Bridging the Gap: Mismatch Effects and Catch-Up Dynamics Under a Brazilian College Affirmative Action Program*

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Abstract

Affirmative action in higher education can lead to mismatch, where students admitted through preferential treatment struggle academically due to inadequate preparation before college. Although some students may face initial challenges, by providing access to quality education for talented individuals who might have otherwise been overlooked due to systemic disadvantages, these programs may enable students to bridge the gap and catch up to their peers. In this study, we examine the effects of a quota-type affirmative action policy on gaps in college outcomes between potential beneficiaries and non-beneficiaries. Using comprehensive administrative data from a leading Brazilian university which implemented affirmative action in 2005, we find that compared to their non-quota peers, potential quota beneficiaries are less likely to progress smoothly through college and less likely to graduate, a result that is mostly driven by those who would not be admitted to the university otherwise. Notably, however, most of these differences shrink as the students progress through college, suggesting a catch-up effect between those groups. While potential quota students initially face challenges, resulting in a reduced course load in their early college years, they compensate by taking more credits in later years to ultimately graduate.

Keywords: Affirmative action, margins of adjustment, Brazilian higher education
JEL Codes: I23, I24, I28, J15

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1 Introduction

Affirmative action programs have long been a subject of intense debate, with critics often emphasizing the negative consequences of such policies. Critics argue that affirmative action leads to a mismatch between minority students and the institutions they attend, claiming that they are admitted under lower standards and subsequently struggle to keep up academically. Although it is true that some students may face initial challenges, in principle these effects could be temporary. Affirmative action programs provide opportunities for talented individuals who might have otherwise been overlooked due to systemic disadvantages. By providing access to quality college education, these programs may enable students to bridge the gap and catch up to their peers. Most previous studies, however, have focused on mismatch effects, overlooking the potential catch-up effects associated with affirmative action programs.

In this study, we examine the effects of affirmative action on mismatch, measured by grade point average (GPA) and dropout rates, and catch up, measured by the GPA at the beginning and at the end of their major for those students who eventually graduate. In addition, our rich administrative data allow us to investigate the margins of adjustment used by students benefiting from affirmative action. In Brazil, prospective students usually take a university-specific entry examination – the so-called "vestibular" – and must choose a major before the exam.[1] Prospective students compete with others only within the chosen major, and admissions are solely based on the entry exam score. Once in college, it is highly costly to switch majors. If students' expectations about their major are not realized, the most common option is to drop out and retake the entry exam the following year. If students decide to stay, they face another rigidity: the curriculum. In Brazil, students have relatively few options for elective courses; in our sample, only about 6% of the courses are elective. This reduces students' margins of adjustment when experiencing

[1] Although this admission process was dominant in Brazil during our study period, it is no longer the norm for most public universities. Since the introduction of a centralized admissions system (Sistema de Seleção Unificada – SISU) by the federal government in 2010, many universities have started admitting students through the system. Admission may be granted based on the scores obtained in a standardized test at the end of high school (Exame Nacional do Ensino Médio – ENEM), which is carried out nationwide by the Brazilian Ministry of Education.

difficulties early in college.

The context of our study is the Federal University of Bahia (UFBA), the second federal university in Brazil to adopt affirmative action (quotas, hereafter) in 2005. This policy reserves 45% of the available slots for former public school students, usually from low-income households. Out of the reserved slots, 85% must be filled by black and mixed-race students. Besides the clarity of the eligibility rules, three other features contribute to making this setting unique and ideal for our analysis. First, UFBA is the second-largest university in the Northeast region and one of the top 15 universities in Brazil. The UFBA diploma is an attractive signal for employers. Second, the university is tuition-free, which enables students from low-income families to pursue a college degree. Third, Bahia is the state of Brazil with the highest share of black and mixed-race population – almost 85% of the state population – so the pool of potential beneficiaries is not small.

To assess the impacts of quotas on student progress at the university, we use a difference-in-differences strategy leveraging the pioneering implementation of the policy in 2005 and the formal rules of the affirmative action program. Eligibility requires that students complete all years of high school and at least one year of elementary or middle school in a public institution, a criterion that students cannot manipulate in the *short term*. We restrict our sample to 2003-2006, two years before and two years after the policy was implemented. This sample restriction may alleviate concerns of potential changes in effort decisions and strategic behavior of applicants and avoid issues related to the potential creation of new majors over time. New majors might change prospective students' choices, possibly changing the pool of candidates for each major. As usual with difference-in-differences approaches, our identification strategy relies on the parallel trends assumption, which seems to be supported by the empirical evidence we provide. The robustness checks section addresses several other identification challenges, reporting many further pieces of evidence supporting our research design.

We leverage rich administrative data to assess the impacts of quotas and explore the mechanisms of adjustment used by quota students after they enroll in the university. The dataset contains the history of each student in the university from the application process

until graduation (or dropout), including entry exam scores, courses taken while in college and the respective grades, course failures, number of credits taken each term, and time taken to graduate (or to drop out). Besides comparing potential quota and non-quota students, we conduct a heterogeneity analysis that also considers two distinct groups of potential quota students – the first consisting of students who would have been admitted even without affirmative action and the second consisting of those who were only admitted because of the policy. In the robustness checks section, we provide evidence that although these groups were admitted with different entry exam scores, they have relatively similar academic achievement at the end of their college experience.

Our results indicate that UFBA's affirmative action policy succeeded in targeting disadvantaged students. The share of quota students after the policy was 43%, close to the 45% target of the policy. The share of former public high school students increased even more from 28% to about 49%, but not all students from public high schools are quota-eligible. The policy also requires students to attend at least one year of elementary or middle school in a public school.[2] Due to data limitations, our main treatment variable is defined as potential quota student based on public high school attendance only. Notwithstanding, in robustness checks using imprecise information on elementary and middle school as well, our main results hold similarly.

Our main estimates reveal that potential quota students are 3.91 percentage points more likely to fail and 5.77 percentage points less likely to graduate than non-quota students. They also obtained a lower GPA in the initial years of college, but the gap was reduced by 50% by the time they graduated, suggesting some catching up throughout the college years. Controlling for entry exam score – a proxy for latent ability as in Bagde et al. (2016) – the effects on failures and graduation rates disappear. Besides, the effect on GPA becomes positive, suggesting that quota students with a similar entry score to non-quota students perform better while in college.

The negative effects on graduation rates seem to be driven by students enrolled in

[2]See Appendix A.1 for a detailed explanation of affirmative action eligibility and our data constraints.

technology majors, which require deeper background and skills in math and science.[3] In contrast, the negative effect on GPA and the catching up over time appear to happen for students enrolled in all three broad fields of study – social sciences, health sciences, and technology. Also, when the heterogeneity analysis distinguishes the two groups of potential quota students as defined above, the results suggest that the difference in academic achievement measured by dropout or GPA is driven by students who were only admitted because of the affirmative action policy. Again, the difference seems to be driven by potential quota students in technology majors.

We then turn to the margins of adjustment to understand the catching-up dynamics. Our analysis reveals that potential quota students failed more courses in the first few years in college, lowering their GPA in comparison to potential non-quota students. This appears to continue until the fifth college semester. They also reduced the number of credit hours in their first and second college years, probably to focus on fewer courses and to improve their learning. Because we find no difference in time taken to graduate conditional on not dropping out, this means that potential quota students tended to successfully take more courses and credit hours than potential non-quota students in their last years in college.[4] These margins of adjustment may explain the 50% decrease in the GPA gap by the time of graduation.

This paper makes two main contributions to the literature. First, it contributes to the literature on the impacts of affirmative action on the performance of students benefiting from the policy. Several previous studies have highlighted potential mismatch effects (Arcidiacono et al., 2011, 2012, 2016), but others have provided no evidence of such adverse

[3]Technology majors can be thought of as STEM majors in the United States. They include engineering, computer science, and math-related majors. The full list of technology majors can be seen in *Area I* at: https://www.ufba.br/cursos?qt-cursos_quicktabs=0#qt-cursos_quicktabs. Nevertheless, although we can broadly call technology majors STEM majors, the comparison is imprecise. In the U.S., STEM includes majors from other broad fields of study such as economics and some health-related majors.

[4]These findings contrast to Angrist et al. (2022), who provide evidence from a different setting in the United States that it is crucial for students to take full early college course loads in order to graduate, as opposed to taking lighter loads to avoid drop-out. This might be related to the flexibility of course choice and course load in U.S. colleges, especially in the first two years in college. The college curriculum in Brazil is usually quite rigid. Failing courses that serve as pre-requisite for other courses limits the selection of courses in the second year. Therefore, it is likely that struggling students have a lighter load in the second year and focus more on learning the content of those courses to avoid further delays towards graduation.

impacts (Rothstein and Yoon, 2008a,b; Bagde et al., 2016; Bleemer, 2022). We show that although there is some mismatch in our unique developing world context, there is also a nontrivial catch-up effect for those affirmative action beneficiaries who struggle initially yet manage to graduate. It is important to note that most countries operate an educational system that is more like the Brazilian one than the U.S. (Bordon and Fu, 2015), making these findings more generalizable than the related literature studying the U.S. context.

Second, we contribute to the literature on margins of adjustment used by quota students to eventually graduate. Prior work has pointed out that affirmative action beneficiaries might switch from high-return to low-return majors in order to graduate (Arcidiacono et al., 2012, 2016). Because in our setting switching majors is highly costly and the curriculum is rather rigid, potential quota students use other mechanisms of adjustment to ultimately graduate in the originally-intended major. They manage the rigidity of the curriculum. This is an important finding because affirmative action has been shown to improve social mobility via access to more prestigious colleges and lucrative majors (e.g., Hinrichs, 2012, 2014; Alon and Malamud, 2014; Estevan et al., 2019a; Melo, 2021; Otero et al., 2021).

This paper also adds to the literature showing that affirmative action increases diversity in higher education (Long, 2004a,b; Howell, 2010; Francis and Tannuri-Pianto, 2012a,b; Hinrichs, 2012, 2014; Antonovics and Backes, 2014; Estevan et al., 2019b; Vieira and Arends-Kuenning, 2019; Melo, 2021). Our estimates for targeting corroborate the results of this broad literature.

The remainder of the paper is structured as follows. Section 2 introduces the context in which we examine the impacts of affirmative action in higher education. Section 3 presents our analytical framework. Section 4 describes the data and some descriptive evidence of the impact of quotas on UFBA's students. Section 5 presents our empirical strategy. Section 6 reports the estimation results and discusses the mechanisms through which the quota students adjust to the reality of higher education at UFBA. Section 7 presents robustness checks for our main results. Finally, section 8 provides some concluding remarks.

2 Institutional Background

The Federal University of Bahia (UFBA) is the largest and best university in the State of Bahia, and is among the top 15 universities in Brazil.[5] Until 2013, the university admitted students solely based on their performance in its entry examination, carried out once per year – the so-called "vestibular."

The entry examination was composed of two parts. The first part was comprised of five multiple-choice exams covering reading comprehension, humanities, natural sciences, math, and foreign language. Every year, all applicants would take the same exam, no matter their chosen major. Every student needed to choose a major before taking the test, and would compete only against other prospective students who selected the same major.

Applicants could take the second part of the entry exam only if they obtained a major-specific minimum score on the first part. This minimum score was determined so that there would be three candidates competing for each slot available in that major. In the second part of the exam, each student would take a specific exam on the courses related to the major chosen and write an essay.[6] After completing the two entry exam phases, prospective students would be ranked based on the sum of the scores in both parts of the examination.

As mentioned above, an important characteristic of all Brazilian public, tuition-free, federal universities is that students must choose a major before the entry exam, and switching majors is highly costly. In some universities, students can take a specific exam to transfer majors. But, this exam does not happen frequently, and the number of slots for each major depends on administrative board decisions based on dropouts. For the majors included in our analysis, for example, only 0.34% of students who entered UFBA between 2003 and 2006 switched majors – 0.36% among non-quota students and 0.33% among

[5] See, for example, the ranking of Brazilian universities created by a major news outlet in Sao Paulo (*Folha de S.Paulo*) at https://ruf.folha.uol.com.br/2019/ranking-de-universidades/principal/. In relative terms, the position of UFBA in that ranking is equivalent to the position of the University of California, Davis, or the University of Texas, Austin, in the U.S. News ranking of public universities: https://www.usnews.com/best-colleges/rankings/national-universities/top-public.

[6] For example, applicants for mechanical engineering would take three exams – mathematics, physics, and chemistry – and write an essay.

quota students. The percentage of students dropping out and retaking the entry exam in another year was 0.9%.

Although Brazil has a public federal university system, it is important to highlight that there is no centralized data center where researchers can access identified data about different universities.[7] Most of the studies that use data from a single university have requested data access through a formal request to that specific university's legal department. Each university decides separately whether or not to grant access to the data. We received detailed identified data only for UFBA, which limits using other university students as comparisons to the UFBA affirmative action beneficiaries.

UFBA was the second federal university to adopt an affirmative action policy in Brazil.[8] According to the policy, announced in 2004 and implemented from 2005 onward, 45% of the available slots in each major must be filled by students who attended all years of high school in a public institution, plus at least one year in a public elementary or middle school.[9] In general, Brazilian public schools have lower quality than private schools at the elementary, middle, and high school levels. The performance of public school students relative to private school students is unusually low in Brazil, even when compared to similar countries.[10] Public universities, on the other hand, are usually better than private universities.[11] Besides the public school requirement, out of the reserved slots under the UFBA quota policy, 85% must be filled by black or mixed-race students.[12]

Importantly, if a prospective student eligible for the quota policy achieved a sufficient

[7] In 2012, with the introduction of the centralized admissions system (SISU), the Ministry of Education started to centralize the data.

[8] The first one was the University of Brasilia. Its affirmative action policy was solely focused on race and reserved only 20% of the slots for black and mixed-race students.

[9] The schools must be run by municipalities, states, or the federal government.

[10] See, for example, Figures 3.13 to 3.15 in this 2021 OECD report comparing the quality of public and private school education in the OECD countries versus developing countries: https://www.oecd.org/publications/education-in-brazil-60a667f7-en.htm. In addition, the 2010 Brazilian population census shows that excluding the students enrolled in colleges or universities, 84% of the white students are enrolled in a public school, while the share of black or mixed-race students is 93%. Looking particularly at students from households with per capita income above the national median, the share of white students in public schools is 73%, while the corresponding share for black or mixed-race students is 83%. Those shares drop to 39% and 57% for students from households at the top decile of the income distribution, but increase to 92% and 97% for students at the bottom decile of the distribution.

[11] In the ranking mentioned at the top of this section, created by the major news outlet *Folha de S.Paulo*, the first 15 universities are all public, and only 3 out of the first 30 universities in the ranking are private.

[12] This was the share of the black and mixed-race population in the state of Bahia at the time.

entry exam score to be admitted regardless of the policy, they would still be ranked among the quota students. Therefore, after the implementation of the affirmative action policy, there was no longer competition in the admission process between prospective students from public and private high schools.

Another feature that makes UFBA a unique setting for this study is its location in Salvador, the capital of the State of Bahia and the fourth largest city in Brazil. The majority of its 2.7 million population is black or mixed-race – 79% in 2010 – with a high level of poverty and inequality, even for Brazil. According to the 2010 Brazilian Census, 78% of Salvador's population earned up to three times the minimum wage, and 47% earned up to the equivalent of one minimum wage (IBGE, 2010).[13]

3 Analytical Framework

This section presents a simple analytical framework highlighting how students benefiting from affirmative action may perform in college. It also features the main components of the affirmative action program in our Brazilian context.

Consider an individual accumulating human capital in two time periods, $t \in \{1, 2\}$. Assume the first period represents high school, and the second represents college. The following equations depict the human capital at the end of each time period:

$$h_i^1 = I_i^1 + a_i, \tag{1}$$

$$h_i^2 = h_i^1 + I^2 + e_i, \tag{2}$$

where h_i^t is the individual i's human capital at the end of period t, a is their innate ability, and e is their effort while in college. I^t is the investment in human capital in period t, and represents all resources available at the school level that affect human capital accumulation, such as school infrastructure and teacher quality.

To mimic the situation in Brazil, where private high schools are usually of higher

[13] In Brazil, earnings are usually measured and reported monthly, and there is a federal monthly minimum wage. In surveys, the information on earnings is often requested as equivalent to minimum wages.

quality, assume that $I_i^1 = H$ if student i attended a private high school, and $I_i^1 = L < H$ if they attended a public high school. For simplicity, we also assume that once students have been admitted and enrolled in the university, the investment in human capital I^2 is the same regardless of whether they came from private or public high schools. The idea is that while school resources *available* to students are different in high school, they are somewhat similar once students are enrolled in the same university.[14] Notwithstanding, the total investment in human capital at graduation will depend on student effort e_i while in college.

In order for a student to be admitted to a public, tuition-free university, they have to score at least $\underline{h}$ in the entry examination. For simplicity, assume each student scores h_i^1 in that exam. The affirmative action program described in the previous section, implemented as a quota policy, is isomorphic to adding M to the entry examination score of the targeted students – those attending public school, primarily non-whites. Hence, if $h_i^1 \geq \underline{h}$, then student i is admitted regardless of their eligibility for the affirmative action program. If $h_i^1 < \underline{h}$, but the student is eligible for affirmative action and $h_i^1 + M = L + a_i + M \geq \underline{h}$, then they are also admitted.

Assume there is a minimum high school preparation h^* for a student to perform well in college – especially in the first semesters – and eventually graduate. If $h^* \geq \underline{h}$, then students who would have not have been admitted without affirmative action would not likely graduate, and some of those admitted without the need for affirmative action might not succeed either. In other words, there would be some *mismatch*.

Because competition for admission to public universities in Brazil is fierce,[15] it is not unrealistic to assume that $h^* < \underline{h}$. That is, performance in the entry examination is likely above and beyond the preparation needed for admitted students to not fall behind in

[14] In practice, potential affirmative action beneficiaries might not be able to take advantage of the available resources to the same extent as non-quota students. This could be due to longer commutes, part-time jobs, and fewer household resources to invest in a college education. It is important to highlight, however, that public universities such as UFBA have free room and board available for the most disadvantaged students. Also, part-time jobs on campus such as working as helpers in libraries, dining halls, and computing services are available to students.

[15] Considering the 22 majors included in our sample, the average number of applicants per slot was 11.46 during our study period (2003-2006). The most competitive majors were Medicine, Law, and Nursing, with 28.21, 19.40, and 18.81 applicants per major slot, respectively.

college courses. In such a case, students admitted without the push from the affirmative action policy would certainly succeed ($h_i^1 \geq \underline{h} > h^*$), but those benefiting from affirmative action may succeed only if one of the following two conditions is satisfied.

The first condition is their ability being sufficiently high, i.e., $h_i^1 = L + a_i \geq h^*$, or

$$a_i \geq h^* - L. \tag{3}$$

The second condition is their being able to overcome the ability gap and relative deficiency in high school preparation – in settings with potential grading-on-the-curve schemes – with sufficiently high levels of effort while in college. That is, $h_i^1 = L + a_i^M < h^*$, but $(L + a_i^M) + I^2 + e_i^M \geq (H + a_j^N) + I^2 + e_j^N \geq \underline{h} + I^2 + e_j^N > h^* + I^2 + e_j^N$, or

$$e_i^M \geq e_j^N + (a_i^N - a_i^M) + (H - L) > e_j^N + [h^* - (L + a_i^M)] > e_j^N, \tag{4}$$

where a_i^M and e_i^M are the ability of and effort made by student i benefiting from affirmative action, respectively, and a_j^N and e_j^N are ability and effort made by student j *not* eligible for affirmative action, respectively.

Notice further that students who would have not been admitted without affirmative action might have a higher probability of dropping out even when their ability is comparable to the ability of some non-affirmative action students. That is, among admitted students of ability $a_i = a$, it is possible that $L + a < h^*$ and $H + a \geq h^*$. Indeed, that happens when the ability is in the range $h^* - H \leq a < h^* - L$.

Lastly, observe that students benefiting from affirmative action might be able to outperform even non-affirmative action students of similar ability with higher levels of effort while in college. From inequality (4) and $a_i^M = a_i^N = a$, the outperformance might happen when the effort made by affirmative action students is sufficiently high to close the initial gap in high school preparation, i.e.,

$$e_i^M \geq e_j^N + (H - L). \tag{5}$$

To sum up, the four main takeaways from this analytical framework that will guide the

interpretation of the empirical results are:

(i) students benefiting from affirmative action may disproportionately drop out of college, particularly those who would have not been admitted without the policy;

(ii) they might be more likely to drop out even when their ability is similar to the ability of some non-affirmative action students;

(iii) affirmative action students might be able to catch up with non-affirmative action students while in college as long as their level of effort is relatively higher; and

(iv) they might even outperform non-affirmative action students of similar ability with a sufficiently high level of effort.

4 Data Description

In this study, we use UFBA administrative data. The first dataset contains all records of students while in college, including major, credit hours, grades, failures, whether the course was mandatory or elective, graduation, and withdrawal. The second dataset is the entry exam socioeconomic survey containing student information regarding the entry exam score, race, gender, age, whether the elementary, middle, and high school they attended were public, etc. We merge these datasets by a unique individual identifier at the university. The final sample contains students enrolled at UFBA between 2003 and 2006, accounting for 6,973 students,[16] 312,180 courses taken, and 22 majors.[17]

Throughout the study, we compare the outcomes of two groups of students: (i) the group of potential quota students, which consists of the former public high school students, and (ii) the group of potential non-quota students, which consists of the former private high school students. Recall that eligibility for the affirmative action program at UFBA requires

[16]This number includes all students enrolled at UFBA over 2003-2006 who did not request 2 or more course waivers in the first semester or 5 or more course waivers over the entire college experience, or took fewer than 3 courses in their first semester. Students are allowed to request course waivers when they have already completed the same course at UFBA or a similar course in another university. It is important to note that including all students in the 2003-2006 period does not affect our findings. This number differs from the 5,798 presented in Table 2, because as it will be clear later, that table only includes the 55% highest-ranking private school students before the quota policy, students who provided information on their elementary, middle, and high school attendance, and students whose age information is available.

[17]The full list of majors included in our study is reported in Appendix Table A.1.

attending all years of high school in a public institution plus at least one year of elementary or middle school in a public school. Because of a change in the entry exam questionnaire during our study period, the information on where students attended elementary or middle school is not consistently measured, so in our main analysis we define potential eligibility based on where students attended high school only. In robustness checks, we use the noisier information on elementary and middle school, or the actual quota classification after the policy. The results are similar. Appendix A.1 provides a detailed explanation of these alternative definitions and the robustness checks.

To have a relatively stable comparison group of potential non-quota students before and after the policy, we restrict the sample of students from private high schools in 2003 and 2004 to only the 55% highest-ranked students based on the entry exam score. Before the quotas, there was no limit on the share of former private school students in each major. After the quotas, the share must be up to 55%. Restricting the private school group before the quotas guarantee that we compare the best 55% students from private schools before and after the introduction of the policy. Without this restriction, there could be composition effects, potentially biasing our results.[18]

Regarding the potential quota students, in heterogeneity analysis we also split them into two subgroups. The first subgroup consists of potential quota students who are admitted only because of the affirmative action policy (65.3% of all quota students). The second subgroup consists of potential quota students who would have been admitted even without affirmative action (34.7% of quota students). We identify students in the second subgroup by ranking all applicants based on their entry exam score in each major. Because we know how many slots a major admits each year, we just pick the students from public schools who would have scores high enough to be within the number of slots allocated to affirmative action beneficiaries in the major. This would have been the only admission criterion in the absence of affirmative action.

[18]It is important to note that because affirmative action might affect the choice of effort, it is plausible that a student's test score might actually depend on the existence of an affirmative action policy. This is an important caveat regarding the comparison group. In fact, we will be able to identify the effects of the policy on the gap between the treatment and comparison group, but not in each group separately, as in Bleemer (2022).

Table 1 presents the descriptive statistics for the potential non-quota students and potential quotas students before (columns 1 and 2) and after (columns 3 and 4) the policy came into effect. Column 5 reports an unconditional difference-in-differences estimate for each variable. The first row shows that 87% of the potential quota students are actually enrolled as quota students. Ideally, this number would be 100%, but as we explain in Appendix A.1, due to data limitations we cannot accurately identify a potential quota student before and after the policy only with the information on high school attendance. Again, Appendix A.1 shows that our results are robust to alternative quota definitions.

Table 1 shows that the implementation of the quota system increased the number of students who come from disadvantaged backgrounds. The table also reports an increase in the proportion of students that come from low-income families and students who worked while in school, but a reduction in the proportion of students who took preparatory courses.[19] Moreover, there is no differential impact on self-reported race, but that seems to happen because both groups increase self-identification as black or mixed-race. Except for characteristics directly affected by the policy – public school attendance, race, low socioeconomic status (household income, parental education, and need to work while in college), need for a test prep course, and low entry exam score – there does not seem to be any economically or statistically significant effects on other covariates, suggesting that the covariates are well balanced across groups. Appendix Table A.2 also shows that there was an increase in the participation of former high school students from 27.7% to about 49.2%. The share of actual quota students was approximately 42.8%, close to the 45% target of the policy. Again, this difference arises from the other eligibility requirement regarding attending at least one year in a public elementary or middle school, which is not consistently measured in our data.

Figure 1, Panel (a), shows that the average entry exam score of public students enrolled at UFBA reduces after the introduction of the quota policy, an expected result related to

[19]If a student is not well prepared for the exam, they might take extra lessons targeting the exam. Usually, these are offered by private companies, but non-governmental organizations often offer lessons for disadvantaged students. With the introduction of the affirmative action policy, eligible students did not have to compete with private school students anymore, so this may explain the reduction in the need for these preparatory courses.

the policy goal of providing access to disadvantaged students. The score of students from private high schools increases by a small amount. We can also see that this result is more substantial for technology and health-related fields (Appendix Figures A.1 to A.3), which suggests that they are more selective. Panel (b) shows that the difference between groups is much smaller when we look at GPA. These panels suggest some catching-up over time and almost no mismatch for the quota group.

5 Empirical Strategy

In this study, we use a difference-in-differences approach to estimate the effects of a quota-type affirmative action policy on gaps in college outcomes between potential beneficiaries and non-beneficiaries. Our sample consists of all students enrolled at UFBA in the two years after the affirmative action policy was implemented (2005 and 2006), all students from public schools enrolled in the two years before the policy (2003 and 2004), and the 55% highest-ranked students from private schools before the policy. As explained before, the treatment group consists of potential quota students (those from public high schools) both before and after the policy. The comparison group consists of potential non-quota students: the 55% highest-ranked students from private high schools before the policy, and all private school students after the policy.

It is imperative to point out that, ideally, to study the policy effects, one would observe the performance of *applicants* from both public and private schools, before and after the policy implementation. Nevertheless, the available data only allows us to follow enrolled students before and after the policy. If we could follow the applicants instead of the enrolled students, we would be able to split our treatment group before the policy (public school students) between those who would have been admitted regardless of the policy and those who would have been admitted only if the policy was in place. We do not have information on the academic outcomes of the latter group.

In order to create a reasonable comparison group before the policy under the data constraints, we would like to drop the private school students who would not have been

admitted if the policy had been in place. Recall that after policy implementation, the available slots for private school students fell to 55% of the total slots. We identify the best private school students by straightforwardly ordering all admitted private students using the entry exam score. The 55% highest-ranked students would have been admitted regardless of the policy, but the remaining private students who ended up enrolling at UFBA would have not been admitted if the policy was already in place. Again, dropping this last subgroup of the private students is important because a naive comparison using the whole pool of enrolled private school students before and after policy implementation could generate a mechanical effect from changes in the composition of the comparison group. Appendix Tables A.3 and A.4, however, provide estimates using the whole sample of non-quota students instead of the best 55%. The main results hold. Interestingly, there are only minor changes in the estimated parameters.

To provide supportive evidence for the parallel trends assumption, Figure 2 depicts the outcomes of interest from 2003 to 2006, our period of analysis. Although there are only two years of data prior to the policy implementation in 2005, this figure suggests no differences in the trends between treated and comparison groups before the treatment. Appendix Table A.7 shows that in the period before the quota policy, treated and comparison groups behaved similarly except for some income-related characteristics of the families.

Another assumption in our research design is that students cannot change *ex-ante* behavior to be eligible for the quota policy (Assuncao and Ferman, 2015; Mello, 2023). Restricting the sample to the period 2003-2006 may guarantee the comparison of similar individuals. High school in Brazil lasts for at least three years. Thus, unless students' families had information about UFBA's affirmative action policy before it started, they could not enroll their children in public schools to benefit from the policy. This sample period restriction also allows us to avoid changes in the number of slots available for some majors, and the creation of new majors over time.[20] These changes could modify the

[20]In 2008 there was a substantial change in the university. It created three broad majors, which increased the total number of slots by almost 30% per year. These majors are called "Interdisciplinary Majors" ("Bacharelados Interdisciplinares," or just BI). In the technology BI, for example, students take two years of calculus, introduction to engineering, physics, etc. After those two years, they are ranked by their cumulative GPA and can choose their main major – for example, computer science or electrical

university profile and affect student preferences.

Because of the potential effects of the affirmative action policy on the comparison group, we are able to identify the effects of the policy on the gap between the treatment and comparison group, but not in each group separately, as in Bleemer (2022). The quota policy might have indeed affected the comparison group, as suggested by the post-policy outcomes plotted in Figure 2. Potential changes in the university student profile after the policy may have affected the performance of former private school students while in college as well. In addition, Estevan et al. (2019a) and Melo (2021) have shown that affirmative action in higher education may affect choice of major and student effort before college admission. Students from private schools could put more effort into their preparation for the entry examination. As a result, the 55% best private high school students after the policy can be better than the 55% best students before the policy.

Although we cannot rule out this potential source of bias, we provide a piece of evidence suggesting that the bias might not be large. Appendix Figure A.4 shows that the entry exam score cutoffs for the 55% highest-ranked private students in most majors are similar before and after the policy. A difference appeared for only 6 out 22 majors in our sample. Appendix Tables A.5 and A.6 report estimates excluding the six majors that had cutoff changes: geophysics, mechanical engineering, environmental engineering, pharmacy, nursing, and architecture. The results are robust to this sample restriction.

We estimate the impact of the quota policy using the following equation:

$$Y_{imc} = \beta_0 Q_{imc} + \beta_1 [Post_c \times Q_{imc}] + X_{imc}\gamma + \psi_m + \eta_c + \epsilon_{imc}, \tag{6}$$

where Y_{imc} is the outcome for student i in major m and cohort c. The main outcomes of interest are grades, failures, major completion, and dropouts. Q is a dummy variable equal to 1 if the individual is a potential beneficiary of the quota policy. Again, in our main analysis we define a potential quota student as a student who attended all years of high school in a public institution. Appendix A.1 shows that our results are robust to alternative quota definitions. *Post* is a dummy variable indicating the cohorts affected by

engineering.

the policy, X_{imc} is a set of student characteristics, ψ_m is a set of major fixed effects, and η_c is a set of cohort fixed effects. β_1 is the difference-in-differences coefficient of interest.

In addition, we aim to identify the magnitude of the effect for potential quota students who were able to enroll at UFBA only because of the policy and for students who would have been admitted even without the policy. Ideally, we would estimate the following triple-difference model:

$$\begin{aligned} Y_{imc} = \beta_0 Q_{imc} + \beta_1 W_{imc} + \beta_2[Q_{imc} \times W_{imc}] + \beta_3[Post_c \times W_{imc}] \\ +\beta_4[Post_c \times Q_{imc} \times W_{imc}] + \beta_5[Post_c \times Q_{imc} \times (1 - W_{imc})] \\ +X_{imc}\gamma + \psi_m + \eta_c + \epsilon_{imc}, \end{aligned} \tag{7}$$

where W is a dummy variable indicating whether a potential quota student would have been admitted to UFBA even if the quota policy was not in place. Recall that we can identify these students because they attended public schools before college and obtained an entry exam score high enough to earn a slot in the university even without the policy.

Because we do not observe information on potential quota students who would have *not* been admitted before the policy implementation, $Q_{imc} = W_{imc} = Q_{imc} \times W_{imc}$ for the pre-policy cohorts, so we can only identify the coefficient of one out of those three variables. For post-policy cohorts, however, we can separate Q_{imc} between W_{imc} and $1 - W_{imc}$. Nevertheless, the interactions $Post_c \times W_{imc}$ and $Post_c \times Q_{imc} \times W_{icm}$ are also equivalent, so we can only identify the coefficient of one of them. After accounting for these issues, the estimating equation that is feasible becomes:

$$\begin{aligned} Y_{imc} = \beta_0 Q_{imc} + \beta_1[Post_c \times Q_{imc} \times W_{imc}] + \beta_2[Post_c \times Q_{imc} \times (1 - W_{imc})] \\ +X_{imc}\gamma + \psi_m + \eta_c + \epsilon_{imc}. \end{aligned} \tag{8}$$

Therefore, equation (8) does not identify triple-difference parameters but rather captures the heterogeneous forces driving the estimated treatment effects. We are interested in the parameters β_1 and β_2, where the latter can be interpreted as the effect on those who actually needed the policy to access the university. The former can be interpreted as

a placebo effect because the policy should have had minimal impact on those students. It is important to mention that this heterogeneity analysis should be interpreted cautiously, as there is no perfect comparison group for each treatment subgroup.

Although we include many fixed effects, the main analysis does not control for observable characteristics that might affect our results because of missing values. Appendix Table A.8, however, reports estimates using equations (6) and (8) with the inclusion of these additional covariates for the subsample with non-missing values. The main results are remarkably stable across specifications, suggesting that selection on observables (and potentially unobservables) might not be a first-order issue in our analysis. In particular, concerns regarding bias arising from the possibility that affirmative action may change the pool of applicants should be alleviated. Detailed explanation of each of these robustness checks is presented in Section 7.

Lastly, it is important to highlight the potential consequences of no competition between public and private school students due to how the university separately runs the acceptance list. Aygun and Bo (2021) shows how this may create distortion – that is, how high-achieving beneficiary students can often not be accepted due to this rule. This distortion would be particularly salient in majors where potential beneficiaries were admitted at higher rates before the policy. We have assessed the relevance of this issue by comparing the entry exam score of the lowest-ranked admitted non-quota student to the score of the lowest-ranked admitted quota student. While it is plausible that high-achieving beneficiary students might be less likely to be admitted in less selective majors after the policy, consistent with Aygun and Bo (2021), Appendix Table A.9 reports that for only 3 out of the 22 majors in our sample the minimum score of the non-quota student was lower than the minimum score of the quota student in the post-policy period. Those majors are Executive Assistant, Pedagogy, and Statistics. This piece of evidence suggests that such distortion might not be of first-order importance in our context.

6 Results

We present the results in three parts. First, we report the baseline effects of the quota-type affirmative action policy at UFBA on gaps in college outcomes between potential beneficiaries and non-beneficiaries, using a sample consisting of all students who enrolled at UFBA from 2003 to 2006. Second, we present estimates from a sample consisting of students who eventually graduated. Third, we investigate the mechanisms of adjustment for students who made it to graduation.

To address potential concerns regarding selection bias in the estimated effects for all college outcomes examined in this study, we present estimates with and without the control for entry exam score. Lacking data on latent ability, we proxy it with the entry exam score as in Bagde et al. (2016). It is important to acknowledge, however, that the entry exam score is an imperfect measure of ability and may reflect factors beyond innate academic aptitude. For instance, the entry score may also reflect changes in high school effort in light of the affirmative action program, quality of the high school attended, and family characteristics (income, parents' educational level, etc.). Therefore, caution should be exercised when interpreting the estimates that are adjusted for entry exam scores.

It is also crucial to emphasize that by controlling for entry exam scores, we are comparing potential quota and non-quota students who have similar scores. Quota students with similar scores to non-quota students would likely have been admitted even without the policy. Thus, this subgroup of the potential quota students must have academic preparation as well as potential non-quota students, have higher latent ability, or put more effort into learning. In addition, we would be abstracting from the identification contributions of the non-quota high-achieving students without a close comparison in the quota group.

6.1 Results for all enrolled students

We start by presenting the estimated effects of quotas on failures and graduation using a sample consisting of all students enrolled at UFBA from 2003-2006.[21] Table 2, Panel A,

[21] Again, for each student we define failures as the proportion of failed courses among all courses taken while in college. Also, we define graduation as an indicator equal to 1 if a student graduated in up to two

reports estimates of the difference-in-differences coefficient in equation (6). The result in column 1 suggests that after the policy implementation, the proportion of failures increased by 3.91 percentage points for potential quota students, who are from public schools and primarily non-whites. This means a 24.6% increase in the proportion of course failures relative to the comparison group. However, this effect disappears when we control for the entry exam score (column 2). The quota students are also 5.77 percentage points less likely to graduate (column 3), but this effect also reduces considerably when we control for the entry exam score (column 4). Relative to the comparison group average, the estimated decrease in the probability of graduation is 7.47%.

Table 2, Panel B, reports the estimates of interest from equation (8), where we allow for heterogeneity according to whether the policy was crucial or not for the potential quota students to be admitted at UFBA. Panel B shows that the results in Panel A are driven mainly by students who would not be admitted without the affirmative action policy. Given the takeaways (i) and (ii) from our analytical framework, it is unsurprising that the estimated effects are larger for this group. Quota students who would not be admitted without the policy have 8.28 percentage points higher rate of course failures. They also have 11.2 percentage points less chance of graduating, which means a 14.5% reduction relative to the comparison group.

Although controlling for entry exam scores attenuates the negative impact on graduation rates, the policy seems to still reduce the graduation rates of quota students admitted only because of the policy by about 7.77 percentage points. This result suggests that there may be unequal barriers in college faced by disadvantaged students, even when compared to equally academically prepared advantaged peers. The difference between estimates with and without the score control may reflect a *negative* omitted variable bias consistent with the omission of ability or pre-college investments in the specification without score control. High ability or high investment students are more likely to perform better in college and

years after the regular duration for that major. While the typical duration of a major is four or five years, it could go up to six years for majors such as Medicine (again, see Appendix Table A.1 for regular major durations). In our sample, only 27 (0.43%) out of 6,281 students had neither graduated nor dropped out by 2018. As this is a small portion of our sample, it is unlikely to bias our main estimates.

graduate, but are disproportionately less likely to be quota beneficiaries.

To put our results into perspective, we compare them to Arcidiacono et al. (2016). Those authors reported that while the University of California (UC) was implementing affirmative action, minority students were 13.1 percentage points less likely to graduate within five years. Although that statistic is unconditional and lacks identification from a policy change, it seems like a useful benchmark for our estimates. The UC system might serve as a reasonable comparison to UFBA – both are public universities with good reputations in teaching and research, and both make efforts to admit minority students. Nevertheless, different from the UC system, where students are able to switch majors, this is highly costly at UFBA. Thus, we would have expected a large difference between graduation rates in the two universities, but surprisingly that does not seem to be the case. This evidence suggests a relatively small mismatch among quota students at UFBA.

Table 3 reports the results for broad fields of study. As mentioned earlier, our prior is that potential quota students have lower math and science backgrounds, which can impact their academic performance in college. As displayed in Appendix Figures A.1, A.2 and A.3, the distributions of entry exam scores and GPA differ by fields of study. Table 3, Panel A, shows that the increase in failure rates for potential quota students is driven mostly by students in technology majors, but the statistical significance disappears when controlling for entry exam scores. Without controlling for entry exam scores, those students have 5.60 percentage points higher failure rates and are 11.6 percentage points less likely to graduate. While the percentage variation relative to the comparison group average for failures is quite similar to the findings in Table 2, it significantly differs for graduation rates. Potential quota students in technology majors are 17.5% less likely to graduate without controlling for entry exam score and 9.07% less likely when controlling for it. Therefore, the mismatch in terms of graduation rates seems to be largely driven by students enrolled in technology majors.

Table 3, Panel B, depicts a pattern similar to Table 2, Panel B: the results for technology students are driven mainly by students who would not be admitted without the policy. Notwithstanding, the size of the estimates increases for all regressions, both with

and without the entry exam score control. As displayed in Appendix Figure A.1, the distribution of entry exam scores for quota students who would not be admitted without the policy differs significantly from the other groups. It also differs more when compared to health sciences and social sciences and humanities. Those students may disproportionately drop out of college, even when their entry exam score is similar to the entry exam score of some non-quota students. Although the results for health sciences and social sciences and humanities have the same sign, they have lower magnitudes and/or lack statistical significance.

6.2 Results for students who graduated

This subsection presents the analysis only for students who made it to graduation. We report results for GPA at the beginning and at the end of the college experience, failed courses, and on-time graduation.

Table 4, Panel A, reports the estimated difference-in-differences coefficient of equation (6) only for students who eventually graduated. Comparing with our previous results in Table 2, we observe a similar impact on failures: a 1.3 percentage point increase or a 26.3% increase relative to the comparison group average (column 1). The estimated effect in column 2 is not statistically significant when controlling for entry exam scores. Columns (7) and (8) show no effects of the quota policy on graduating on time, with and without the entry exam score control, respectively.

The main result in Table 4 is the considerable reduction in the GPA gap between potential quota and non-quota students over time. In the first semester of the course (column 3), the policy reduces the average GPA by 0.309 points on a 10-point scale, or a 4.1% reduction relative to the comparison group. But this difference drops by more than 50% by graduation (column 5). Indeed, the policy reduces the average GPA at graduation by 0.148 points. This is evidence pointing to catching up in learning over the college years, consistent with the idea that quota students might be able to catch up with non-quota students while in college as long as their level of effort is relatively higher. It is important to note that this result is driven by potential quota students who would not be admitted

without the policy.

While column (5) reports a negative effect of quotas on the final GPA, column (6) shows that this estimate becomes positive when controlling for entry exam scores. It means that among students with comparable entry exam scores, students from public high schools earn better grades than private school students. Therefore, conditional on the accumulated human capital at the end of high school, they are likely to differ in other characteristics, such as ability or effort. This finding aligns with takeaway (iv) of our analytical framework. As can be seen in Appendix Figure 1 and Appendix Table A.10, there is a negative relationship between entry exam score and being a quota student. In addition, the higher the entry exam score, the higher the likelihood of earning a high GPA and the lower the probability of failing courses. These relationships could explain the sign of the omitted variable bias. Taken together, these results suggest no evidence of mismatch for potential quota students comparable to non-quota students at UFBA once they enroll and eventually complete college.[22]

Table 5 presents the results for different fields of study for students who eventually graduated. For the three broad fields, the estimates without controlling for entry exam scores (odd columns) are somewhat similar across comparable panels, and indicate that potential quota students who would not be admitted without the policy have higher failure rates and lower GPAs in the first semester and at graduation. The results also show that the size of the estimated GPA effects reduces with time, reinforcing the catching-up evidence. We do not find statistically significant results for graduation on time (columns 7 and 8).

When controlling for the entry exam score (even columns), the estimates for health sciences and social sciences and humanities lose magnitude and statistical significance. More remarkably, for the technology majors, the results turn positive and statistically significant. Indeed, without controlling for entry exam scores, quota students had a reduction

[22]It is important to recognize that although the same university resources are *available* to all students, in practice potential affirmative action beneficiaries might not be able to take advantage of those resources due to longer commutes, part-time jobs, and fewer household resources to invest in a college education. On the other hand, overcoming these difficulties may develop social and other non-cognitive skills that might change the incentives for quota beneficiaries to exert effort while in college. For instance, time-constrained beneficiaries might become better at managing time and collaborating with fellow students on course assignments.

in first GPA of 0.167 points and a reduction in final GPA of 0.132. Controlling for entry exam scores, these parameters turn positive and significant with values of 0.382 and 0.252, respectively. Once again, these results are consistent with our analytical framework's take-away (iv). Interestingly, this pattern of results is driven by students who would not have been admitted without quotas.

6.3 Margins of Adjustment

In the last two subsections we provided evidence suggesting that the negative difference in graduation rates between potential quota and non-quota students is not large.[23] Remarkably, we provide evidence of a strong catching-up effect between the GPA at the beginning and at the end of the major. In some cases, UFBA potential quota students who graduated have similar GPAs or even outperform non-quota students. It is important to understand the mechanisms behind these results, specifically how students manage to catch up to their peers and graduate. In this subsection, we turn to margins of adjustment among the potential quota students who eventually graduate.

Although there are majors with a minimum length of 10 or 12 semesters, we focus on the period between the first and the eighth semester. This period comprises the typical time required to complete an undergraduate major at UFBA. Looking beyond that, we might capture some composition effects, which we aim to avoid. We also present the estimates separately for potential quota students admitted only because of the affirmative action policy and those who would have been admitted even without the policy.

Figure 3 shows that there is no difference between potential non-quota students and quota students who would have been admitted even without the policy (red), or β_1 in equation (8). All 95% confidence intervals include zero. Hence, the adjustment process occurs only for those who would have not been admitted without the policy (blue), or β_2 in equation (8). While the evidence suggests that lower grades early on in the college

[23]Even though the setting is different, the size of the estimate does not systematically differs from descriptive statistics from the UC system, where major switching is allowed (Arcidiacono et al., 2016). Again, with the caveat that the statistic in Arcidiacono et al. is unconditional and lacks identification from a policy change, we would have expected a larger mismatch in our setting because of the much higher cost to switch majors.

years predict major switching in the United States (Astorne-Figari and Speer, 2019), in our setting it seems to affect the learning pattern within the major.

Figure 3, Graph (a), displays the average grades by semester. It is possible to see that there is a process of adjustment at the beginning of the college experience. The difference between groups is the highest in the first semester, reducing in the second semester and increasing again in the third. Nevertheless, the difference decreases from the fourth semester onward. Graph (b) presents the cumulative GPA. The difference between groups drops semester by semester until graduation.

The previous evidence is complemented by Graph (c). This graph displays a higher number of failed courses in the first semester, which reduces in the second semester but increases again in the third. This pattern leads to a higher cumulative number of failed courses, as Graph (d) shows. Complementary evidence is also reported in Graphs (e) and (f) regarding the number of retaken courses by semester, and the cumulative number of retaken courses, respectively. Graph (e) shows that the number of retaken courses reduces over time, suggesting that potential quota students retake more courses along their graduation path, but this happens primarily in the first few semesters in college.

Figure 4, Graph (a), shows that quota students decrease their total number of credit hours in each period between the second and fourth semesters in college, compensating for this reduction in the final college years. This implies that they spend more hours in classes in the final years, as shown in Graph (b). This pattern seems to be driven primarily by the number of mandatory courses. Potential quota students reduce the number of mandatory courses taken in the third semester (Graph (c)), and cumulatively until the fifth semester (Graph (d)), but compensate for such a reduction in the final years. No clear differences emerge for elective courses, even though there is suggestive evidence that potential quota students substitute elective courses for mandatory courses in the second and third years in college (Graphs (e) and (f)).

One possible explanation for such a pattern is that as potential quota students fail relatively more courses in the first few semesters in college, they need to retake them. However, some of those failed courses are prerequisites for other courses. If a student is

not approved in course "A" in the second semester, they cannot enroll in course "B" in the third semester. Another explanation could be that potential quota students choose to enroll in fewer courses at the beginning of their college experience to catch up with former private school students or to improve their learning. Although suggestive, this evidence indicates that quota students may behave rationally, using university rules in their favor. Because it may be more difficult for them to follow the courses initially, they might adjust in the margins they can – the number of mandatory courses per semester – considering the setup with highly costly major switching.

Appendix Figures A.5 and A.6, which correspond to the counterparts of Figures 3 and 4 but with the control for entry exam score, show that there are only a few differences in the margins of adjustment for potential quota students relative to non-quota students. Interestingly, however, the pattern is largely similar for potential quota students who would have been admitted without the affirmative action policy and those who would have not been admitted otherwise. This is likely due to the fact that students with similar entry exam scores are more homogeneous regardless of the subgroup of potential quota students they belong. That said, the GPA in the second and fourth semesters is still above potential non-quota students, likely due to a reduction in the number of credit hours taken in the second semester. Also, the number of mandatory courses taken in the fourth and sixth semesters is higher, but the cumulative GPA is also higher in the last years in college. This is particularly the case for potential quota students who would have not been admitted without the affirmative action policy, but again we cannot rule out that these patterns are statistically the same for the two subgroups of potential quota students.

7 Additional Robustness Checks

In the previous section we have presented strong evidence on the impact of affirmative action on academic outcomes and explored the underlying mechanisms. Notwithstanding, it is crucial to consider alternative factors that may contribute to the estimated patterns in our results. In this section we address various concerns and bolster the reliability of our

findings through additional evidence and supplementary analyses.

First, a potential concern in our study is that potential quota students who enroll because of the affirmative action policy and potential quota students who would have enrolled even without the policy differ in observable and unobservable characteristics. Therefore, our heterogeneity analysis would lack a pure comparison group.

To provide evidence that those subgroups are generally similar but differ only in their entry exam score potentially due to high school quality, we use a regression discontinuity design (RDD) comparing the two potential quota subgroups. We use the entry exam score as the running variable and set to zero the score of the last quota student who would be admitted in major m and year t even without affirmative action. Next, we normalize the entry exam score of all quota students of major m and year t with respect to that student in the threshold. We then estimate a local linear regression using the robust optimal bandwidth selection proposed by Calonico et al. (2014).

Table 6 reports the estimates comparing the two potential quota subgroups using the RDD. The results suggest no difference in academic outcomes between the quota subgroups. We recognize, however, that this approach has the limitation that we are comparing only students around the threshold – that is, with entry exam scores close to the last quota student who would have been admitted even without the policy. In the estimation using the optimal bandwidth, we account for approximately 41% to 53% of the quota sample. In Appendix Figure A.7 we provide evidence that using a more flexible bandwidth does not significantly change the results. Besides, Appendix Tables A.11 and A.12 show that estimating the RDD using a higher degree polynomial does not change our results.

Second, because the quota policy allowed students with lower entry exam scores to enroll at UFBA, controlling for entry exam scores in the estimation may lead to comparisons with extrapolation, i.e., for potential quota students at the lower end of the entry exam score distribution, we might not have students in the comparison group who have a similar score, so these comparisons would be made by linear extrapolation of the regression line. To deal with this lack of common support, we restrict our sample to those students with similar entry exam scores and re-estimate equations (6) and (8). The common support was

defined such that for each major, we computed the lowest entry exam score for admitted potential quota students and non-quota students. We kept the highest score from these two values, $score_L$. Then, we computed the highest entry exam score for admitted potential quota students and non-quota students, and from these two values, we kept the lowest score, $score_H$. We then restrict our sample to students with entry exam scores between $score_L$ and $score_H$.[24] Appendix Tables A.13 and A.14 reveal that our results are statistically undistinguishable from our main estimates when the analysis focuses on students with comparable entry exam scores.

Third, introducing the quota policy may have changed instructors' behavior on how they grade students. Thus, GPA before and after the implementation of the policy may not represent comparable academic performance. Although we cannot rule out this mechanism, we explore this issue by estimating the following equation:

$$GPA_{imc} = \beta_0 Post_c + \beta_1 Score_{imc} + \beta_2 [Post_c \times Score_{imc}] + \psi_m + \epsilon_{imc}, \tag{9}$$

where i denotes student, m major, and c cohort. $Score$ is the entry exam score, $Post$ is a dummy variable indicating the cohorts affected by the policy, and ψ_c is a set of fixed effects for majors.

Appendix Table A.15 reports the results. As expected, the entry exam score affects GPA positively. Interestingly, however, this effect seems statistically the same before and after the policy. Indeed, the coefficient of the interaction is not statistically significant. This evidence suggests that GPA may convey similar academic performance before and after the implementation of the quota policy.

Fourth, if instructors believe that quota students are less academically prepared to attend the university, they may also adjust their course level to make it more manageable for those students. Unfortunately, this is another mechanism that we cannot rule out. Notwithstanding, to provide some evidence on the extent to which this may happen, we

[24] Out of the 22 majors in our main sample, 10 do not have common support for quota students who would have *not* been admitted without the policy: computer science, economics, environmental engineering, law, mechanical engineering, medicine, phonoaudiology, physical education, physics, and veterinary science.

estimate equation (10) for first-semester courses. This is the time at which instructors have a better chance of identifying quota and non-quota students, and also when they are still adapting to the introduction of the policy. The estimating equation is:

$$\begin{aligned} Y_{imcjp} = \beta_0 Post_c + \beta_1 Q_{imcjp} + \beta_2 [Post_c \times Q_{imcjp}] \\ + \beta_3 Score_{imcjp} + \beta_4 [Post_c \times Score_{imcjp}] + \psi_m + \nu_{jp} + \epsilon_{imcjp}, \end{aligned} \tag{10}$$

where Y_{imcjp} is the grade of student i from major m and cohort c in course j taught by instructor p, Q and $Post$ are defined as in equation (6), $Score$ is the student score in the entry examination, ψ_m is a set of major fixed effects, and ν_{jp} is a set of instructor-by-course fixed effects. Hence, β_0 implicitly reveals how instructors who taught the same first semester courses behaved before and after the quota implementation. We estimate the equation with and without the interactions of $Post$ and the indicator for quota students and the entry exam score.

Appendix Tables A.16 and A.17 show that the coefficient for "After Quotas" is negative and significant for the equation without interactions, suggesting that grades in courses taught by the same instructors in the same courses are smaller after the implementation of the quota policy. Nevertheless, estimating the full equation (10) reveals that the coefficient of the indicator for "After Quotas" becomes small and not statistically significant, indicating that the difference in grades before and after the implementation of the quota policy is explained by the lower performance of potential quota students. These results suggest that instructors did not appear to change the course materials significantly. Given that the instructors' beliefs that quota students are less academically prepared may be interpreted as discrimination against black and mixed-race students from public schools, only strong beliefs would bias our results.

Fifth, one may also worry that if courses in the final years of college have higher grades and smaller variances, the catching-up effect we find for potential quota students who eventually graduate would be mechanical. In an attempt to rule this out, we calculate the mean and standard deviation of grades for each semester by major before and after the

affirmative action policy was implemented, and estimate the following equation:

$$Y_{ijc} = \beta_0 Post_c + \beta_1 Semester_i + \beta_2 [Post_c \times Semester_i] + \psi_c + \epsilon_{ijc}, \tag{11}$$

where Y_{ijc} is either the mean or the variance of grades in semester i and course j for cohort c (before or after quotas).

Appendix Table A.18 reports that grades in the later years of college seem higher, but the magnitude of the effect is small. When we look at variance, grades appear to be more, not less, dispersed in the later years of college, and such dispersion appears to be the same before and after the implementation of the affirmative action policy. Thus, the catching-up effect we have reported does not seem to be driven by the narrowing of the grade distribution in the later years of college.

Lastly, a potential concern with the heterogeneity analysis by broad fields of study is that the estimates might reflect impacts of the quota policy arising from majors with different levels of selectivity. Major selectivity is defined based on the entry exam score of the last student enrolled in that major, with majors with higher minimum scores defined as more selective. To address this concern, we first provide descriptive statistics in Appendix Table A.23 on the variation in minimum scores across majors. Because majors are ordered by selectivity, we can observe that the most selective majors come from different broad fields of study – medicine and dentistry from health sciences, law and business from social sciences and humanities, and computer science and environmental engineering from technology. Furthermore, there is variation in selectivity across majors within a field. Among technology majors, for example, computer science and environmental engineering are much more selective than civil and engineering and geology.

We then run the analysis for students in top-selective majors – those in the first quartile of the selectivity – and students in all other majors. The estimates are reported in Appendix Tables A.24 and A.25. Although point estimates may differ in magnitude, statistically we cannot rule out that they are similar for more versus less selective majors. Interestingly, most of the estimates by subgroups of quota students are larger in abso-

lute values for less selective majors. These patterns of results reveal another interesting dimension of heterogeneity in the effects of the affirmative action policy.

8 Concluding Remarks

This paper has examined the effect of the affirmative action policy at the Federal University of Bahia (UFBA), Brazil, on student academic performance. We have leveraged administrative records from the aforementioned university within a difference-in-differences approach, comparing average outcomes of potential quota and non-quota students.

The main contribution of the paper is to provide evidence of a relatively low mismatch effect among affirmative action students at UFBA and of a relatively strong catch-up effect. Also, even with highly costly major switching, most students who benefited from affirmative action exploited any margins of adjustment available to them to reach graduation. Curriculum rigidity, a typical feature of the higher education system in Brazil, did not seem to preclude disadvantaged students from successfully completing their undergraduate studies. The analysis also pointed out that mismatch occurred primarily within technology majors, where a strong foundation in mathematics is crucial. This finding emphasizes the critical role of pre-college preparation in ensuring alignment between students' knowledge and the demands of their chosen fields.

Ultimately, the UFBA affirmative action policy seems to serve as a gateway for students from socioeconomically disadvantaged backgrounds to access a prestigious university and acquire a top-tier education. In this regard, the policy aligns with the objectives outlined by the United Nations' development agenda, particularly in its pursuit of reducing societal inequalities and fostering the provision of quality education.

The catch-up effects resulting from the affirmative action, in particular, may play a pivotal role in promoting diversity in the labor market. By providing opportunities for historically marginalized groups to access quality higher education and overcome initial academic challenges, affirmative action enables individuals to acquire the necessary skills and qualifications for meaningful employment. As these beneficiaries catch up and demonstrate

their capabilities, they contribute to a more diverse and inclusive workforce, potentially fostering different perspectives, creativity, and innovation. This diversity may enhance the overall productivity of the labor market.

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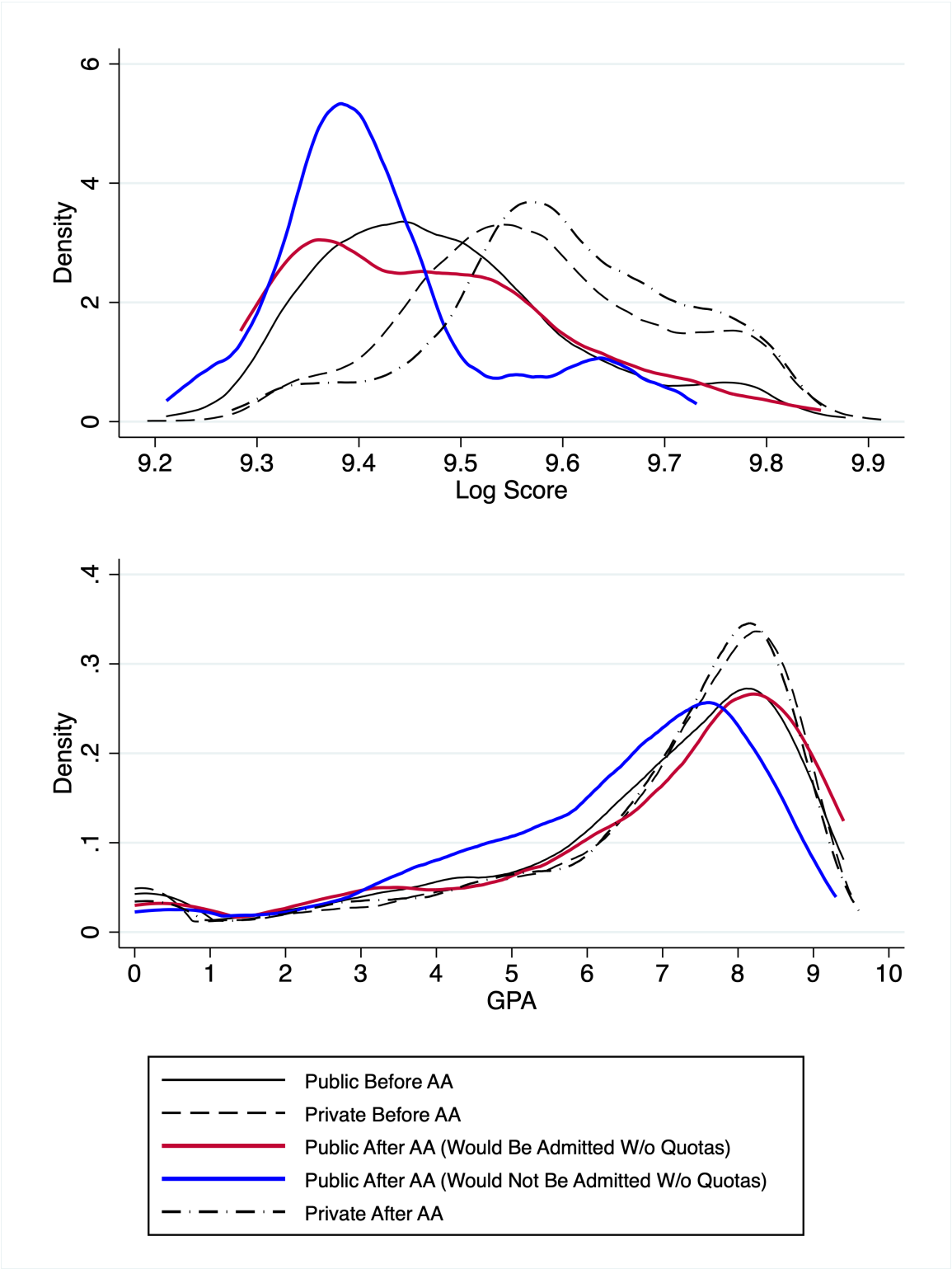
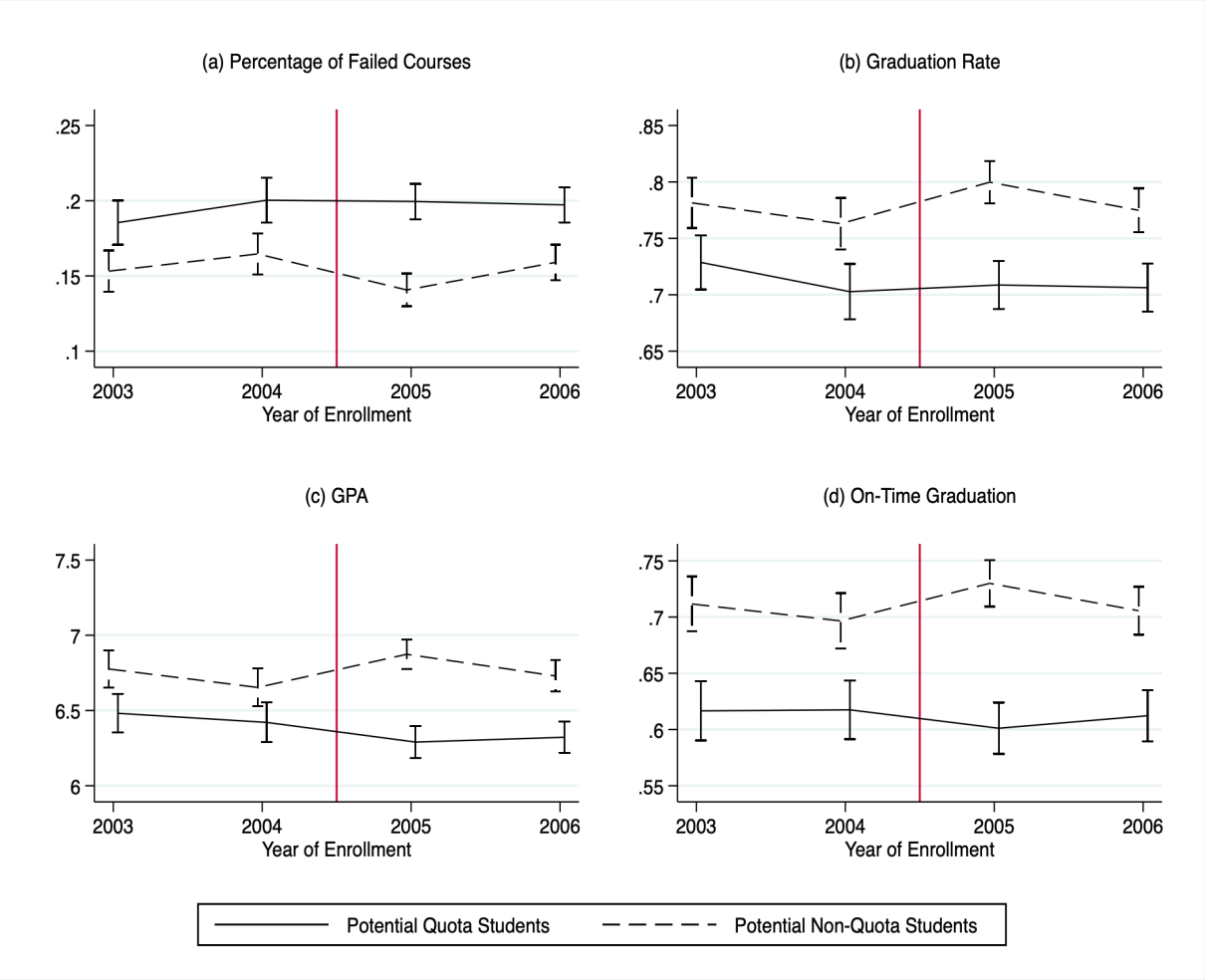
Figures and Tables

Fig. 1: Entry Exam Score and GPA for Different Subgroups of Students



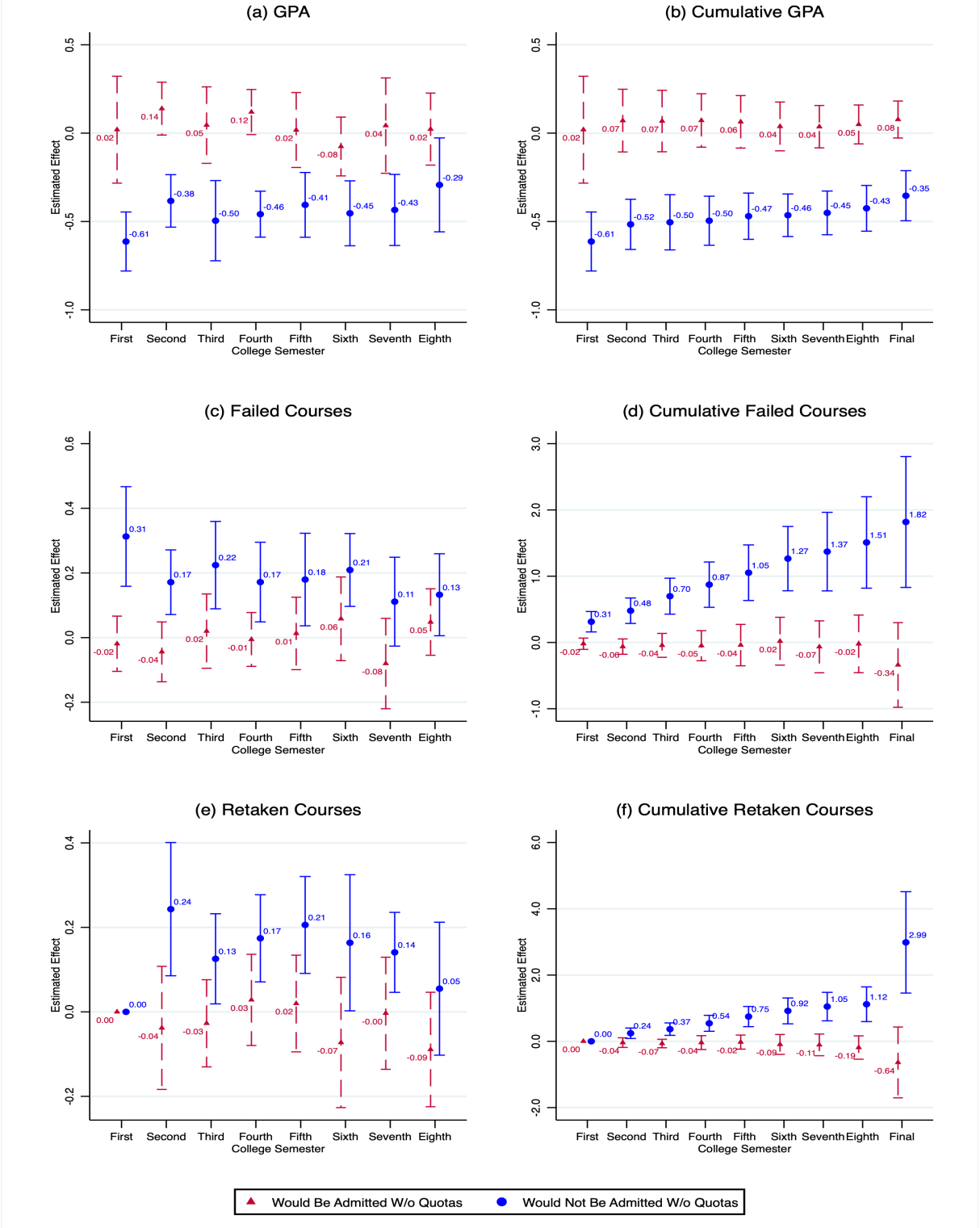
Notes: This figure displays the distribution of: (a) entry exam score and (b) final grade point average (GPA) among all enrolled students from public and private high schools, before and after the quota-type affirmative action (AA) policy.

Fig. 2: Supporting Evidence of Parallel Trends for Main Outcomes



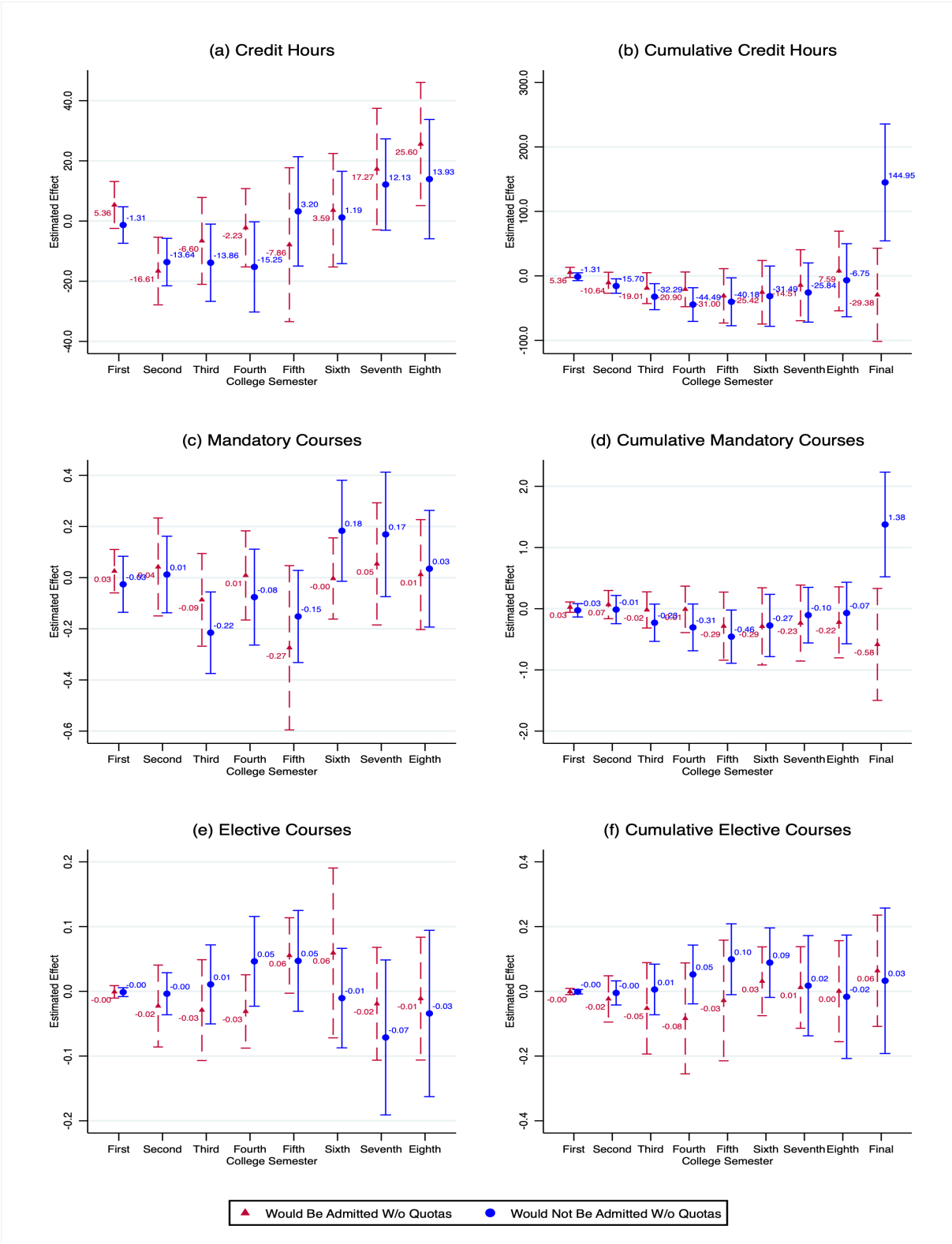
Notes: This figure displays the trends in outcomes for the treatment group (solid line) and the comparison group (dashed line). Graph (a) shows the percentage of failed courses among all courses taken while in college; graph (b) graduation rates, measured as the percentage of students who eventually graduated; graph (c) the final GPA, measured as the credit-hour weighted course grades; and graph (d) the percentage of on-time graduation, defined as graduation up to two years after the regular duration for that major (see Appendix Table A.1 for the major regular duration).

Fig. 3: Effects of Admission via Quotas by College Semester



Notes: This figure presents the estimated impacts of the UFBA quota policy on (a) semester GPA, (b) cumulative GPA, (c) number of failed courses in the semester, (d) cumulative number of failed courses, (e) number of retaken courses in the semester, and (f) cumulative number of retaken courses. The estimates refer to the difference-in-differences coefficients β_1 (red) and β_2 (blue) from equation (8) for each student outcome by semester. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006.

Fig. 4: Effects of Admission via Quotas by College Semester



Notes: This figure presents the estimated impacts of the UFBA quota policy on (a) number of credit hours, (b) cumulative number of credit hours, (c) number of mandatory courses, (d) cumulative number of mandatory courses, (e) number of elective courses, and (f) cumulative number of elective courses. The estimates refer to the difference-in-differences coefficients β_1 (red) and β_2 (blue) from equation (8) for each student outcome by semester. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006.

Table 1: Descriptive Statistics and Unconditional DiD Estimates

Variables	Before Affirmative Action (1) Potential Non Quota Average	(2) Potential Quota Average	After Affirmative Action (3) Potential Non Quota Average	(4) Potential Quota Average	(5) Difference in Differences
Enrolled Quota Student	-	-	0.00	0.87	0.87***
			[0.05]	[0.33]	(0.01)
Age at College Admission	20.06	21.6	18.81	20.46	0.11
	[1.7]	[2.57]	[1.72]	[2.83]	(0.12)
Male	0.5	0.44	0.49	0.49	0.06**
	[0.5]	[0.5]	[0.5]	[0.5]	(0.03)
Black or Mixed Race	0.49	0.71	0.65	0.86	-0.01
	[0.5]	[0.45]	[0.48]	[0.35]	(0.02)
Single	0.99	0.93	0.99	0.95	0.02**
	[0.1]	[0.26]	[0.09]	[0.22]	(0.01)
Have Children	0.01	0.06	0.02	0.06	-0.01
	[0.11]	[0.25]	[0.13]	[0.23]	(0.01)
Took Test Prep Course	0.52	0.76	0.55	0.74	-0.05*
	[0.5]	[0.43]	[0.5]	[0.44]	(0.03)
Worked While in School	0.04	0.23	0.04	0.26	0.04**
	[0.21]	[0.42]	[0.2]	[0.44]	(0.02)
Plan to Work Since 1st Year	0.33	0.5	0.32	0.5	0.02
	[0.47]	[0.5]	[0.47]	[0.5]	(0.03)
Household Income					
Up to 5 Minimum Wages	0.16	0.54	0.25	0.75	0.12***
	[0.36]	[0.5]	[0.43]	[0.44]	(0.02)
From 5 to 10 Min. Wages	0.31	0.31	0.29	0.2	-0.08***
	[0.46]	[0.46]	[0.45]	[0.4]	(0.02)
More than 10 Min. Wages	0.53	0.16	0.46	0.06	-0.03
	[0.5]	[0.37]	[0.5]	[0.23]	(0.02)
Parent's Education					
Father - College Degree	0.47	0.13	0.46	0.09	-0.03
	[0.5]	[0.34]	[0.5]	[0.28]	(0.02)
Mother - College Degree	0.46	0.12	0.45	0.07	-0.04
	[0.5]	[0.33]	[0.5]	[0.26]	(0.02)
Entry Exam Performance					
Entry Exam Standardized Score	0.55	-0.14	0.69	-0.42	-0.42***
	[1.02]	[0.96]	[0.99]	[0.91]	(0.05)
College Performance					
Failed Course	0.09	0.11	0.08	0.13	0.03**
	[0.29]	[0.31]	[0.28]	[0.34]	(0.02)
First Semester GPA	6.83	6.69	6.99	6.45	-0.4***
	[2.2]	[2.37]	[2.1]	[2.14]	(0.12)
Final GPA	6.71	6.45	6.81	6.31	-0.24*
	[2.33]	[2.42]	[2.18]	[2.25]	(0.12)
Graduation	0.77	0.72	0.79	0.71	-0.02
	[0.42]	[0.45]	[0.41]	[0.46]	(0.02)
On-Time Graduation	0.70	0.62	0.72	0.61	-0.03
	[0.46]	[0.49]	[0.45]	[0.49]	(0.03)

Notes: This table reports unconditional difference-in-differences estimates of the quota policy for the average characteristics of students and main outcomes. Columns (1) and (3) present the average for the comparison group while columns (2) and (4) present the average for the treatment group, before and after the quota policy took place, respectively. For columns (1) through (4) we present the standard deviation in square brackets below each average. Column (5) presents the unconditional difference-in-differences (DiD) estimate for each variable, and standard errors in parentheses. We characterize an individual as a potential quota student if they attended most of their high school in a public institution.

Table 2: Impacts of the Quota Policy for All Enrolled Students

Dependent Variable	(1) Failures	(2) Failures	(3) Graduation	(4) Graduation
Panel A: Effects for All Quota Students				
Potential Quota Student	0.0391***	-0.000511	-0.0577***	-0.0253
	(0.0128)	(0.0151)	(0.0172)	(0.0172)
Comparison Group Average	0.159	0.159	0.772	0.772
Panel B: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.0116	-0.0169	0.00540	0.00858
	(0.0144)	(0.0147)	(0.0206)	(0.0208)
Would *NOT* Be Admitted W/o Quotas	0.0828***	0.0249	-0.112***	-0.0777**
	(0.0175)	(0.0227)	(0.0263)	(0.0276)
Comparison Group Average	0.159	0.159	0.772	0.772
Observations	5,798	5,798	5,798	5,798
Cohort FE	✓	✓	✓	✓
Major FE	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓
Entry Exam Score		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on two student outcomes – the proportion of failed courses among all courses taken ("Failures") and the proportion of students who eventually graduate ("Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the score obtained by the student in the overall entry examination. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 3: Results for All Enrolled Students by Broad Fields of Study

Dependent Variable	(1) Failures	(2) Failures	(3) Graduation	(4) Graduation
Technology				
Panel A: Effects for All Quota Students				
Potential Quota Student	0.0560**	0.00193	-0.116***	-0.0602***
	(0.0177)	(0.0187)	(0.0159)	(0.0178)
Comparison Group Average	0.246	0.246	0.663	0.663
Panel B: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.0113	-0.0157	-0.0294	-0.0253
	(0.0232)	(0.0223)	(0.0363)	(0.0349)
Would *NOT* Be Admitted W/o Quotas	0.110***	0.0263	-0.186***	-0.108**
	(0.0249)	(0.0364)	(0.0314)	(0.0384)
Comparison Group Average	0.246	0.246	0.663	0.663
Observations	1,793	1,793	1,793	1,793
Health Sciences				
Panel C: Effects for All Quota Students				
Potential Quota Student	0.0262	-0.00583	-0.0254	-0.0291
	(0.0295)	(0.0322)	(0.0331)	(0.0376)
Comparison Group Average	0.088	0.088	0.864	0.864
Panel D: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.0358	-0.0367	0.0249	0.0241
	(0.0296)	(0.0297)	(0.0493)	(0.0497)
Would *NOT* Be Admitted W/o Quotas	0.0485	0.0173	-0.0435	-0.0690
	(0.0286)	(0.0355)	(0.0344)	(0.0406)
Comparison Group Average	0.088	0.088	0.864	0.864
Observations	2,110	2,110	2,110	2,110
Social Sciences and Humanities				
Panel E: Effects for All Quota Students				
Potential Quota Student	0.0371*	0.0124	-0.0475	-0.0234
	(0.0166)	(0.0268)	(0.0256)	(0.0336)
Comparison Group Average	0.159	0.159	0.764	0.764
Panel F: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	0.00702	0.00168	-0.000154	0.00233
	(0.0220)	(0.0250)	(0.0292)	(0.0320)
Would *NOT* Be Admitted W/o Quotas	0.0926***	0.0507	-0.135**	-0.115
	(0.0218)	(0.0461)	(0.0428)	(0.0650)
Comparison Group Average	0.159	0.159	0.764	0.764
Observations	1,895	1,895	1,895	1,895
Cohort FE	✓	✓	✓	✓
Major FE	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓
Entry Exam Score		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on two student outcomes – the proportion of failed courses among all courses taken ("Failures") and the proportion of students who eventually graduate ("Graduation"). The estimates in Panel A, C, and E refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B, D, and F refer to the β's from equation (8). Panel A and B show the results only for students in technology majors. Panels C and D show the results only for students in health science majors. Panels E and F show the results only for students in social science majors. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the score obtained by the student in the overall entry examination. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 4: Results for Students Who Graduated

Dependent Variable	(1) Failures	(2) Failures	(3) 1st GPA	(4) 1st GPA	(5) GPA	(6) GPA	(7) Graduation on Time	(8) Graduation on Time
Panel A: Effects for All Quota Students								
Potential Quota Student	0.0133***	-0.00738	-0.309***	0.0770	-0.148***	0.149**	-0.0180	0.0134
	(0.00453)	(0.00547)	(0.0945)	(0.130)	(0.0491)	(0.0591)	(0.0176)	(0.0158)
Comparison Group Average	0.051	0.051	7.526	7.526	7.706	7.706	0.911	0.911
Panel B: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.00400	-0.00698	0.0195	0.0737	0.0770	0.121**	0.00636	0.0110
	(0.00459)	(0.00482)	(0.145)	(0.150)	(0.0503)	(0.0527)	(0.0208)	(0.0206)
Would *NOT* Be Admitted W/o Quotas	0.0292***	-0.00801	-0.613***	0.0822	-0.354***	0.192**	-0.0404*	0.0172
	(0.00658)	(0.00830)	(0.0803)	(0.121)	(0.0681)	(0.0787)	(0.0232)	(0.0210)
Comparison Group Average	0.051	0.051	7.526	7.526	7.706	7.706	0.911	0.911
Observations	4,392	4,392	4,375	4,375	4,392	4,392	4,392	4,392
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Major FE	✓	✓	✓	✓	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓	✓	✓	✓	✓
Entry Exam Score		✓		✓		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on four student outcomes – the proportion of failed courses among all courses taken ("Failures"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most four semesters (2 years) after their major's minimum duration ("On-Time Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the score obtained by the student in the overall entry examination. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters.

Table 5: Results for Students Who Graduated by Broad Fields of Study

Dependent Variable	(1) Failures	(2) Failures	(3) 1st GPA	(4) 1st GPA	(5) GPA	(6) GPA	(7) On-Time Graduation	(8) On-Time Graduation
Technology								
Panel A: Effects for All Quota Students								
Potential Quota Student	0.0124	-0.0187*	-0.167	0.382**	-0.132	0.252**	-0.0297	0.0200
	(0.0111)	(0.00977)	(0.158)	(0.125)	(0.0986)	(0.0818)	(0.0629)	(0.0525)
Comparison Group Average	0.095	7.211	7.068	0.814	0.095	7.211	7.068	0.814
Panel B: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.00995	-0.00919	0.416*	0.393*	0.107	0.0978	-0.00781	-0.00910
	(0.00827)	(0.00811)	(0.213)	(0.207)	(0.0743)	(0.0974)	(0.0655)	(0.0639)
Would *NOT* Be Admitted W/o Quotas	0.0301*	-0.0303*	-0.639***	0.369**	-0.324**	0.440***	-0.0472	0.0555
	(0.0138)	(0.0144)	(0.133)	(0.120)	(0.113)	(0.107)	(0.0706)	(0.0536)
Comparison Group Average	0.095	0.095	7.211	7.211	7.068	7.068	0.814	0.814
Observations	1,469	1,469	1,466	1,466	1,469	1,469	1,469	1,469
Health Sciences								
Panel C: Effects for All Quota Students								
Potential Quota Student	0.0130	-0.00606	-0.318**	0.136	-0.126	0.199*	-0.0161	0.0127
	(0.00725)	(0.00721)	(0.113)	(0.130)	(0.0906)	(0.0899)	(0.0222)	(0.0199)
Comparison Group Average	0.027	0.027	7.477	7.477	7.923	7.923	0.964	0.964
Panel D: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.0120	-0.0132	0.196	0.226	0.202*	0.224*	0.0263**	0.0280**
	(0.00700)	(0.00701)	(0.144)	(0.139)	(0.0966)	(0.0957)	(0.00787)	(0.00923)
Would *NOT* Be Admitted W/o Quotas	0.0224**	-0.000586	-0.511***	0.0667	-0.249**	0.180*	-0.0320	0.000845
	(0.00808)	(0.00839)	(0.0988)	(0.131)	(0.0780)	(0.0867)	(0.0309)	(0.0332)
Comparison Group Average	0.027	0.027	7.477	7.477	7.923	7.923	0.964	0.964
Observations	1,794	1,794	1,792	1,792	1,794	1,794	1,794	1,794
Social Sciences and Humanities								
Panel E: Effects for All Quota Students								
Potential Quota Student	0.0102	-0.000937	-0.405	-0.236	-0.124	0.0645	-0.0139	-0.0000757
	(0.00720)	(0.00919)	(0.210)	(0.285)	(0.0776)	(0.112)	(0.0178)	(0.0305)
Comparison Group Average	0.047	0.047	7.877	7.877	7.964	7.964	0.921	0.921
Panel F: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.00106	-0.00386	-0.354	-0.294	0.0294	0.0821	0.00286	0.00595
	(0.00663)	(0.00817)	(0.241)	(0.284)	(0.0655)	(0.0898)	(0.0344)	(0.0367)
Would *NOT* Be Admitted W/o Quotas	0.0352*	0.0108	-0.521***	0.000390	-0.465**	-0.00647	-0.0512	-0.0243
	(0.0159)	(0.0197)	(0.127)	(0.334)	(0.168)	(0.244)	(0.0315)	(0.0306)
Comparison Group Average	0.047	0.047	7.877	7.877	7.964	7.964	0.921	0.921
Observations	1,129	1,129	1,117	1,117	1,129	1,129	1,129	1,129
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Major FE	✓	✓	✓	✓	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓	✓	✓	✓	✓
Entry Exam Score		✓		✓		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on four student outcomes – the proportion of failed courses among all courses taken ("Failures"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most four semesters (2 years) after their major's minimum duration ("On-Time Graduation"). The estimates in Panel A, C, and E refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B, D, and F refer to the β's from equation (8). Panel A and B show the results only for students in technology majors. Panel C and D show the results only for students in heath science majors. Panels E and F show the results only for students in social science majors. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the score obtained by the student in the overall entry examination. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6: RDD Estimation Comparing Academic Outcomes Between the Two Subgroups of Potential Quota Students

	(1) Failures	(2) 1st GPA	(3) GPA	(4) Graduation
Would Be Admitted W/o Quotas	-0.037	-0.084	0.363	0.084
	(0.029)	(0.364)	(0.250)	(0.061)
Observations	1,468	1,446	1,467	1,468
Effective Observations	806	695	806	858
Major FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓

Notes: This table reports RDD estimates that compare the outcome of the last potential quota student who would have been admitted even without the policy with the outcome of the first potential quota student who was admitted only because of the policy. We use the entry exam score as the running variable and set to zero the score of the last quota student who would be admitted in major m and year t even without the affirmative action. Next, we normalize the entry exam score of all potential quota students of major m and year t in relation to that student in the threshold. We then estimate a local linear regression on the running variable. We use the robust optimal bandwidth selection proposed by Calonico et al. (2014). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in 2005 and 2006. There are 4 major-years for which there are either no potential quota students who would have been admitted even without the quota policy (speech therapist in 2006) or for which all potential quota students would have been admitted even without quotas (Executive Assistant, Geology, and Pedagogy in 2005). Students in these major-years are dropped from the sample for this analysis. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

ONLINE APPENDIX
(NOT FOR PUBLICATION)

Bridging the Gap: Mismatch Effects and Catch-Up Dynamics in a Brazilian College Affirmative Action

Rodrigo Oliveira, Alei Santos, Edson Severnini

Appendix A.1 Explaining the creation of the treatment variable and robustness checks using alternative treatment definitions

In this paper, our main treatment definition is "potential status as affirmative action student," or simply *potential quota student*. This refers to students that attended high school in a public institution. We chose this as our preferred definition because of data limitations. Recall that eligibility to the UFBA affirmative action policy requires an applicant to attend all years of high school in a public institution and at least one year of elementary or middle school in a public school. Unfortunately, the latter piece of information is not consistently measured in the entry exam socioeconomic questionnaire.

Before the policy was in place, the socioeconomic questionnaire asked: **what was the type of elementary and middle school you attended?** The potential answers were:

1. Public school
2. Initially public, then private school
3. Private school
4. Initially private, then public school
5. Do not know

Regarding **high school**, the potential answers were:

1. Public school, owned by municipality
2. Public school, owned by state
3. Public school, owned by the federal government
4. Private school
5. Public school, community school
6. High school equivalency (General Educational Diploma - GED)
7. Mostly in private school
8. Mostly in public school

After policy implementation, however, the socioeconomic questionnaire changed, and the question became: **which type of school did you attend for most of your elementary and middle school (or high school)?** The potential answers became:

1. Public school, owned by municipality
2. Public school, owned by state
3. Public school, owned by the federal government
4. Private school
5. Public school, community school

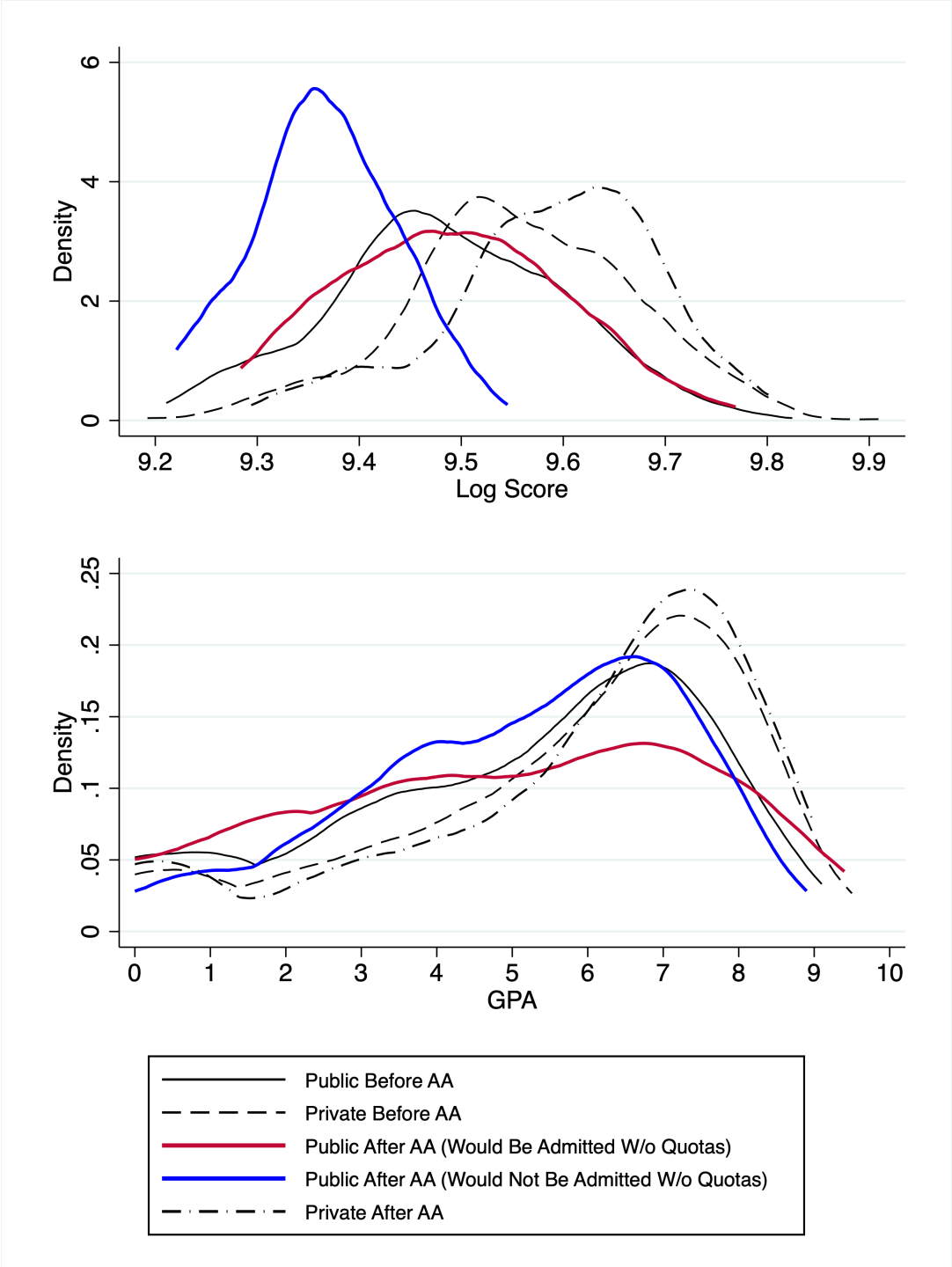
We define our main treatment variable – potential quota student – using only the information embedded in the high school questions. Notice that the answers 1, 2, 3, 5, and 8 in the pre-policy period are consistent with the answers 1, 2, 3, and 5 in the post-policy period. On the other hand, if we were to use the information embedded in the elementary and middle school questions, there would be some imprecision. We cannot consistently match the answers for these questions in the pre- and post-policy periods.

That said, the dataset also has information on whether a student is an affirmative action beneficiary or not after the policy. Therefore, we can compare the potential quota student status with the actual quota status. It turns out that 87% of the potential quota students are actual quota students using our preferred treatment definition. Furthermore, only 0.12% of the potential non-quota students are not actual non-quota students.

To provide evidence that our results using our preferred treatment definition are not sensitive to alternative definitions, we conduct two robustness checks. First, we re-estimate the main difference-in-differences regressions using the actual quota status instead of the potential quota status for the post-policy period. The results are presented in Appendix Tables A.19 and A.20. Second, we create a rather imprecise definition of potential quota students using both the high school and the elementary and middle school information. Appendix Tables A.21 and A.22 report the results. Overall, the estimated coefficients using these two alternative treatment definitions do not change significantly relative to our main results.

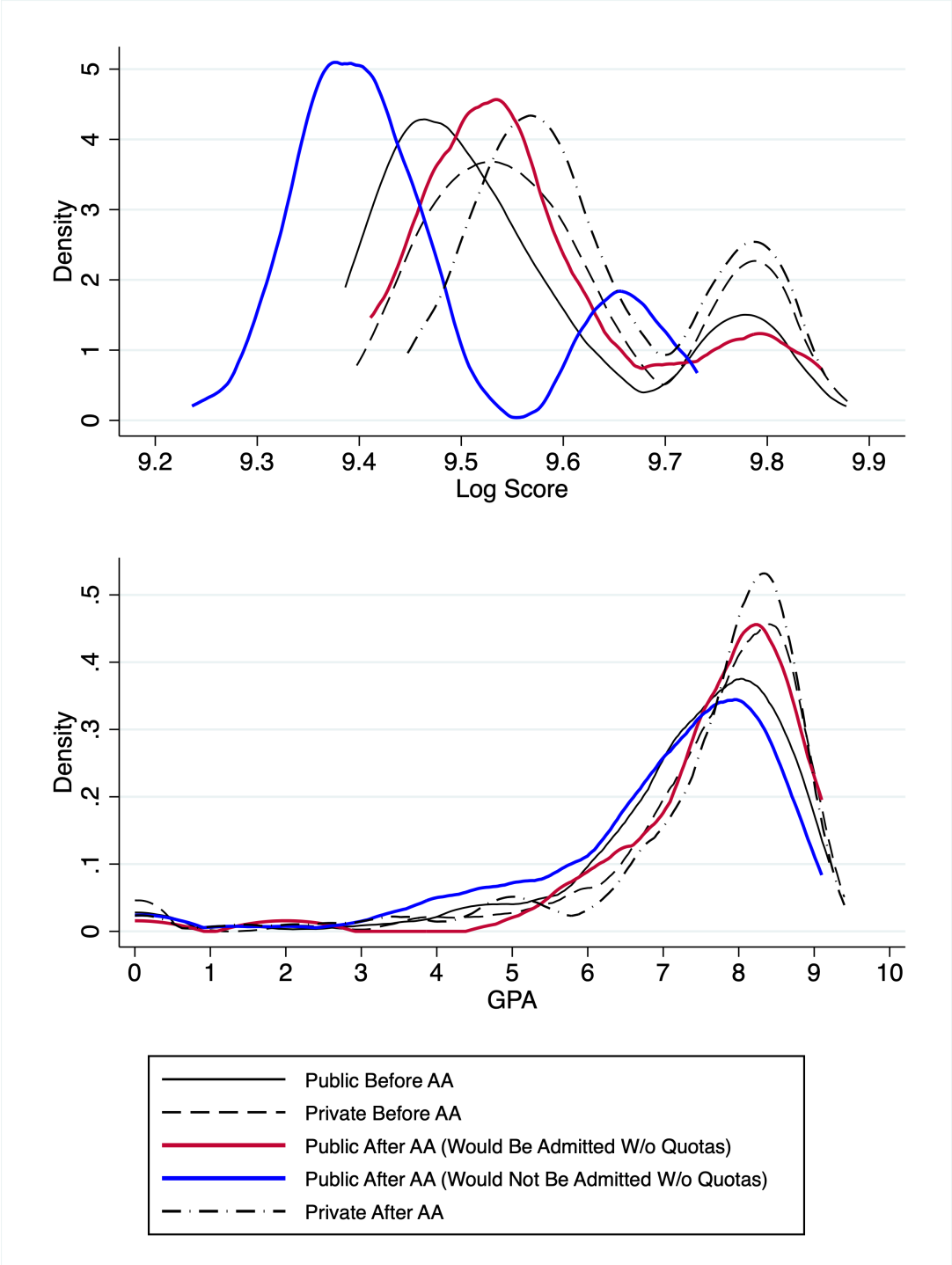
Appendix A.2 Additional Figures and Tables

Fig. A.1: Entry Exam Score and GPA for Different Subgroups of Students in Technology Majors



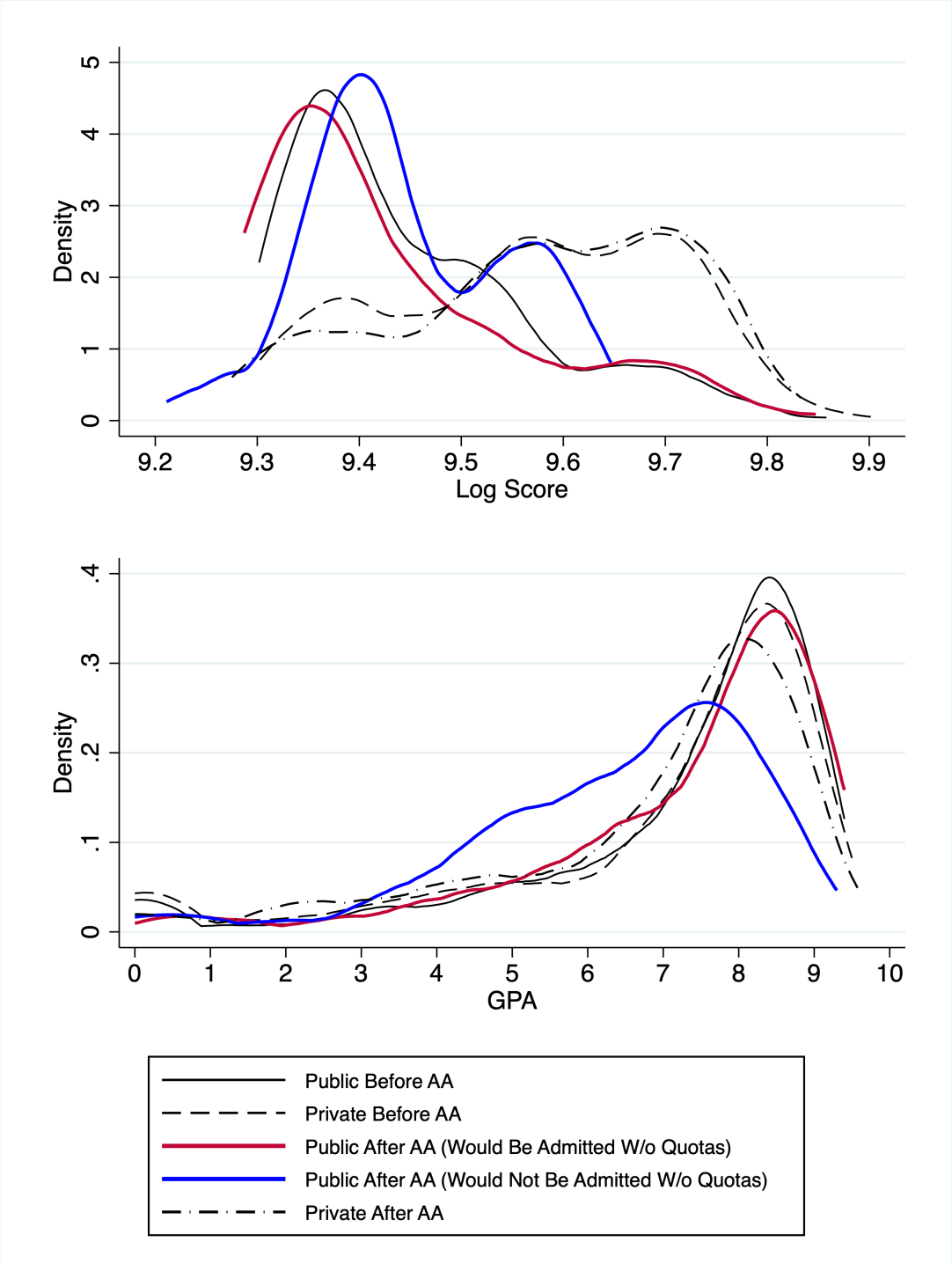
Notes: This figure presents the distribution of: (a) entry exam score, and (b) final grade point average (GPA) among all enrolled technology major students from public and private high schools, before and after the quota-type affirmative action (AA) policy.

Fig. A.2: Entry Exam Score and GPA for Different Subgroups of Students in Health Sciences Majors



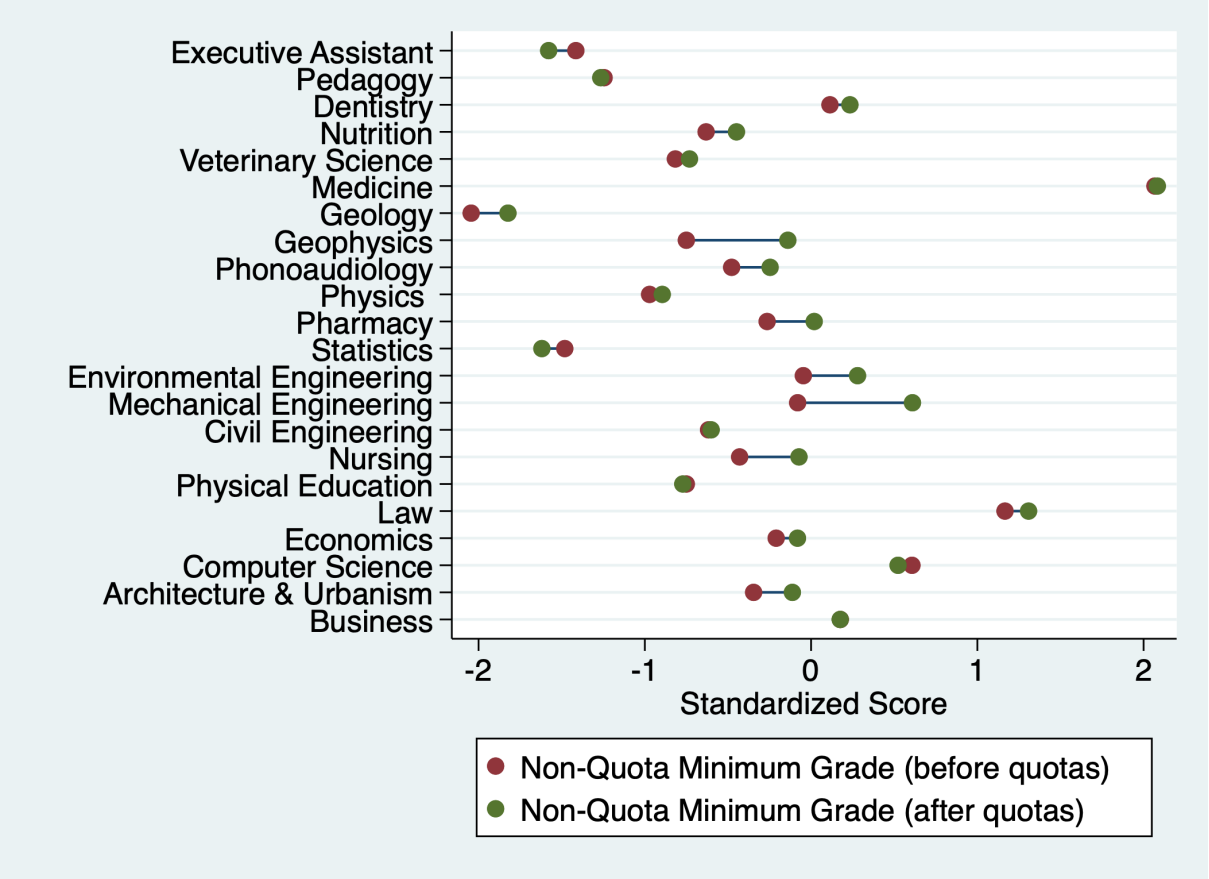
Notes: This figure presents the distribution of: (a) entry exam score, and (b) final grade point average (GPA) among all enrolled health science major students from public and private high schools, before and after the quota-type affirmative action (AA) policy.

Fig. A.3: Entry Exam Score and GPA for Different Subgroups of Students in Social Sciences and Humanities Majors



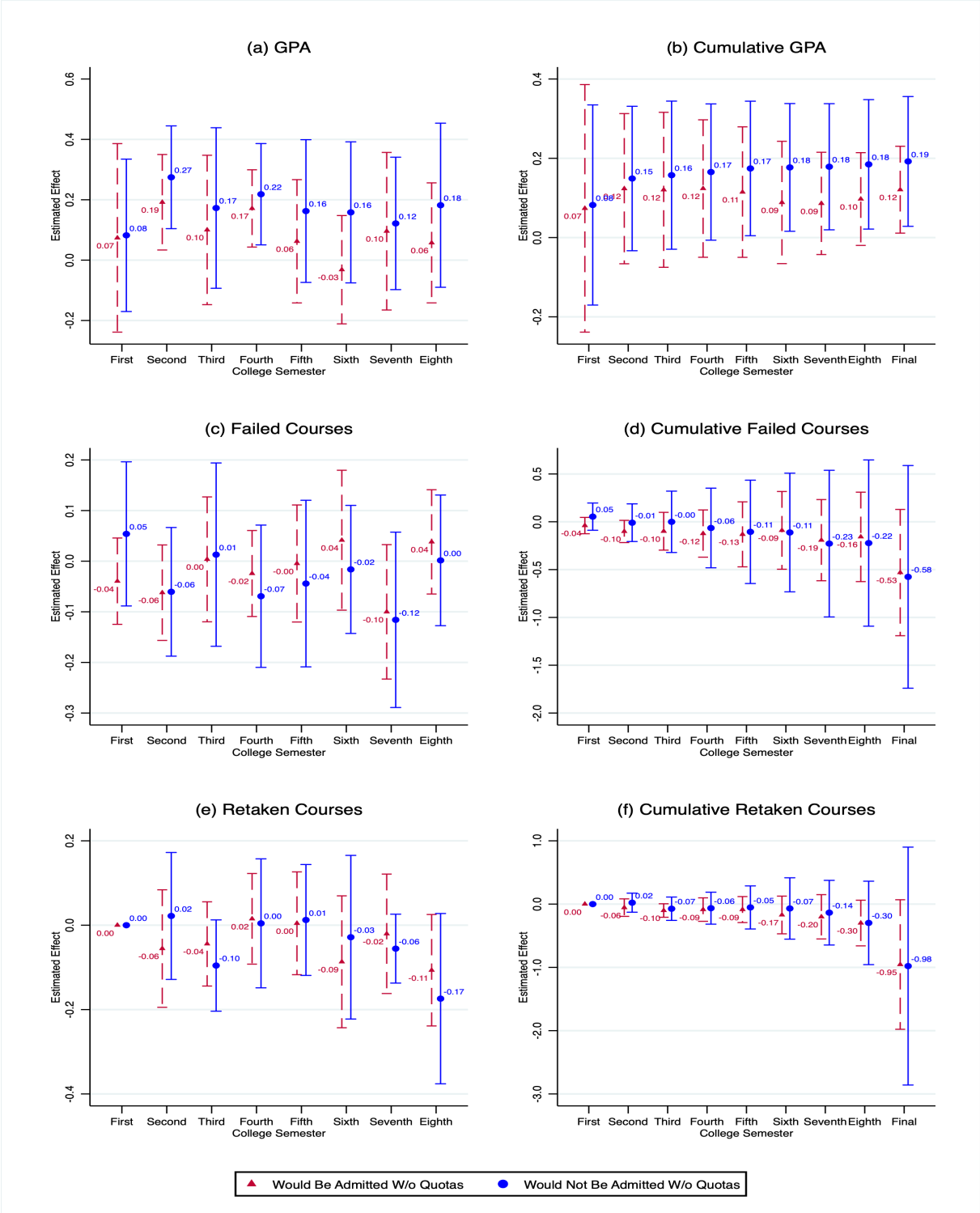
Notes: This figure presents the distribution of: (a) entry exam score, and (b) final grade point average (GPA) among all enrolled social sciences and humanities major students from public and private high schools, before and after the quota-type affirmative action (AA) policy.

Fig. A.4: Minimum Entry Exam Scores for Non-Quota Students Before and After the Quota Policy



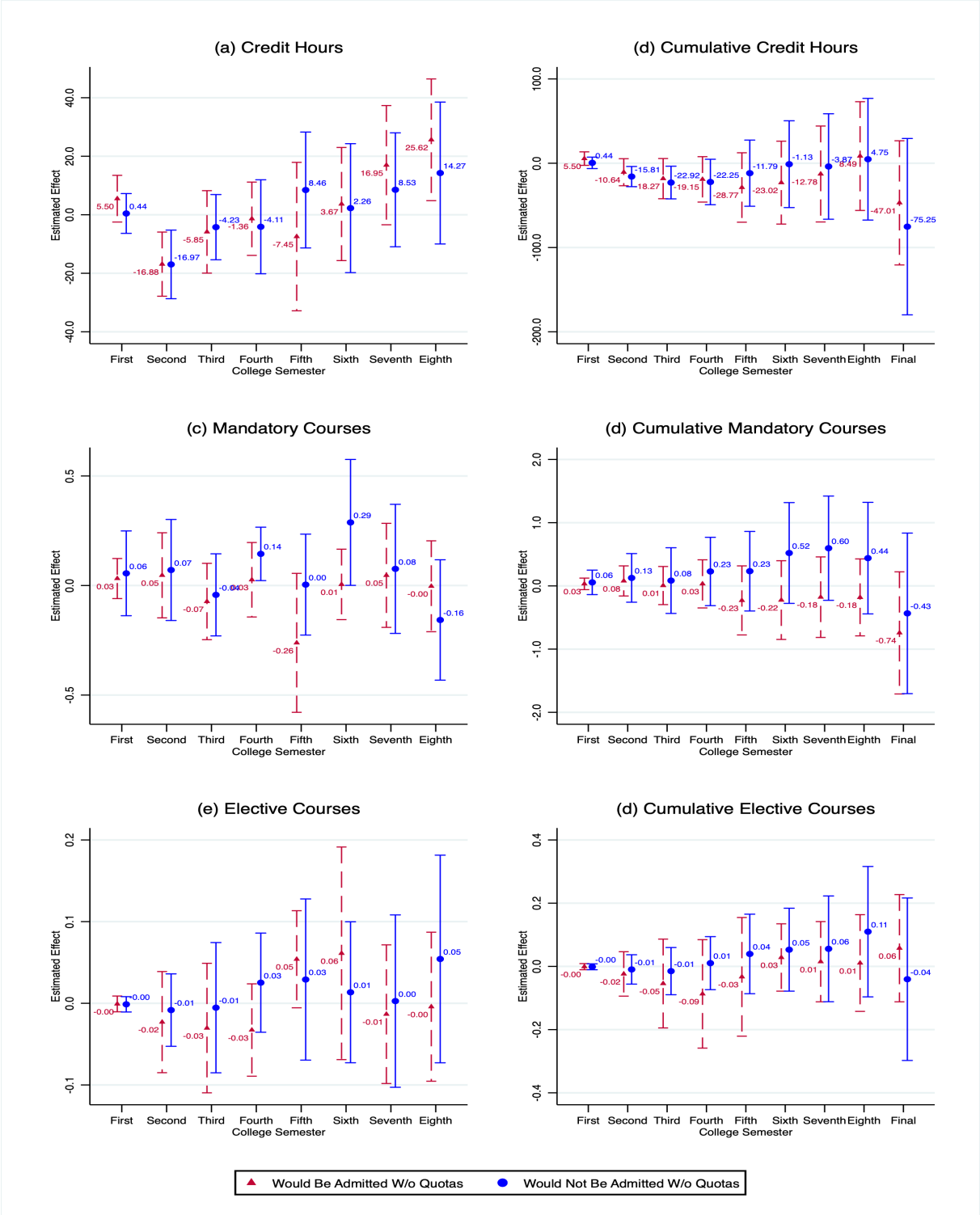
Notes: This figure presents the standardized entry exam score for the last non-quota student who would have been admitted at UFBA before the quota policy (red) and the score for the last admitted non-quota student after the introduction of the policy (green).

Fig. A.5: Effects of Admission via Quotas by College Semester When Controlling for Entry Exam Scores



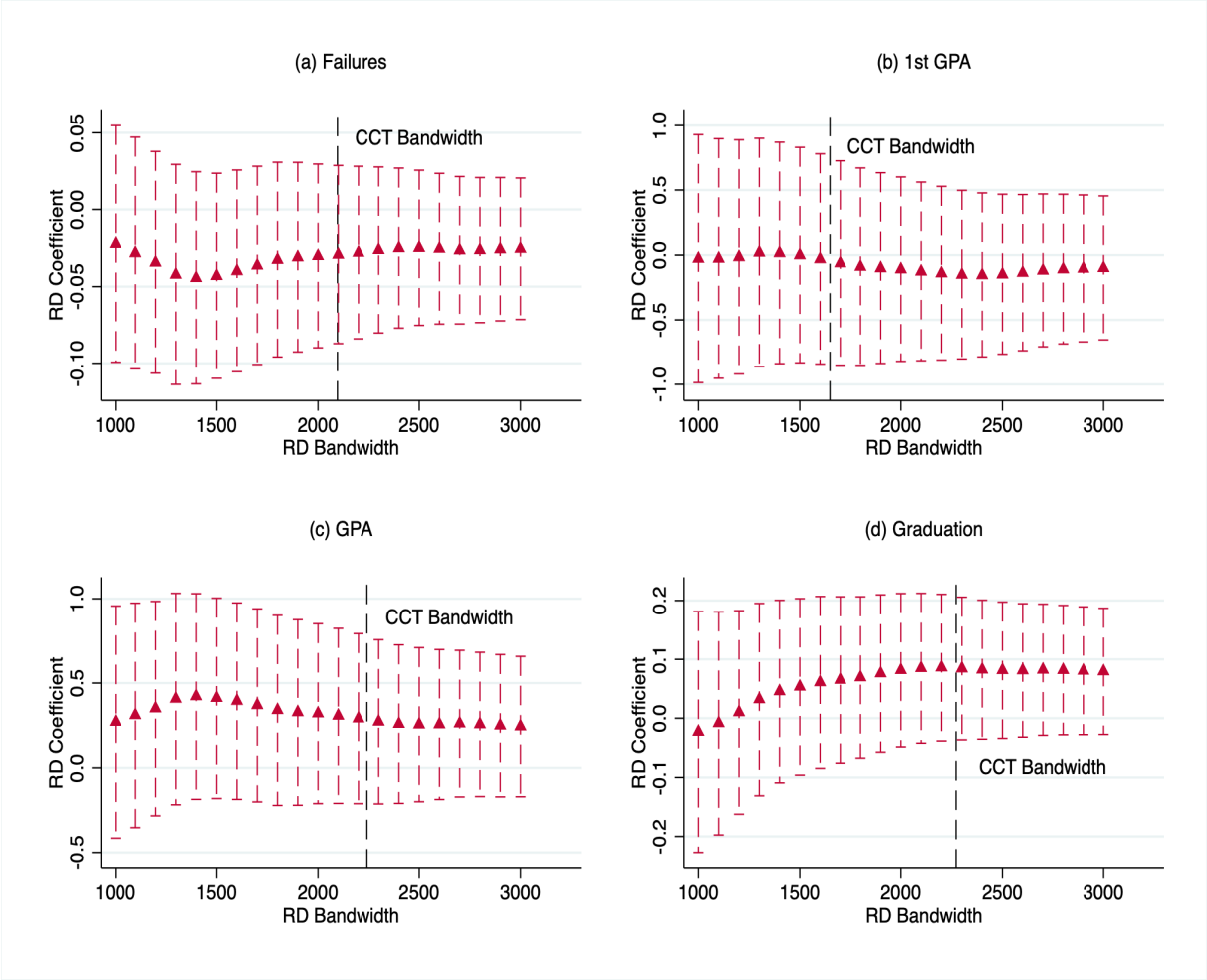
Notes: This figure displays the estimated impacts of the UFBA quota policy on (a) semester GPA, (b) cumulative GPA, (c) number of failed courses in the semester, (d) cumulative number of failed courses, (e) number of retaken courses in the semester, and (f) cumulative number of retaken courses. The estimates refer to the difference-in-differences coefficients β_1 (red) and β_2 (blue) from equation (8) for each student outcome by semester controlling for entry exam scores. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006.

Fig. A.6: Effects of Admission via Quotas by College Semester When Controlling for Entry Exam Scores



Notes: This figure displays the estimated impacts of the UFBA quota policy on (a) credit hours, (b) cumulative credit hours, (c) number of mandatory courses, (d) cumulative number of mandatory courses, (e) number of elective courses, and (f) cumulative number of elective courses. The estimates refer to the difference-in-differences coefficients β_1 (red) and β_2 (blue) from equation (8) for each student outcome by semester controlling for entry exam scores. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006.

Fig. A.7: Robustness Checks for RDD Bandwidth



Notes: This figure presents the RDD estimates as explained in the third and fourth paragraph of Section 7. It is the comparison between the outcome of the last potential quota student that would have been admitted even without the policy and the outcome of the first potential quota student that was admitted because of the policy and is next to the threshold. We use the entry exam score as the running variable and set to zero the score of the last quota student that would be admitted in major m and year t even without affirmative action. Next, we normalize the entry exam score of all potential quota students of major m and year t in relation to that student in the threshold. We then estimate a local linear regression. In each panel, the red triangles represent the coefficient estimated using a triangular kernel and the bandwidth depicted on the x-axis. The vertical dashed red lines represent the 95% confidence interval. The vertical black dashed line depicts the Calonico et al. (2014)'s optimal bandwidth.

Table A.1: Majors Included in the Study

Major	Broad field of study	Number of slots per year	Minimum number of semesters to graduate
Business	Social Sc. & Hum.	155	8
Economics	Social Sc. & Hum.	90	8
Law	Social Sc. & Hum.	200	10
Pedagogy	Social Sc. & Hum.	120	8
Executive Assistant	Social Sc. & Hum.	80	6
Architecture & Urbanism	Technology	120	10
Computer Science	Technology	70	8
Civil Engineering	Technology	160	10
Mechanical Engineering	Technology	80	10
Environmental Engineering	Technology	40	10
Statistics	Technology	40	8
Physics	Technology	40	7
Geophysics	Technology	15	8
Geology	Technology	50	10
Physical Education	Health Sciences	45	8
Nursing	Health Sciences	80	10
Pharmacy	Health Sciences	120	10
Phonoaudiology	Health Sciences	30	10
Medicine	Health Sciences	160	12
Veterinary Science	Health Sciences	110	10
Nutrition	Health Sciences	80	8
Dentistry	Health Sciences	120	10

Notes: This table presents the list of majors included in our study, as well as the broad field of study. We have excluded majors that require any subjective evaluation besides the entry exam score, such as Music and Industrial Design. We have also excluded majors where students could choose between a bachelor's degree or a "licenciatura" degree, in which the main goal is to prepare the student to become a teacher. For these majors, it is not possible to identify the type of degree in different years due to changes in the major unique identifiers. Many of these majors have also changed names through the years, making comparisons not accurate.

Table A.2: Descriptive Statistics – Enrolled Students

Variables	Before AA (1) Average	(2) Obs.	After AA (3) Average	(4) Obs.	(5) Difference	(6) p-value
Enrolled Quota Student	**-**	-	**0.43**	3,532	-	-
			[0.49]			
Potential Quota Student	**0.28**	3,180	**0.49**	3,315	0.210	0.000
	[0.45]		**[0.5]**			
Age	**20.42**	3,349	**19.58**	3,426	-0.840	0.000
	[2.06]		**[2.46]**			
Male	**0.48**	3,437	**0.49**	3,526	0.010	0.583
	[0.5]		**[0.5]**			
Black or Mixed Race	**0.56**	3,210	**0.75**	3,294	0.190	0.000
	[0.5]		**[0.43]**			
Single	**0.97**	3,205	**0.97**	3,288	0.000	0.856
	[0.17]		**[0.17]**			
Have Children	**0.03**	1,617	**0.04**	3,316	0.010	0.099
	[0.16]		**[0.19]**			
Took Test Prep Course	**0.59**	3,210	**0.64**	3,314	0.050	0.000
	[0.49]		**[0.48]**			
Worked While in School	**0.1**	3,198	**0.15**	3,316	0.050	0.000
	[0.29]		**[0.36]**			
Plan to Work Since 1st Year	**0.38**	3,210	**0.41**	3,318	0.030	0.023
	[0.49]		**[0.49]**			
Household Income						
Up to 5 Minimum Wages	**0.26**	3,208	**0.49**	3,310	0.230	0.000
	[0.44]		**[0.5]**			
From 5 to 10 Min. Wages	**0.31**	3,208	**0.24**	3,310	-0.070	0.000
	[0.46]		**[0.43]**			
More than 10 Min. Wages	**0.43**	3,208	**0.26**	3,310	-0.170	0.000
	[0.49]		**[0.44]**			
Parent's Education						
Father - College Degree	**0.37**	3,214	**0.28**	3,314	-0.090	0.000
	[0.48]		**[0.45]**			
Mother - College Degree	**0.36**	3,213	**0.26**	3,311	-0.100	0.000
	[0.48]		**[0.44]**			
Entry Exam Performance						
Entry Exam Standardized Score	**0.32**	3,437	**0.15**	3,526	-0.170	0.000
	[1.02]		**[1.1]**			

Notes: This table reports the descriptive statistics for all students who enrolled at UFBA over the period 2003-2006, splitting them between the period before (2003 and 2004) and after (2005 and 2006) the quota policy. Columns (1) and (3) present the mean for each of the characteristics in the pre- and post-period, respectively, with standard deviation in square brackets. Columns (2) and (4) report the number of observation for each of the characteristics. Column (5) presents the mean difference for each characteristic, and column (6) the p-value for this difference. We characterize an individual as a potential quota student if they have attended most of their high school in a public institution.

Table A.3: Impacts of the Quota Policy for All Enrolled Students Including All Non-Quota Students Before Quotas in the Comparison Group

Dependent Variable	(1) Failures	(2) Failures	(3) Graduation	(4) Graduation
Panel A: Effects for All Quota Students				
Potential Quota Student	0.0512***	0.000920	-0.0677***	-0.0267
	(0.0129)	(0.0155)	(0.0185)	(0.0175)
Comparison Group Average	0.162	0.162	0.774	0.774
Panel B: By Group of Quota Students				
Would Be Admitted W/o Quotas	0.00160	-0.0124	-0.00530	0.00364
	(0.0138)	(0.0149)	(0.0204)	(0.0207)
Would *NOT* Be Admitted W/o Quotas	0.0952***	0.0229	-0.123***	-0.0768**
	(0.0171)	(0.0223)	(0.0269)	(0.0273)
Comparison Group Average	0.162	0.162	0.774	0.774
Observations	6,320	6,320	6,320	6,320
Cohort FE	✓	✓	✓	✓
Major FE	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓
Entry Exam Score		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on two student outcomes – the proportion of failed courses among all courses taken ("Failures") and the proportion of students who eventually graduate ("Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of all students from private schools for both the pre- and post-period. "Entry exam score" refers to the score obtained by the student in the overall entry examination. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.4: Results for Students Who Graduated Including All Non-Quota Students Before Quotas in the Comparison Group

Dependent Variable	(1) Failures	(2) Failures	(3) 1st GPA	(4) 1st GPA	(5) GPA	(6) GPA	(7) On-Time Graduation	(8) On-Time Graduation
Panel A: Effects for All Quota Students								
Potential Quota Student	0.0196***	-0.00663	-0.396***	0.0776	-0.229***	0.141**	-0.0314	0.0108
	(0.00456)	(0.00546)	(0.0880)	(0.129)	(0.0497)	(0.0593)	(0.0185)	(0.0160)
Comparison Group Average	0.055	0.055	7.460	7.460	7.658	7.658	0.902	0.902
Panel B: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	0.00277	-0.00539	-0.0759	0.0693	-0.0118	0.105*	-0.00771	0.00575
	(0.00457)	(0.00494)	(0.134)	(0.146)	(0.0514)	(0.0548)	(0.0209)	(0.0202)
Would *NOT* Be Admitted W/o Quotas	0.0354***	-0.00868	-0.700***	0.0912	-0.433***	0.200**	-0.0536**	0.0191
	(0.00638)	(0.00830)	(0.0775)	(0.123)	(0.0629)	(0.0789)	(0.0243)	(0.0208)
Comparison Group Average	0.055	7.460	7.658	0.902	0.055	7.460	7.658	0.902
Observations	4,800	4,800	4,783	4,783	4,800	4,800	4,800	4,800
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Major FE	✓	✓	✓	✓	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓	✓	✓	✓	✓
Entry Exam Score		✓		✓		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on four student outcomes – the proportion of failed courses among all courses taken ("Failures"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most 4 semesters (2 years) after their major's minimum duration ("On-Time Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of all students from private schools for both the pre- and post-period. "Entry exam score" refers to the score obtained by the student in the overall entry examination. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.5: Impacts of the Quota Policy for All Enrolled Students, Excluding the Six Majors with Different Non-Quota Cutoff Before and After the Quota Policy

Dependent Variable	(1) Failures	(2) Failures	(3) Graduation	(4) Graduation
Panel A: Effects for All Quota Students				
Potential Quota Student	0.0366**	0.0008	-0.0509**	-0.0225
	(0.015)	(0.0192)	(0.0201)	(0.0221)
Comparison Group Average	0.164	0.164	0.764	0.764
Panel B: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.0056	-0.0115	0.0036	0.0067
	(0.0173)	(0.0181)	(0.0252)	(0.0254)
Would *NOT* Be Admitted W/o Quotas	0.0813***	0.024	-0.1085***	-0.0778**
	(0.0182)	(0.0292)	(0.027)	(0.0335)
Comparison Group Average	0.164	0.164	0.764	0.764
Observations	4,408	4,408	4,408	4,408
Cohort FE	✓	✓	✓	✓
Major FE	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓
Entry Exam Score		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on two student outcomes – the proportion of failed courses among all courses taken ("Failures") and the proportion of students who eventually graduate ("Graduation"). The sample now excludes students from the 6 out 22 majors that had changes in the entry exam score cutoffs for the 55% highest-ranked private students after the policy: geophysics, mechanical engineering, environmental engineering, pharmacy, nursing, and architecture. The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the score obtained by the student in the overall entry examination. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.6: Impacts of the Quota Policy for Students Who Graduated, Excluding the Six Majors with Different Non-Quota Cutoff Before and After the Quota Policy

Dependent Variable	(1) Failures	(2) Failures	(3) 1st GPA	(4) 1st GPA	(5) GPA	(6) GPA	(7) On-Time Graduation	(8) On-Time Graduation
Panel A: Effects for All Quota Students								
Potential Quota Student	0.0115**	-0.0072	-0.3095***	0.0237	-0.1265**	0.1452**	-0.0264	0.0091
	(0.0048)	(0.0063)	(0.1154)	(0.1627)	(0.0576)	(0.071)	(0.0206)	(0.0196)
Comparison Group Average	0.048	0.048	7.534	7.534	7.792	7.792	0.919	0.919
Panel B: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.0041	-0.0076	-0.0613	0.0019	0.0843	0.1359**	0.0012	0.008
	(0.0048)	(0.0055)	(0.1656)	(0.1807)	(0.0544)	(0.0596)	(0.025)	(0.0248)
Would *NOT* Be Admitted W/o Quotas	0.0287***	-0.0064	-0.5857***	0.0656	-0.3583***	0.1627	-0.0567**	0.0114
	(0.0072)	(0.0109)	(0.0881)	(0.1492)	(0.0788)	(0.1042)	(0.0281)	(0.0282)
Comparison Group Average	0.055	7.460	7.658	0.902	0.055	7.460	7.658	0.902
Observations	3,321	3,321	3,311	3,311	3,321	3,321	3,321	3,321
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Major FE	✓	✓	✓	✓	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓	✓	✓	✓	✓
Entry Exam Score		✓		✓		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on four student outcomes – the proportion of failed courses among all courses taken ("Failures"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most 4 semesters (2 years) after their major's minimum duration ("On-Time Graduation"). The sample also excludes students from the six majors with score cutoff changes after the policy: geophysics, mechanical engineering, environmental engineering, pharmacy, nursing, and architecture. The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of all students from private schools for both the pre- and post-period. "Entry exam score" refers to the score obtained by the student in the overall entry examination. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.7: Parallel Trends Before the Affirmative Action Policy

Variables	2003 (1) Potential Non-Quota Average	2003 (2) Potential Quota Average	2003 (3) Difference	2004 (4) Potential Non-Quota Average	2004 (5) Potential Quota Average	2004 (6) Difference	(7) Difference in Differences	(8) p-value
Age	20.0709	21.6643	1.5933	20.0591	21.5335	1.4744	-0.1189	0.4869
Male	0.4760	0.4193	-0.0567	0.5271	0.4700	-0.0571	-0.0004	0.9923
Black or Mixed Race	0.4392	0.6883	0.2491	0.5461	0.7367	0.1907	-0.0585	0.1425
Single	0.9862	0.9321	-0.0541	0.9922	0.9209	-0.0713	-0.0172	0.2270
Took Prep Course	0.5155	0.7551	0.2396	0.5327	0.7685	0.2358	-0.0037	0.9242
Worked While in School	0.0471	0.2308	0.1836	0.0421	0.2286	0.1865	0.0029	0.9065
Plan to Work Since 1st Year	0.3295	0.5000	0.1705	0.3370	0.4942	0.1572	-0.0133	0.7379
Household Income								
Up to 5 Minimum Wages	0.1502	0.4809	0.3307	0.1600	0.5912	0.4312	0.1006	0.0031
From 5 to 10 Min. Wages	0.3050	0.3438	0.0388	0.3211	0.2679	-0.0532	-0.0920	0.0161
More than 10 Min. Wages	0.5447	0.1753	-0.3694	0.5189	0.1409	-0.3780	-0.0086	0.8212
Parent's Education								
Father - College Degree	0.4783	0.1233	-0.3549	0.4629	0.1366	-0.3263	0.0286	0.4431
Mother - College Degree	0.4399	0.1143	-0.3255	0.4839	0.1270	-0.3569	-0.0313	0.3974
Entry Exam Performance								
Entry Exam Standardized Score	0.5815	-0.1384	-0.7199	0.5204	-0.1457	-0.6660	0.0539	0.5131
College Performance								
Failures	0.1532	0.1855	0.0323	0.1646	0.2003	0.0357	0.0034	0.8735
First Semester GPA	6.8346	6.6533	-0.1813	6.8311	6.7289	-0.1023	0.0791	0.6719
Final GPA	6.7759	6.4818	-0.2941	6.6534	6.4210	-0.2324	0.0617	0.7512
Graduation	0.7815	0.7287	-0.0528	0.7630	0.7028	-0.0602	-0.0075	0.8330
On-Time Graduation	0.7117	0.6166	-0.0951	0.6966	0.6175	-0.0791	0.0160	0.6772

Notes: This Table presents the unconditional difference-in-differences estimates for the average characteristics of students and main outcomes considering 2003 the pre-period and 2004 the post-period, before the quota policy was in place. Columns (1) and (4) present the average for the comparison group while columns (2) and (5) present the average for the treatment group in 2003 and 2004, respectively. Columns (3) and (6) present the difference in averages between groups for 2003 and 2004, respectively. Column (7) presents the unconditional difference-in-differences estimate, and column (8) the p-value for this estimate. We characterize an individual as a potential quota student if they have attended most of their high school in a public institution.

Table A.8: Admitted via Quota Estimate with Additional Covariates

Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Potential Quota Student											
Panel A: Effects for All Enrolled Students												
Failures	0.0431***	0.0391***	0.0399***	0.0391***	0.0406***	0.0392***	0.00214	-0.000511	0.000187	-0.000673	-0.00000216	-0.00132
	(0.0135)	(0.0128)	(0.0127)	(0.0127)	(0.0128)	(0.0130)	(0.0166)	(0.0151)	(0.0150)	(0.0151)	(0.0151)	(0.0154)
Gradation	-0.0647***	-0.0577***	-0.0607***	-0.0599***	-0.0645***	-0.0630***	-0.0284	-0.0253	-0.0281	-0.0275	-0.0295	-0.0282
	(0.0172)	(0.0172)	(0.0174)	(0.0168)	(0.0181)	(0.0184)	(0.0183)	(0.0172)	(0.0172)	(0.0168)	(0.0172)	(0.0174)
Panel B: Effects for Students Who Graduated												
Failures	0.0178***	0.0133***	0.0130**	0.0132**	0.0132**	0.0140***	-0.00354	-0.00738	-0.00782	-0.00766	-0.00722	-0.00640
	(0.00431)	(0.00453)	(0.00459)	(0.00472)	(0.00475)	(0.00476)	(0.00511)	(0.00547)	(0.00550)	(0.00558)	(0.00563)	(0.00546)
1st GPA	-0.353***	-0.309***	-0.306***	-0.315***	-0.321***	-0.321***	0.0440	0.0770	0.0802	0.0722	0.0657	0.0651
	(0.0929)	(0.0945)	(0.0958)	(0.0970)	(0.0943)	(0.0939)	(0.129)	(0.130)	(0.131)	(0.132)	(0.126)	(0.127)
GPA	-0.204***	-0.148***	-0.142**	-0.146***	-0.143***	-0.156***	0.100*	0.149**	0.155**	0.153**	0.148**	0.135**
	(0.0460)	(0.0491)	(0.0505)	(0.0510)	(0.0505)	(0.0512)	(0.0528)	(0.0591)	(0.0596)	(0.0594)	(0.0596)	(0.0584)
On-Time Graduation	-0.0233	-0.0180	-0.0173	-0.0186	-0.0176	-0.0186	0.0111	0.0134	0.0143	0.0132	0.0134	0.0123
	(0.0172)	(0.0176)	(0.0172)	(0.0175)	(0.0168)	(0.0169)	(0.0153)	(0.0158)	(0.0158)	(0.0162)	(0.0160)	(0.0158)
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Major FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Age and Gender		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Civil Status			✓	✓	✓	✓			✓	✓	✓	✓
Worked During High School				✓	✓	✓				✓	✓	✓
Household Income					✓	✓					✓	✓
Prep Course						✓						✓
Entry Exam Score							✓	✓	✓	✓	✓	✓

Notes: This table reports the estimated impacts of the UFBA quota policy on five student outcomes – the proportion of failed courses among all courses taken ("Failures"), the proportion of students who eventually graduate ("Graduation"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most 4 semesters (2 years) after their major's minimum duration ("On-Time Graduation") – for different sets of control variables. The estimates in Panel A refer to the coefficient β from equation (6) using Failures and Graduation for all enrolled students as outcomes. The estimates in Panel B also refer to the coefficient β from equation (6), but they use Failures, 1st GPA and GPA for graduated students as outcomes. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of students from private schools who were ranked among the top 55% prior to the policy, and all private school students after the policy. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.9: Minimum Entry Exam Score by Quota Type

Major/Year	Minimum Score Private School	Minimum Score Public (Black & Mixed Race)	Minimum Score Public (All Race Groups)	Minimum Score Public (Indigenous)	Minimum Score Public (Quilombola)
Architecture & Urbanism 2005	13,442.4	10,657.1	10,826.9	-	-
Architecture & Urbanism 2006	13,492.6	10,152.3	10,856.3	-	-
Civil Engineering 2005	12,698.4	11,062.4	11,089.1	-	-
Civil Engineering 2006	13,484.4	10,893.3	10,887.7	-	-
Mechanical Engineering 2005	14,767.1	11,680.6	11,996.2	11,351.3	-
Mechanical Engineering 2006	15,325.4	11,819.2	11,807.1	11,336.3	-
Environmental Engineering 2005	14,527.1	11,589.5	11,561.1	11,240.0	-
Environmental Engineering 2006	14,070.4	11,456.7	11,750.7	-	-
Physics 2005	12,296.3	11,992.8	13,403.9	11,302.3	-
Physics 2006	11,914.9	11,759.8	13,150.2	-	-
Geology 2005	10,541.3	10,549.4	10,336.5	-	-
Geology 2006	12,164.8	11,437.6	11,229.7	-	-
Computer Science 2005	14,667.0	13,212.7	13,116.2	11,221.1	11,186.7
Computer Science 2006	15,054.9	12,423.2	12,369.0	11,242.5	-
Statistics 2005	10,805.2	11,074.2	10,993.7	-	-
Statistics 2006	11,300.5	10,763.0	10,729.0	-	-
Geophysics 2005	13,211.3	12,400.8	12,392.6	-	-
Geophysics 2006	14,240.0	12,342.7	12,498.5	-	-
Nursing 2005	13,583.6	11,910.5	11,887.2	11,114.9	-
Nursing 2006	13,982.6	12,470.2	12,430.8	10,230.5	10,234.9
Pharmacy 2005	13,782.8	12,337.6	12,622.8	10,972.0	-
Pharmacy 2006	13,930.3	11,971.3	11,949.3	10,830.6	-
Medicine 2005	17,496.9	15,045.9	15,669.6	11,275.8	-
Medicine 2006	17,353.3	15,252.0	15,058.7	13,646.9	10,726.4
Veterinary Science 2005	12,323.7	11,499.8	11,648.3	11,384.5	-
Veterinary Science 2006	12,725.2	11,125.0	11,395.9	10,453.1	-
Nutrition 2005	12,819.7	11,753.1	11,670.6	11,083.9	-
Nutrition 2006	13,218.2	11,705.0	11,754.7	10,679.1	-
Dentistry 2005	14,018.0	11,656.5	11,519.1	10,025.7	-
Dentistry 2006	14,136.6	11,126.1	11,229.8	10,849.1	-
Phonoaudiology 2005	13,197.8	11,566.1	11,986.0	11,211.9	-
Phonoaudiology 2006	13,620.3	11,521.6	11,446.1	10,601.9	-
Business 2005	13,991.8	12,154.7	12,264.9	12,119.3	-
Business 2006	14,066.6	11,672.8	11,641.0	10,007.9	-
Economics 2005	13,398.4	12,503.7	12,491.4	11,617.6	-
Economics 2006	13,631.4	11,841.8	11,743.9	9,588.2	-
Law 2005	15,990.4	14,075.2	14,034.6	10,554.8	11,600.3
Law 2006	16,160.7	14,064.3	13,912.4	11,570.3	10,100.8
Pedagogy 2005	11,422.9	11,717.2	11,649.3	-	10,138.1
Pedagogy 2006	11,234.9	11,322.7	11,314.6	10,520.0	-
Executive Assistant 2005	10,850.2	11,132.4	11,110.8	10,722.7	-
Executive Assistant 2006	10,825.7	10,934.8	10,851.2	10,684.0	-
Physical Education 2005	12,140.3	12,206.4	12,208.0	9,698.7	-
Physical Education 2006	12,522.6	11,775.0	11,694.3	10,936.0	10,258.2

Notes: This table presents the entry exam score for the last student to be admitted via each quota type and for each of the 22 majors in the 2 years after the implementation of quotas (2005 and 2006). The majors in bold are the ones for which the score for the last non-quota student is lower than at least one of the quota types. A "quilombola" is an Afro-Brazilian resident of quilombo settlements first established by escaped slaves in Brazil. They are the descendants of Afro-Brazilian slaves who escaped from slave plantations that existed in Brazil until abolition of slavery in 1888.

Table A.10: Association Between Potential Quota Student and Entry Exam Score

	(1) Entry Exam Score
Potential Quota Student	-0.687***
	(0.0814)
Observations	6,000
Major FE	✓
Time FE	✓
Other Controls	✓

Notes: This table reports the association between an indicator variable for whether a student is a potential quota student and the standardized entry exam score. The unit of observation is each student enrolled at UFBA over the period 2003-2006. The estimated coefficient was obtained by an OLS estimation of the following equation: $Y_{imc} = \beta Q_i mc + X_i mc\gamma + \psi_m + \eta_c + \epsilon_{ict}$, where Y_{imc} is the outcome for student i in major m and cohort c, Q is a dummy variable equal to one if the individual is a potential quota student, $X_i mc$ is a set of student characteristics, ψ_m is a set of major fixed effects, and η_c a set of cohort fixed effects. The dependent variable, entry exam score, is the standardized score of the entry examination. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.11: RDD Estimation Comparing Academic Outcomes Between the Two Subgroups of Potential Quota Students – *Quadratic* RDD for All Quota Students

	(1) Failures	(2) 1st GPA	(3) GPA	(4) Graduation
Would Be Admitted W/o Quotas	-0.036	-0.085	0.381	0.063
	(0.037)	(0.461)	(0.329)	(0.081)
Observations	1,468	1,446	1,467	1,468
Effective Observations	1,213	1,204	1,220	1,197
Major FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓

Notes: This table reports RDD estimates that compare the outcome of the last potential quota student who would have been admitted even without the policy with the outcome of the first potential quota student who was admitted only because of the policy. We use the entry exam score as the running variable and set to zero the score of the last quota student who would be admitted in major m and year t even without the affirmative action. Next, we normalize the entry exam score of all potential quota students of major m and year t in relation to that student in the threshold. We then estimate a quadratic regression on the running variable. We use the robust optimal bandwidth selection proposed by Calonico et al. (2014). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in 2005 and 2006. There are 4 major-years for which there are either no potential quota students who would have been admitted even without the quota policy (speech therapist in 2006) or for which all potential quota students would have been admitted even without quotas (Executive Assistant, Geology, and Pedagogy in 2005). Students in these major-years are dropped from the sample for this analysis. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.12: RDD Estimation Comparing Academic Outcomes Between the Two Subgroups of Potential Quota Students – *Cubic* RDD for All Quota Students

	(1) Failures	(2) 1st GPA	(3) GPA	(4) Graduation
Would Be Admitted W/o Quotas	-0.027	-0.151	0.296	0.079
	(0.035)	(0.435)	(0.326)	(0.077)
Observations	1,468	1,446	1,467	1,468
Effective Observations	1,453	1,431	1,449	1,452
Major FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓

Notes: This table reports RDD estimates that compare the outcome of the last potential quota student who would have been admitted even without the policy with the outcome of the first potential quota student who was admitted only because of the policy. We use the entry exam score as the running variable and set to zero the score of the last quota student who would be admitted in major m and year t even without the affirmative action. Next, we normalize the entry exam score of all potential quota students of major m and year t in relation to that student in the threshold. We then estimate a cubic regression on the running variable. We use the robust optimal bandwidth selection proposed by Calonico et al. (2014). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in 2005 and 2006. There are 4 major-years for which there are either no potential quota students who would have been admitted even without the quota policy (speech therapist in 2006) or for which all potential quota students would have been admitted even without quotas (Executive Assistant, Geology, and Pedagogy in 2005). Students in these major-years are dropped from the sample for this analysis. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.13: Common Support for Entry Exam Score – All Students

Dependent Variable	(1) Failures	(2) Failures	(3) Graduation	(4) Graduation
Panel A: Effects for All Quota Students				
Potential Quota Student	0.0428***	0.0015	-0.0584***	-0.0223
	(0.0143)	(0.0193)	(0.0193)	(0.0199)
Comparison Group Average	0.170	0.170	0.752	0.752
Panel B: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.0061	-0.0121	0.0029	0.0071
	(0.0156)	(0.0164)	(0.0202)	(0.0208)
Would *NOT* Be Admitted W/o Quotas	0.0933***	0.0262	-0.1216***	-0.0754*
	(0.0223)	(0.0341)	(0.0367)	(0.0398)
Comparison Group Average	0.170	0.170	0.752	0.752
Observations	3,366	3,366	3,366	3,366
Cohort FE	✓	✓	✓	✓
Major FE	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓
Entry Exam Score		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on two student outcomes – the proportion of failed courses among all courses taken ("Failures") and the proportion of students who eventually graduate ("Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). For this analysis, we use a sample that includes only students who have their entry exam score in the common support for this variable in that major. That is, for each major we obtain the lowest entry exam score for potential quota and non-quota students and take the largest of these two values, A, then we obtain the highest entry exam score for potential quota and non-quota students and take the smallest of these two other values, B. The sample consists of students whose entry exam score is between A and B. When we do this, 10 of the 22 majors do not have common support for quota students who would *NOT* have been admitted without quotas, Computer Science, Economics, Law, Physical Education, Mechanical Engineering, Environmental Engineering, Physics, Phonoaudiology, Medicine and Veterinary Science. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.14: Common Support for Entry Exam Score – Students Who Graduated

Dependent Variable	(1) Failures	(2) Failures	(3) 1st GPA	(4) 1st GPA	(5) GPA	(6) GPA	(7) On-Time Graduation	(8) On-Time Graduation
Panel A: Effects for All Quota Students								
Potential Quota Student	0.0091	-0.011	-0.2121**	0.1634	-0.1064**	0.1657**	-0.0158	0.0154
	(0.0056)	(0.0077)	(0.107)	(0.1242)	(0.0506)	(0.0728)	(0.0267)	(0.022)
Comparison Group Average	0.0539	0.0539	7.512	7.512	7.6193	7.6193	0.903	0.903
Panel B: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.006	-0.0087	0.1217	0.1689	0.0972*	0.1341**	0.0163	0.0202
	(0.0056)	(0.0059)	(0.1368)	(0.1298)	(0.0528)	(0.0573)	(0.027)	(0.0265)
Would *NOT* Be Admitted W/o Quotas	0.0263***	-0.0151	-0.5985***	0.1531	-0.339***	0.2245**	-0.0524	0.0067
	(0.0081)	(0.012)	(0.1046)	(0.172)	(0.091)	(0.1143)	(0.0362)	(0.0316)
Comparison Group Average	0.0539	0.0539	7.512	7.512	7.6193	7.6193	0.903	0.903
Observations	2,522	2,522	2,507	2,507	2,522	2,522	2,522	2,522
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Major FE	✓	✓	✓	✓	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓	✓	✓	✓	✓
Entry Exam Score		✓		✓		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on four student outcomes – the proportion of failed courses among all courses taken ("Failures"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most 4 semesters (2 years) after their major's minimum duration ("On-Time Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). For this analysis, we use a sample that includes only students who have their entry exam score in the common support for this variable in that major. That is, for each major we obtain the lowest entry exam score for potential quota and non-quota students and take the largest of these two values, A, then we obtain the highest entry exam score for potential quota and non-quota students and take the smallest of these two other values, B. When we do this, 10 of the 22 majors do not have common support for quota students who would *NOT* have been admitted without quotas, Computer Science, Economics, Law, Physical Education, Mechanical Engineering, Environmental Engineering, Physics, Phonoaudiology, Medicine and Veterinary Science The sample consists of students whose entry exam score is between A and B. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.15: Relationship Between Entry Exam Score and GPA Before and After Quotas

	(1) GPA	(2) GPA
After Quotas	0.0512	-0.0396
	(0.0781)	(0.0342)
Entry Exam Score	0.614***	0.458***
	(0.0817)	(0.0398)
After Quotas × Entry Exam Score	0.00641	-0.00743
	(0.0706)	(0.0280)
Observations	6,179	4,652
Major FE	✓	✓

Notes: This table reports a comparison of the hour-weighted average grade at the end of the major ("GPA") before and after the Quotas policy. The estimates refer to the coefficients β_0, β_1 and β_2 from equation (9). Column 1 reports the estimates for all enrolled students, while in column 2 the sample is restricted for students who eventually graduate. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.16: First Semester Grades Before and After the Quota Policy Controlling for Instructor-by-Course Fixed Effects – All Students

	(1) Course Grade	(2) Course Grade
After Quotas	-0.114**	-0.0183
	(0.0497)	(0.0498)
Potential Quota Student		0.146***
		(0.0271)
After Quotas × Potential Quota Student		-0.0663
		(0.0598)
Entry Exam Score		0.329***
		(0.0416)
After Quotas × Entry Exam Score		0.0424
		(0.0498)
Observations	14,729	14,411
Major FE	✓	✓
Instructor-by-Course FE	✓	✓

Notes: This table reports a comparison of the average grade in first semester courses ("Course Grade") before and after the quota policy for all enrolled students. The estimate in column 1 refers to the coefficient β_0 from equation (10) without the interaction terms of *Post*, the indicator for potential quota students, and the entry exam score. The estimates in column 2 refer to coefficients β_0, β_1, β_2, β_3 and β_4 from equation (10). In this estimation, we include only first-semester courses that were taught by the same instructor before and after quota implementation and add instructor-by-course fixed effects so that we only compare students taking the same course with the same instructor before and after quota implementation. The unit of observation is a student-course, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.17: First Semester Grades Before and After the Quota Policy Controlling for Instructor-by-Course Fixed Effects – Students Who Graduated

	(1) Course Grade	(2) Course Grade
After Quotas	-0.103**	-0.00213
	(0.0513)	(0.0483)
Potential Quota Student		0.0673***
		(0.0215)
After Quotas × Potential Quota Student		-0.0617
		(0.0579)
Entry Exam Score		0.305***
		(0.0417)
After Quotas × Entry Exam Score		0.0320
		(0.0585)
Observations	11,417	11,152
Major FE	✓	✓
Instructor-by-Course FE	✓	✓

Notes: This table reports a comparison of the average grade in first semester courses ("Course Grade") before and after the quota policy for students who eventually graduate. The estimate in column 1 refers to the coefficient β_0 from equation (10) without the interaction terms of *Post*, the indicator for potential quota students, and the entry exam score. The estimates in column 2 refer to coefficients β_0, β_1, β_2, β_3 and β_4 from equation (10). In this estimation, we include only first-semester courses that were taught by the same instructor before and after quota implementation and add a instructor-by-course fixed effects so that we only compare students taking the same course with the same instructor before and after quota implementation. The unit of observation is a student-course, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.18: Mean and Variance of Grades by College Semester for Students Who Graduated

	(1) Mean	(2) Variance
Major Semester	0.0184*	0.148***
	(0.00944)	(0.0312)
After Quotas	-0.143*	0.329
	(0.0766)	(0.253)
After Quotas × Major Semester	0.00851	-0.0479
	(0.0132)	(0.0435)
Observations	398	398
Major FE	✓	✓

Notes: This table reports a comparison of the average grade ("Mean") and grade variance ("Variance") by major semester before and after the quota policy. The estimates refer to the coefficients β_0, β_1, and β_2 from equation (11). The unit of observation is a major-semester-year, and the analysis includes all the courses at UFBA in the years 2003-2006 so that the number of observations is given by the sum of the number of semesters for each major in Appendix Table A.1 multiplied by 2 (before and after quota implementation). The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.19: Impacts of the Quota Policy for All Enrolled Students Using *Potential* Quota Status in the Pre-Period and *Actual* Quota Status in the Post-Period

Dependent Variable	(1) Failures	(2) Failures	(3) Graduation	(4) Graduation
Panel A: Effects for All Quota Students				
Potential Quota Student	0.0500***	0.00728	-0.0670***	-0.0325*
	(0.0127)	(0.0158)	(0.0171)	(0.0165)
Comparison Group Average	0.159	0.159	0.772	0.772
Panel B: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.00757	-0.0138	0.00967	0.0133
	(0.0152)	(0.0160)	(0.0238)	(0.0240)
Would *NOT* Be Admitted W/o Quotas	0.0865***	0.0308	-0.116***	-0.0836***
	(0.0177)	(0.0229)	(0.0272)	(0.0279)
Comparison Group Average	0.159	0.159	0.772	0.772
Observations	5,798	5,798	5,798	5,798
Cohort FE	✓	✓	✓	✓
Major FE	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓
Entry Exam Score		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on two student outcomes – the proportion of failed courses among all courses taken ("Failures") and the proportion of students who eventually graduate ("Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of students from private schools who were ranked among the top 55% prior to the policy, and the students who were *not* eligible for the policy after its implementation. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.20: Impacts of the Quota Policy for All Students Who Graduated Using *Potential* Quota Status in the Pre-Period and *Actual* Quota Status in the Post-Period

Dependent Variable	(1) Failures	(2) Failures	(3) 1st GPA	(4) 1st GPA	(5) GPA	(6) GPA	(7) On-Time Graduation	(8) On-Time Graduation
Panel A: Effects for All Quota Students								
Potential Quota Student	0.0161***	-0.00790	-0.370***	0.0751	-0.180***	0.166**	-0.0201	0.0170
	(0.00460)	(0.00541)	(0.0923)	(0.127)	(0.0538)	(0.0600)	(0.0192)	(0.0166)
Comparison Group Average	0.051	0.051	7.526	7.526	7.706	7.706	0.911	0.911
Panel B: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.00444	-0.00856*	0.00775	0.0836	0.0868	0.147**	0.00658	0.0132
	(0.00437)	(0.00449)	(0.150)	(0.156)	(0.0541)	(0.0576)	(0.0260)	(0.0253)
Would *NOT* Be Admitted W/o Quotas	0.0299***	-0.00717	-0.625***	0.0655	-0.360***	0.187**	-0.0381	0.0212
	(0.00670)	(0.00830)	(0.0794)	(0.118)	(0.0689)	(0.0780)	(0.0232)	(0.0202)
Comparison Group Average	0.051	0.051	7.526	7.526	7.706	7.706	0.911	0.911
Observations	4,392	4,392	4,375	4,375	4,392	4,392	4,392	4,392
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Major FE	✓	✓	✓	✓	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓	✓	✓	✓	✓
Entry Exam Score		✓		✓		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on four student outcomes – the proportion of failed courses among all courses taken ("Failures"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most 4 semesters (2 years) after their major's minimum duration ("On-Time Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of students from private schools who were ranked among the top 55% prior to the policy, and the students who were *not* eligible for the policy after its implementation. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.21: Impacts of the Quota Policy for All Enrolled Students Using an Alternative Definition of Potential Quota Student (Public High School + At Least One Year in a Public Elementary or Middle School)

	(1)	(2)	(3)	(4)
Dependent Variable	Failures	Failures	Graduation	Graduation
Panel A: Effects for All Quota Students				
Potential Quota Student	0.0481***	0.0117	-0.0398**	-0.00660
	(0.0113)	(0.0142)	(0.0145)	(0.0184)
Comparison Group Average	0.165	0.165	0.766	0.766
Panel B: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.00591	-0.0100	0.0319	0.0350
	(0.0152)	(0.0153)	(0.0255)	(0.0258)
Would *NOT* Be Admitted W/o Quotas	0.0874***	0.0357	-0.0920***	-0.0527*
	(0.0177)	(0.0219)	(0.0253)	(0.0295)
Comparison Group Average	0.165	0.165	0.766	0.766
Observations	5,798	5,798	5,798	5,798
Cohort FE	✓	✓	✓	✓
Major FE	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓
Entry Exam Score		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on two student outcomes – the proportion of failed courses among all courses taken ("Failures") and the proportion of students who eventually graduate ("Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.22: Impacts of the Quota Policy for All Graduated Students Using an Alternative Definition of Potential Quota Student (Public High School + At Least One Year in a Public Elementary or Middle School)

Dependent Variable	(1) Failures	(2) Failures	(3) 1st GPA	(4) 1st GPA	(5) GPA	(6) GPA	(7) On-Time Graduation	(8) On-Time Graduation
Panel A: Effects for All Quota Students								
Potential Quota Student	0.0157**	-0.00464	-0.389***	-0.00111	-0.182**	0.111	-0.0117	0.0213
	(0.00637)	(0.00720)	(0.121)	(0.152)	(0.0654)	(0.0730)	(0.0251)	(0.0243)
Comparison Group Average	0.053	0.053	7.494	7.494	7.676	7.676	0.906	0.906
Panel B: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.00249	-0.00518	-0.0509	0.00355	0.0432	0.0828	0.00950	0.0141
	(0.00647)	(0.00657)	(0.172)	(0.176)	(0.0685)	(0.0699)	(0.0291)	(0.0292)
Would *NOT* Be Admitted W/o Quotas	0.0300***	-0.00402	-0.657***	-0.00657	-0.358***	0.145	-0.0284	0.0297
	(0.00818)	(0.00973)	(0.0995)	(0.140)	(0.0834)	(0.0887)	(0.0294)	(0.0285)
Comparison Group Average	0.053	0.053	7.494	7.494	7.676	7.676	0.906	0.906
Observations	4,392	4,392	4,375	4,375	4,392	4,392	4,392	4,392
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Major FE	✓	✓	✓	✓	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓	✓	✓	✓	✓
Entry Exam Score		✓		✓		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on four student outcomes – the proportion of failed courses among all courses taken ("Failures"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most 4 semesters (2 years) after their major's minimum duration ("On-Time Graduation"). The estimates in Panel A refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B refer to the β's from equation (8). The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the entry exam score as measured by the score obtained by the student in the entry exam. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.23: Number of Students by Major and Quota Type for the Period After the Quota Implementation

Major	Number of Non-Quota Students	Number of Quota Students Who Would NOT Be Admitted W/o Quotas	Number of Quota Students Who Would Be Admitted W/o Quotas
Medicine	155	100	21
Law	159	85	40
Computer Science	54	31	24
Business	126	89	27
Dentistry	109	84	9
Environmental Engineering	40	21	8
Mechanical Engineering	80	52	12
Pharmacy	106	62	33
Economics	78	34	35
Architecture & Urbanism	127	76	16
Nursing	71	52	18
Phonoaudiology	30	24	4
Nutrition	73	48	19
Civil Engineering	140	85	38
Geophysics	10	6	7
Veterinary Science	100	56	39
Physical Education	36	12	27
Physics	24	3	32
Pedagogy	59	4	126
Executive Assistant	46	4	93
Statistics	28	2	36
Geology	33	4	33
Total	1684	934	697

Notes: This table reports for each of the 22 majors in our sample the number of students by potential quota status. For quota students, we further split them into those who would have been admitted without quotas and those who would have *not* been admitted without quotas. This table uses students from the cohorts of 2005 and 2006, when the quota policy was already in place. The majors are ordered based on selectivity, starting from the most selective major. Major selectivity is defined based on the entry exam score of the last student enrolled in that major, with majors with higher minimum scores defined as more selective.

Table A.24: Results for All Enrolled Students by Major Selectivity

	(1) Failures	(2) Failures	(3) Graduation	(4) Graduation
More Selective Majors				
Panel A: Effects for All Quota Students				
Potential Quota Student	0.0353**	-0.0056	-0.0298*	-0.0072
	(0.0148)	(0.0197)	(0.0164)	(0.03)
Comparison Group Average	0.0876	0.0876	0.8822	0.8822
Panel B: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.0214*	-0.0263**	0.033	0.0337
	(0.0124)	(0.0133)	(0.0369)	(0.0381)
Would NOT Be Admitted W/o Quotas	0.0549***	0.0136	-0.0514***	-0.045
	(0.0161)	(0.0309)	(0.0171)	(0.0332)
Comparison Group Average	0.087	0.087	0.882	0.882
Observations	1,979	1,979	1,979	1,979
Less Selective Majors				
Panel C: Effects for All Quota Students				
Potential Quota Student	0.0355*	-0.0022	-0.065**	-0.0316
	(0.0181)	(0.0196)	(0.0259)	(0.0226)
Comparison Group Average	0.201	0.201	0.706	0.706
Panel D: Effects by Subgroup of Quota Students				
Would Be Admitted W/o Quotas	-0.0081	-0.0155	-0.004	0.0009
	(0.0194)	(0.0194)	(0.0256)	(0.0255)
Would NOT Be Admitted W/o Quotas	0.0875***	0.0231	-0.1375***	-0.094**
	(0.0242)	(0.0289)	(0.0397)	(0.0389)
Comparison Group Average	0.201	0.201	0.706	0.706
Observations	3,819	3,819	3,819	3,819
Cohort FE	✓	✓	✓	✓
Major FE	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓
Entry Exam Score		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on two student outcomes – the proportion of failed courses among all courses taken ("Failures") and the proportion of students who eventually graduate ("Graduation"). The estimates in Panel A and C refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B and D refer to the β's from equation (8). Panel A and B show the results only for students in the most selective majors (top quartile of selectivity): medicine, law, computer science, business, dentistry, and environmental engineering. Major selectivity is defined based on the entry exam score of the last student enrolled in that major, with majors with higher minimum scores defined as more selective. Panels C and D show the results only for students in less selective majors. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the score obtained by the student in the overall entry examination. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.25: Results for Students Who Graduated by Major Selectivity

Dependent Variable	(1) Failures	(2) Failures	(3) 1st GPA	(4) 1st GPA	(5) GPA	(6) GPA	(7) On-Time Graduation	(8) On-Time Graduation
More Selective Majors								
Panel A: Effects for All Quota Students								
Potential Quota Student	0.02**	-0.0071	-0.395***	0.1445	-0.2323***	0.2223**	0.0013	0.0513**
	(0.0087)	(0.0081)	(0.1401)	(0.2877)	(0.067)	(0.1015)	(0.0225)	(0.0217)
Comparison Group Average	0.033	0.033	7.674	7.674	8.039	8.039	0.954	0.954
Panel B: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.0017	-0.0067	-0.0165	0.0862	0.0825	0.1691**	0.0388	0.0481*
	(0.0052)	(0.0049)	(0.2997)	(0.334)	(0.0579)	(0.0838)	(0.0266)	(0.0255)
Would *NOT* Be Admitted W/o Quotas	0.0281**	-0.0074	-0.5373***	0.1994	-0.3499***	0.2723**	-0.0127	0.0542*
	(0.0111)	(0.0117)	(0.1308)	(0.2647)	(0.0881)	(0.121)	(0.0241)	(0.0318)
Comparison Group Average	0.033	0.033	7.674	7.674	8.039	8.039	0.954	0.954
Observations	1,692	1,692	1,690	1,690	1,692	1,692	1,692	1,692
Less Selective majors								
Panel C: Effects for All Quota Students								
Potential Quota Student	0.0102*	-0.0086	-0.2065*	0.1508	-0.126*	0.1182	-0.0228	0.005
	(0.0061)	(0.007)	(0.1144)	(0.1177)	(0.0702)	(0.0741)	(0.0232)	(0.0188)
Comparison Group Average	0.066	.066	7.416	7.416	7.460	7.460	0.881	0.881
Panel D: Effects by Subgroup of Quota Students								
Would Be Admitted W/o Quotas	-0.0042	-0.008	0.1167	0.1855	0.0419	0.0924	-0.0009	0.0047
	(0.0068)	(0.0068)	(0.1482)	(0.1355)	(0.0745)	(0.0726)	(0.0251)	(0.0248)
Would *NOT* Be Admitted W/o Quotas	0.0291***	-0.0098	-0.6414***	0.0812	-0.3482***	0.1695*	-0.0518	0.0056
	(0.0076)	(0.01)	(0.0905)	(0.1175)	(0.0872)	(0.0949)	(0.0358)	(0.0291)
Comparison Group Average	0.066	0.066	7.416	7.416	7.461	7.461	0.881	0.881
Observations	2,700	2,700	2,685	2,685	2,700	2,700	2,700	2,700
Cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Major FE	✓	✓	✓	✓	✓	✓	✓	✓
Age and Gender	✓	✓	✓	✓	✓	✓	✓	✓
Entry Exam Score		✓		✓		✓		✓

Notes: This table reports the estimated impacts of the UFBA quota policy on four student outcomes – the proportion of failed courses among all courses taken ("Failures"), the hour-weighted average grade in the first semester ("1st GPA"), the hour-weighted average grade at the end of the major ("GPA") and a variable equal to 1 if the student graduated at most four semesters (2 years) after their major's minimum duration ("On-Time Graduation"). The estimates in Panel A and C refer to the difference-in-differences coefficient β from equation (6), and the estimates in Panel B and D refer to the β's from equation (8). Panel A and B show the results only for students in the most selective majors (top quartile of selectivity): medicine, law, computer science, business, dentistry, and environmental engineering. Major selectivity is defined based on the entry exam score of the last student enrolled in that major, with majors with higher minimum scores defined as more selective. Panels C and D show the results only for students in less selective majors. The unit of observation is a student-year, and the analysis includes the cohorts of students enrolling at UFBA in the years 2003-2006. The first cohort of students benefiting from the UFBA quota policy is the cohort admitted in 2005. The policy reserved 45% of the available slots in each major from public school students, 85% of which must be filled with black and mixed-race students. The comparison group consists of private school students who were ranked among the top 55% before the policy, and all private school students after the policy. "Entry exam score" refers to the score obtained by the student in the overall entry examination. The number of observations for 1st semester GPA is smaller than the other variables because there is a small number of students who are approved in the entry exam but only start their courses after 1 or 2 semesters. Standard errors clustered at the major level are reported in parentheses. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.