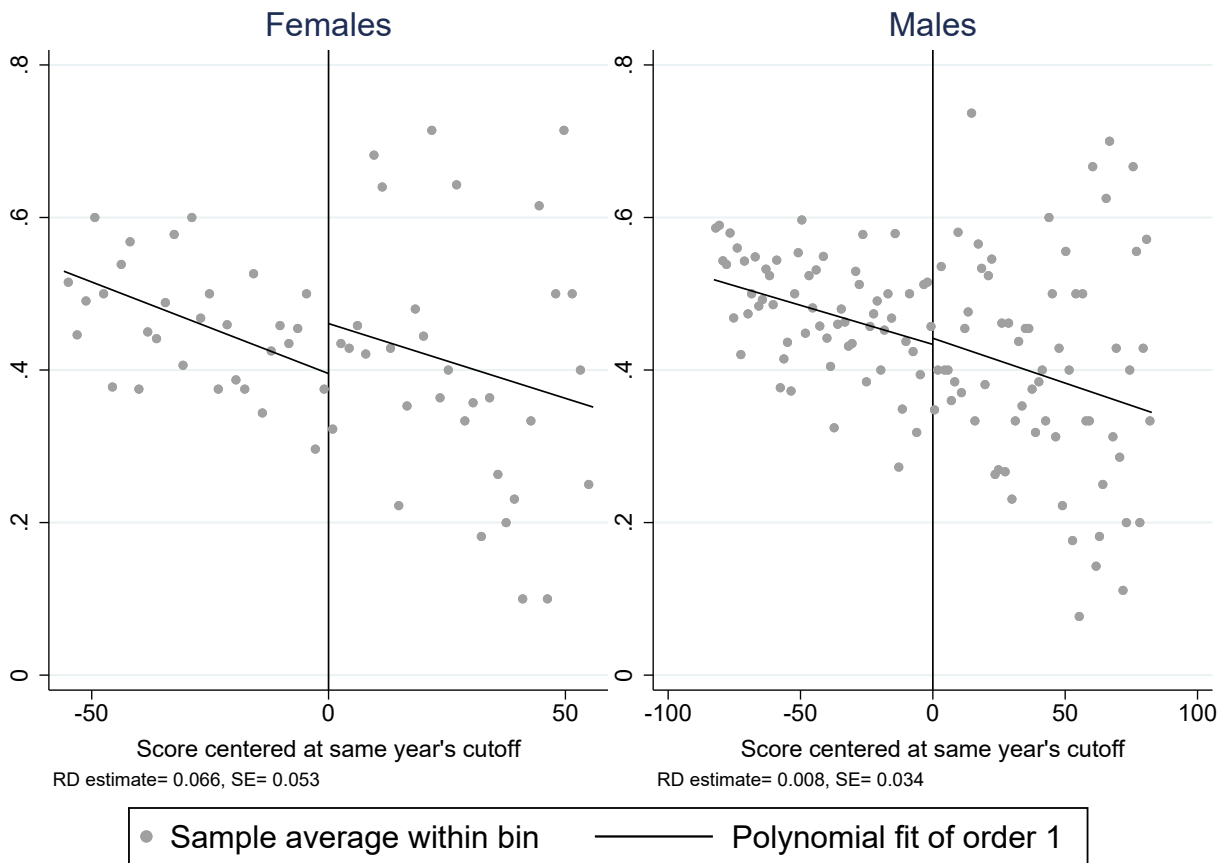


Figure 6: Fraction intending a selective major

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.

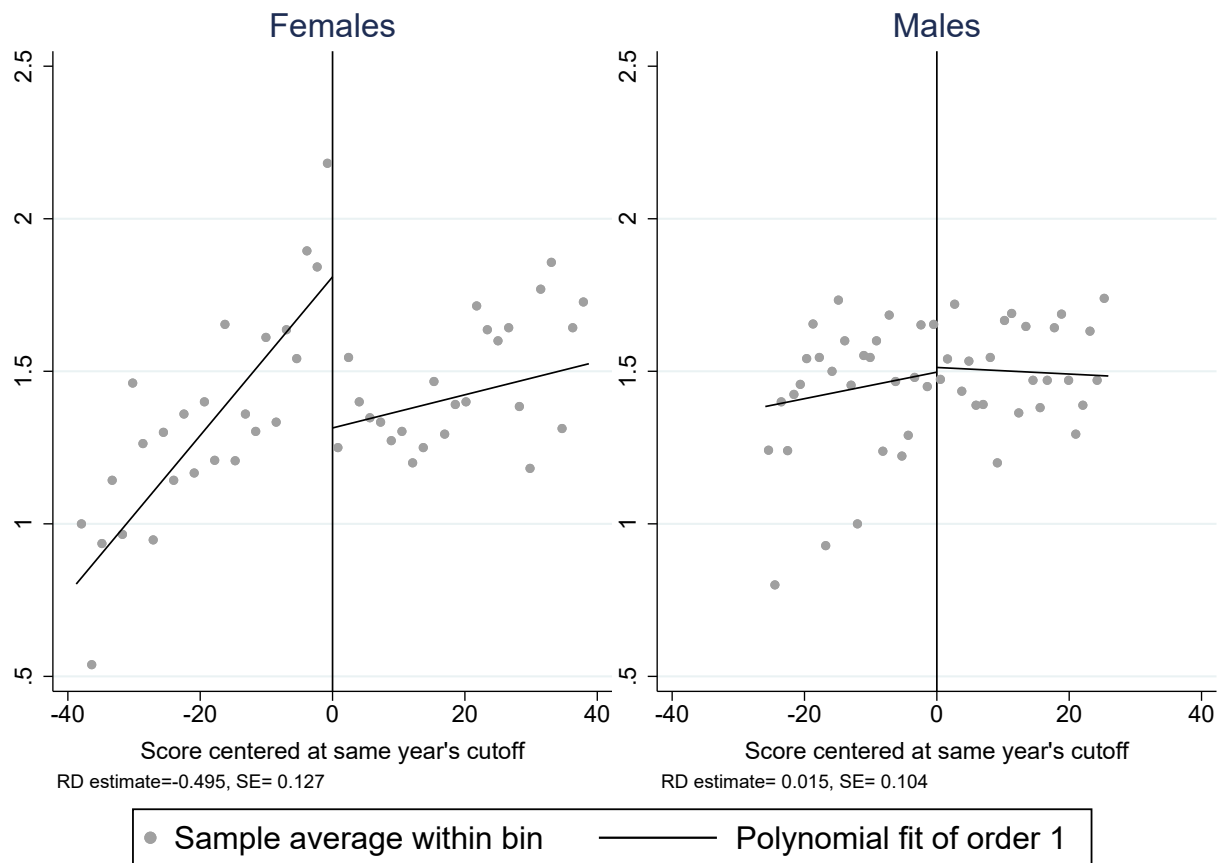


Figure 7: Number of majors reported

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.

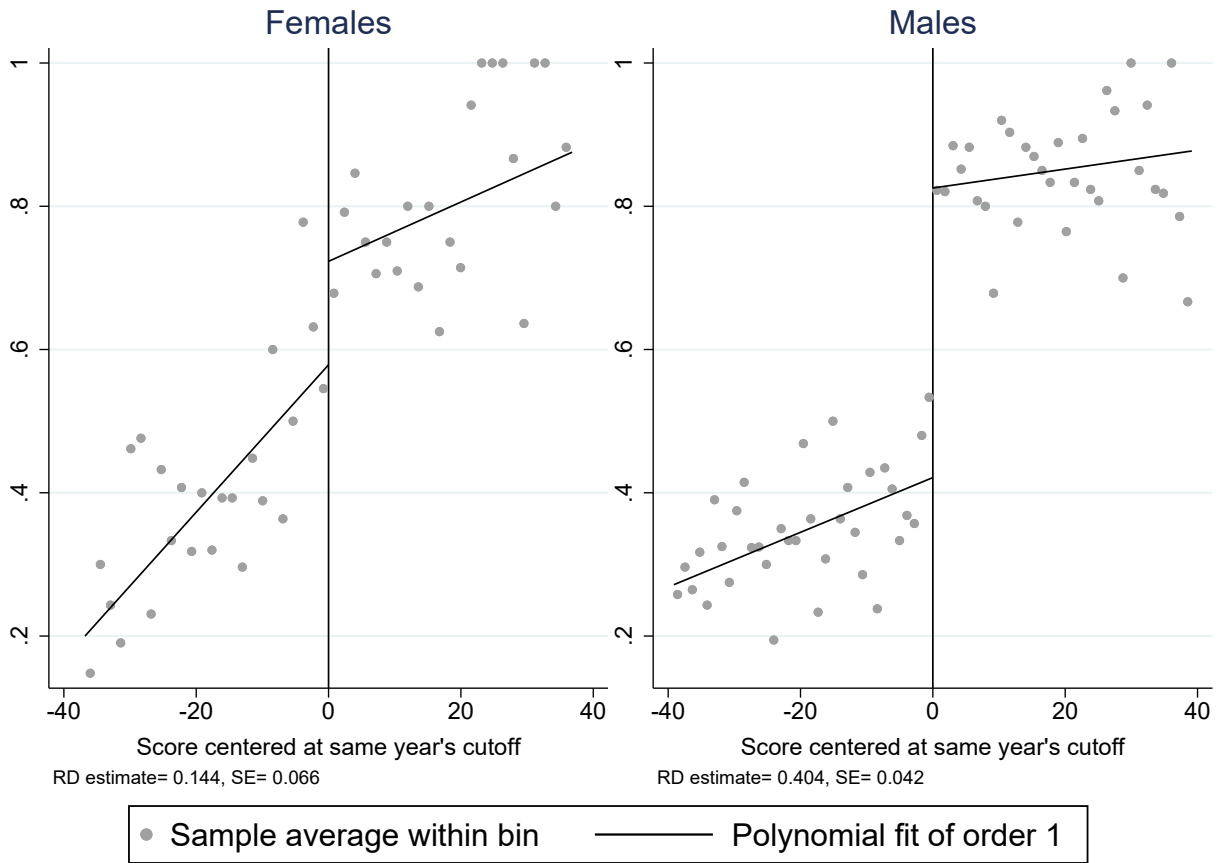


Figure 8: Likelihood of enrolling in *any* major

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.

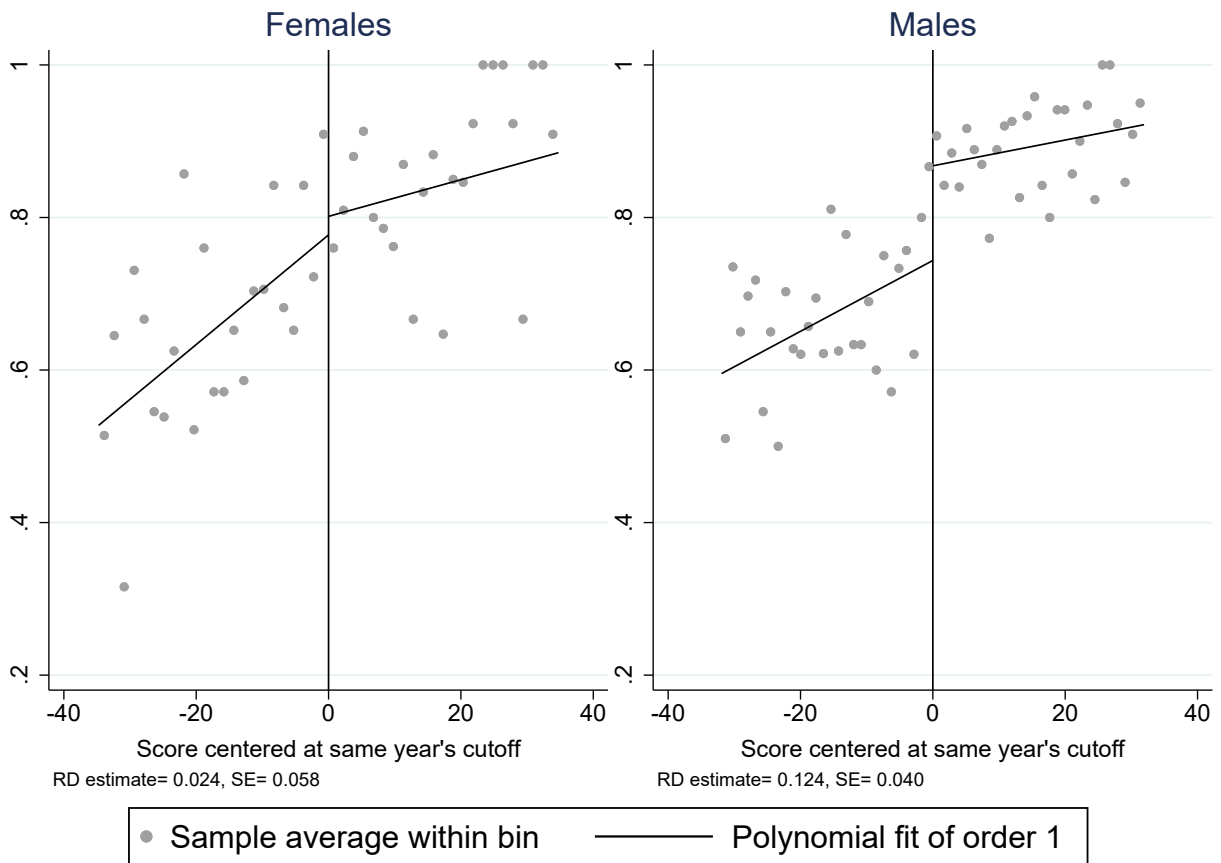


Figure 9: Likelihood of enrolling in *any* major over three admission cycles

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.

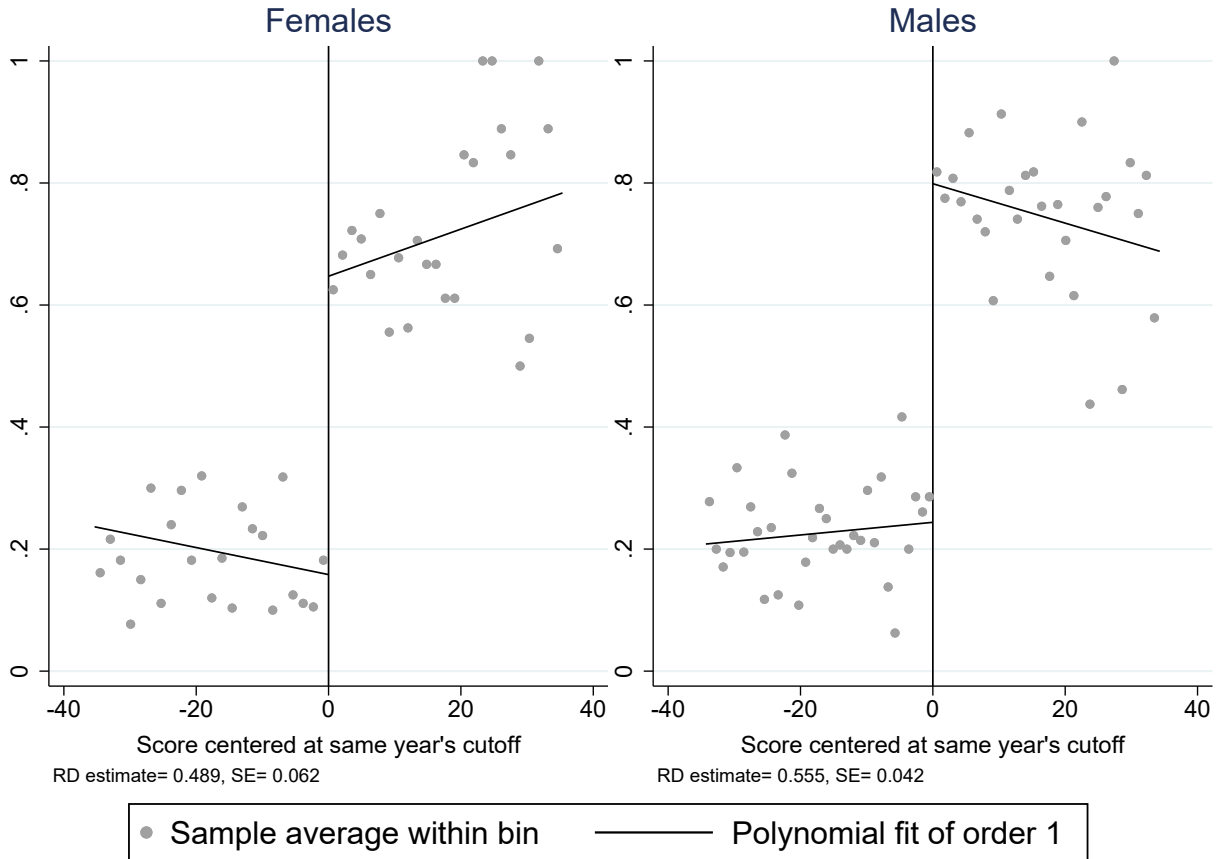


Figure 10: Likelihood of being admitted to their preferred major over three admission cycles

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.

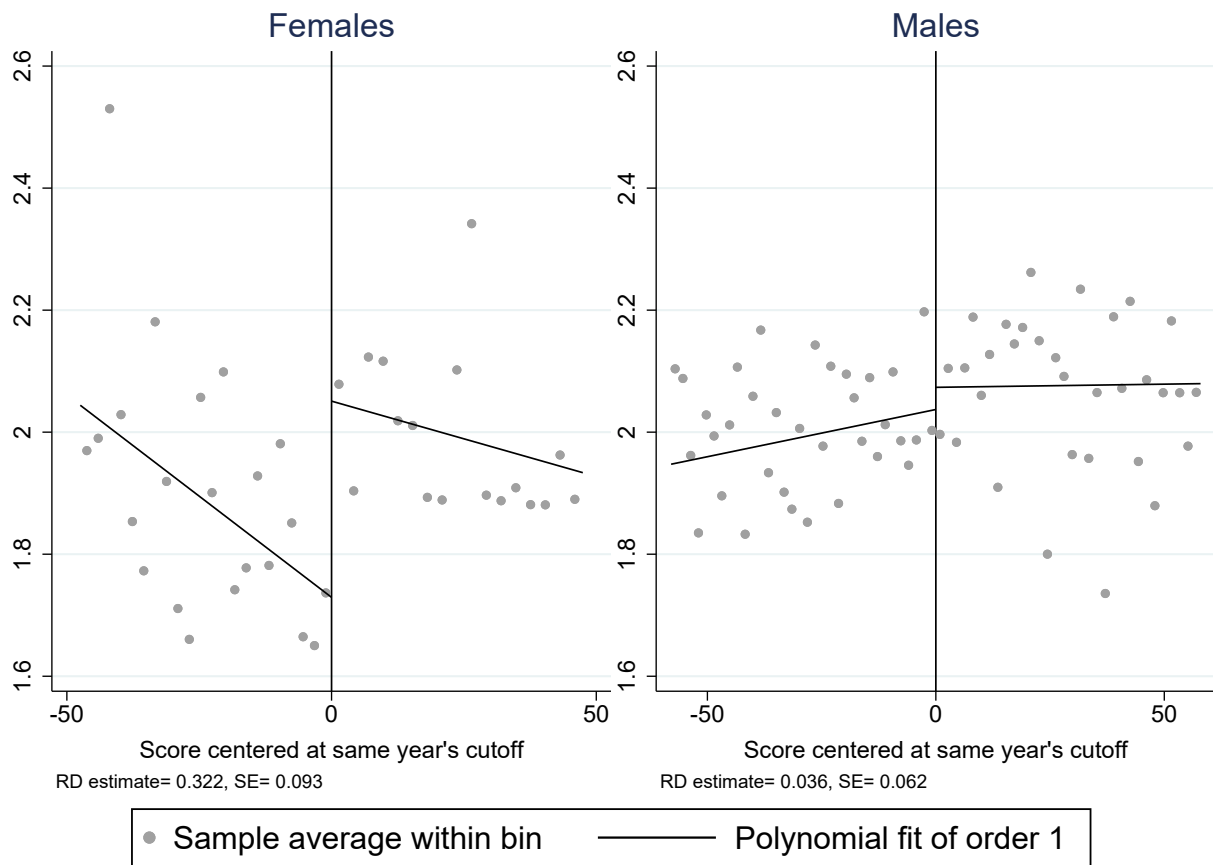


Figure 11: Potential salary of enrolled majors

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.

8 Tables

Table 1: Example of preference submission and slot allocation

<i>Applicant</i>	<i>Score</i>	Preference rankings		No. of slots		Cutoffs		<i>Admitted</i>	<i>Major enrolled</i>
		<i>Choice 1</i>	<i>Choice 2</i>	<i>Choice 1</i>	<i>Choice 2</i>	<i>Choice 1</i>	<i>Choice 2</i>		
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.

Table 2: Gender differences in intended and reported majors

	(1) Intending a selective major	(2) No. available options	(3) No. of majors reported
Below=1	-0.029 (0.033)	-1.733*** (0.396)	0.138* (0.079)
Female	0.038 (0.042)	-0.997** (0.501)	-0.152* (0.090)
Below=1 × Female	-0.023 (0.054)	-0.273 (0.640)	0.383*** (0.136)
Constant	0.667*** (0.030)	46.916*** (0.307)	1.518*** (0.061)
Admission group FE	Yes	Yes	Yes
Observations	5614	3576	2798

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 3: Gender differences in enrolled majors

	(1) Enrolled in any major (first cycle)	(2) Enrolled in same college (first cycle)	(3) Enrolled in any major (three cycles)	(4) Enrolled in preferred major (three cycles)
Below=1	-0.363*** (0.038)	-0.471*** (0.039)	-0.084*** (0.026)	-0.464*** (0.030)
Female	-0.094** (0.044)	-0.113** (0.048)	-0.050 (0.031)	-0.080** (0.040)
Below=1 × Female	0.226*** (0.066)	0.185*** (0.072)	0.051 (0.045)	0.026 (0.050)
Constant	0.929*** (0.030)	0.907*** (0.030)	0.985*** (0.021)	0.849*** (0.027)
Admission group FE	Yes	Yes	Yes	Yes
Observations	2832	2283	4908	5032

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 4: Gender differences in potential salaries of major choices

	(1) Enrolled major (three cycles)	(2) Enrolled major (first cycle)	(3) Preferred major	(4) First choice
Below=1	-0.067 (0.050)	-0.172*** (0.059)	-0.055 (0.043)	0.023 (0.060)
Female	-0.006 (0.068)	0.007 (0.081)	0.048 (0.059)	0.005 (0.080)
Below=1 × Female	-0.179** (0.086)	-0.149 (0.099)	-0.013 (0.072)	-0.080 (0.102)
Constant	2.589*** (0.053)	2.509*** (0.060)	2.768*** (0.050)	2.770*** (0.063)
Admission group FE	Yes	Yes	Yes	Yes
Observations	3008	1757	4850	2383

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.

A Additional Figures

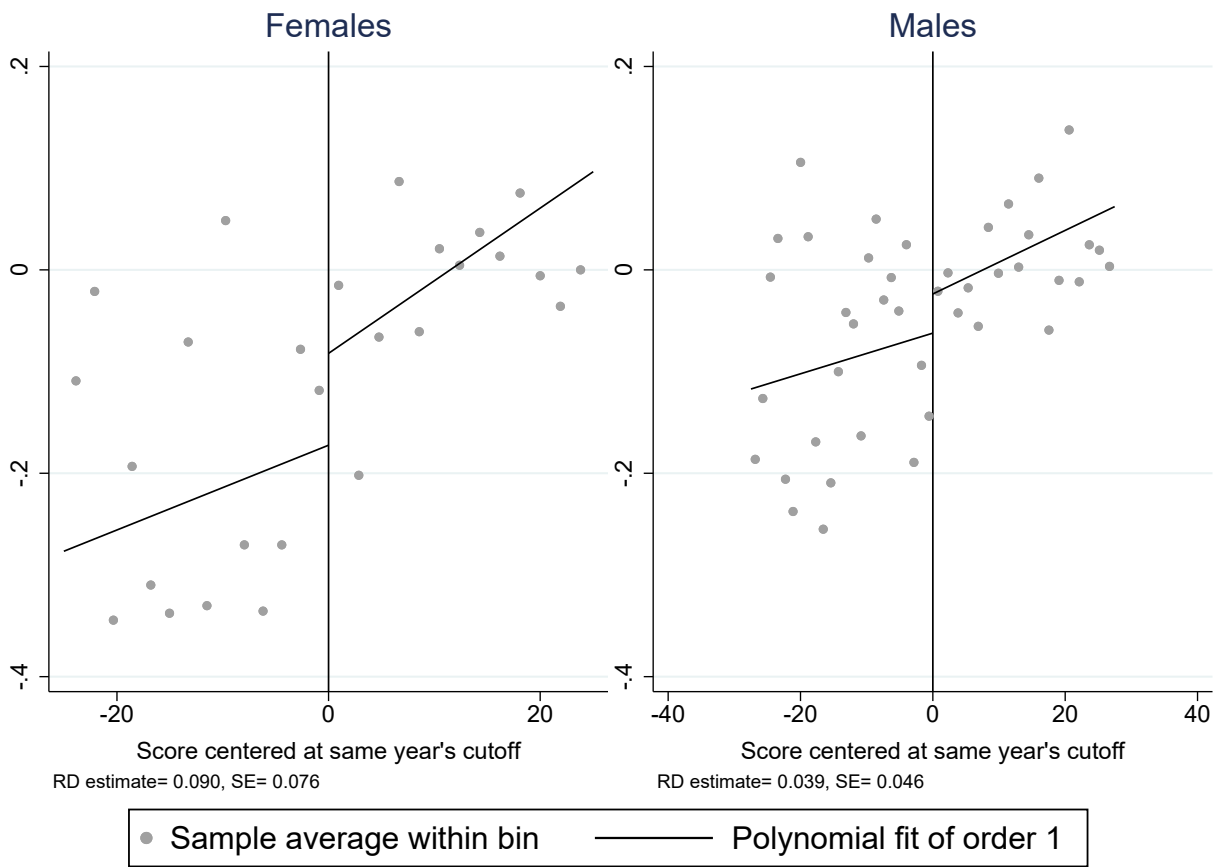


Figure A.1: Salary drop from from intended to enrolled major

Notes:

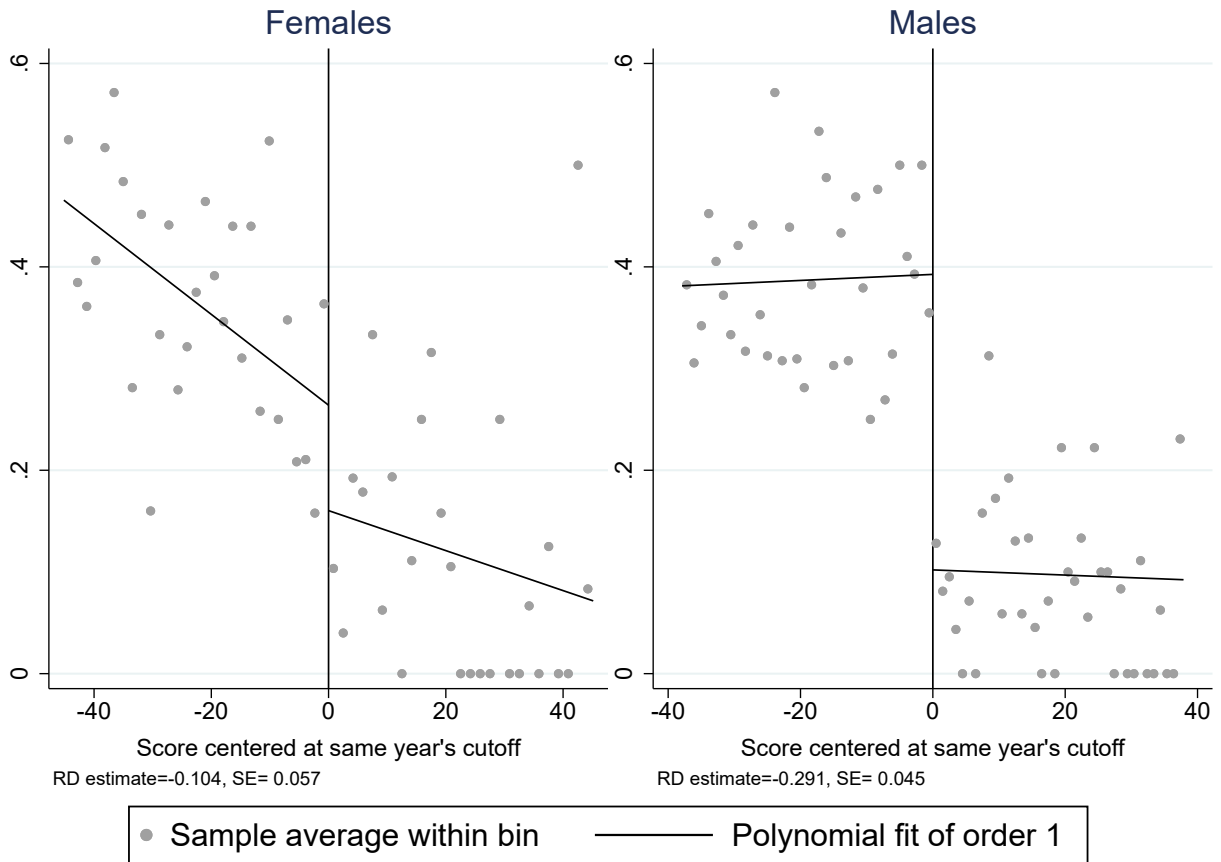


Figure A.2: Likelihood of retaking the CEE in the following two admission cycles

Notes: