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Redistribution without Distortion: Evidence from an Affirmative Action Program at a Large Brazilian University[*]

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Abstract

In this paper, we examine an innovative affirmative action policy designed to increase the representation of underprivileged students at UNICAMP, a large and highly ranked Brazilian university. The university awarded bonus points to targeted applicants (i.e., public high school applicants) on their admission exam, as opposed to imposing a typical quota system. Using a rich set of administrative data from UNICAMP, we assess the effect of this policy on the composition of admitted students, and investigate for possible behavioral responses at the extensive (participation) and intensive (preparation effort) margins. We find that the admission probability of public high school applicants, the targeted applicants, significantly increased following the adoption of the affirmative action program. The policy was also associated with sizable redistribution in the composition of admitted students, with a shift towards students from families with lower socio-economic status. Surprisingly, we find little evidence of behavioral reactions to the affirmative action policy, in terms of test performance or application decision.

Key words: *post-secondary education, affirmative action, university admission, inequality.*

Résumé

Dans cet article, nous examinons une politique innovatrice de discrimination positive visant à accroitre la représentation des élèves défavorisés à UNICAMP, une grande et prestigieuse université brésilienne. Au lieu d'utiliser un système de quota typique, l'université a accordé des points bonus aux candidats ciblés (à savoir, les candidats des écoles secondaires publiques) à leur examen d'admission. En utilisant un riche ensemble de données administratives d'UNICAMP, nous évaluons l'effet de cette politique sur la composition des étudiants admis et investiguons la présence des signes de réponses comportementales possibles à la marge extensive (participation) et intensive (effort dans la préparation). Nous constatons que la probabilité d'admission des candidats des écoles secondaires publiques, les candidats ciblés, a considérablement augmenté suite à l'adoption du programme de discrimination positive. La politique a également été associée à une redistribution importante dans la composition des étudiants admis, avec une augmentation de la proportion d'étudiants issus de familles de statut socioéconomique plus faible. Étonnamment, nous trouvons peu de signes de réactions comportementales à la politique de discrimination positive, en termes de performance au test d'admission ou de décision d'application.

Mots clés : *Éducation post-secondaire, discrimination positive, admission à l'université, inégalité.*

1 Introduction

Policymakers and academics alike have increasingly considered the degree to which socio-economic background determines educational and occupational outcomes. One important factor determining equality of opportunity and social mobility is access to higher education. Indeed, a perception that unequal access to university may be contributing to unequal opportunities has led to various forms of affirmative action in university admission in many countries. Whether these approaches best achieve policy goals and what kind of distortions they produce has been at the heart of a lively debate.[1]

We contribute to this debate by analyzing the impacts of a particular affirmative action policy at UNICAMP, a large and highly ranked public university in Brazil.[2] The policy awarded students from disadvantaged backgrounds (public high school graduates) a significant bonus on their admission exam final score. In this paper, we are particularly interested in investigating the redistributive effects of the policy, as well as potential behavioral responses by applicants. While these questions have been analyzed separately in the literature, our dataset allows us to address both issues simultaneously.

The admission-exam bonus was motivated by the concern that public high schools have very unequal success rates when it comes to placing their pupils into selective universities, an issue relevant not only for Brazil but also for other developing and developed countries. For instance, only 100 (or 3%) of all schools[3] made up about 32% of the intake of Oxford and Cambridge in 2007-2009 (The Sutton Trust, 2011).[4] Similar patterns have been observed for the Universities of California and Texas in the U.S.[5] We therefore believe that our results will also be of interest to the policy debate in such countries, noting that a policy that conditions on the type of high school attended is likely to pass tests of constitutionality, more so than one that conditions on race.[6]

The bonus awarded by UNICAMP to its public high school applicants is large, repre-

[1]See, e.g., Fryer and Loury (2005) for a discussion surrounding the affirmative-action debate in the United States, and Arcidiacono et al. (2015) and Arcidiacono and Lovenheim (2016) for reviews of the literature on the impacts of these policies on educational outcomes.

[2]*Universidade Estadual de Campinas*, located in Campinas, Sao Paulo, Brazil.

[3]This considers only schools offering "sixth forms and sixth form colleges," which have college-bound students.

[4]Indeed, 5.2% of "public", i.e. independent, school pupils were admitted by Oxford and Cambridge. The corresponding figures for state schools are 4.2% for selective "grammar" schools (of which there are very few), and 0.8% for non-selective "comprehensive" schools.

[5]A small number of mostly private high schools have accounted for a disproportionate share of admitted students at the flagship campuses of the Universities of California (Martin et al., 2005) and Texas (Long et al., 2010) before introducing their respective 'percent' plans.

[6]In Fisher vs. University of Texas 2013, the US Supreme Court took the view that any consideration of racial criteria in affirmative action to ensure diversity must be narrowly tailored.

senting about 30% of a standard deviation in admission-exam score. Given the size of this bonus, one could expect that an affirmative action policy at a selective university would trigger behavioral responses, both in terms of the decision to participate in the exam (extensive margin) and the choice of preparation effort (intensive margin). With a fixed number of places going to the 'winning' applicants, the entrance exam seems a good example of a real effort tournament. As we show in a simple model, the intensive- and extensive-margin effects of a bonus-point affirmative action policy (like the one observed at UNICAMP) will depend on whether an individual is favored by the policy and her rank in the ability distribution (see e.g., Stein, 2002). When weaker participants receive a bonus, the policy tends to level the playing field, which increases aggregate effort spent and tends to decrease outcome gaps (see, e.g., Franke, 2012). Gall et al. (2015) point out that access to better peers may affect early stage investment incentives, suggesting that individuals who are favored by the policy will increase their effort and those who are not may decrease their effort. On the other hand, the policy debate often points to effects on the intensive margin, contending that those favored will reduce their effort, profiting from an implicit guarantee, while those not favored will have to work harder (see also Coate and Loury, 1993; Fryer and Loury, 2013, for possible theoretical reasons that beneficiaries may be disincentivized).

Our results indicate that UNICAMP's affirmative action policy led to a sizable redistribution of admission offers: 1) almost 10% of all admitted applicants would not have been admitted in the absence of the policy, and 2) these admitted applicants were from families with significantly lower socio-economic status than the individuals they displaced (the applicants who were rejected in virtue of the policy). However, they did not differ significantly in their centralized high school graduation exam score. The admission rate of public high school graduates increased relative to their private high school counterparts following the introduction of the affirmative action policy. Among private high school applicants, visible minorities suffered the most: the admission rate of visible minorities (from private high schools) decreased significantly relative to their non-visible minority (henceforth referred to as 'white') applicant counterparts.

These results are in line with Bertrand et al. (2010), who study the impact of a quota-based affirmative action policy targeting lower caste individuals in an Indian engineering school. They also find that the policy was redistributive, as those admitted under the policy were from significantly lower socio-economic backgrounds than candidates displaced by the policy. However, their cross-sectional dataset does not allow them to investigate whether the policy had any impact on the applicant composition or whether it affected effort provision by beneficiaries and non-beneficiaries. Thus, they have to assume that neither the number of applicants nor their performance on the admission exam changed following the adoption of the affirmative action.[7] We can test the assumptions made by Bertrand et al. (2010) as well as some predictions of our simple model, given the richness of our dataset. In particular, our dataset and the timing of the policy allow us to investigate possible reactions on both the extensive and intensive margins.[8]

We do not find evidence of sizable behavioral distortions and the policy effects are well predicted by ignoring them. On the intensive margin, we only find weak evidence of changes in effort differentials on the first stage of the exam[9], and these changes are not large enough to affect the probability to make it to the second (and last) stage of the exam. We find similar results when considering applicants' relative performance on the second stage of the exam–this analysis is done with a more selective sample than in the first stage, as only about 30 percent of applicants make it to the second stage.

On the extensive margin, the share of public school alumni among applicants increased slightly, but only temporarily. These results are in line with the empirical literature on U.S. affirmative action for college admission.[10] Overall, our findings suggest that affirmative action policies can be successful without inducing large behavioral reactions or distortions.

The paper is organized as follows. Section 2 discusses the main features of the UNICAMP admission system and its affirmative action policy. Section 3 presents a theoretical framework and describes the expected impact of the policy. Section 4 explains the data sources used in

[7] Another significant difference between our study and Bertrand et al. (2010) is that we observe the cutoff points for each program-year, as the lowest admitted test score in the previous year is publicly available for each program, along with the number of available seats (this information is also known by the applicants). Examining a quota system, Bertrand et al. (2010) cannot observe the cutoff and must estimate the cutoff points using enrollment rather than admission as the dependent variable. On the other hand, Bertrand et al. (2010) can compare the income gains of students admitted under the policy to the income losses of the displaced students, while we are unable to do so as we do not observe students' post-university incomes.

[8] A number of papers have examined the impact of affirmative action policies on individuals' effort choices. While the experimental literature finds both positive and negative results (see, e.g., Schotter and Weigelt, 1992; Calsamiglia et al., 2013; Cotton et al., 2014), non-experimental empirical studies suggest that the effects in terms of effort provision may be small. Antonovics and Backes (2014) find a modest impact of the abolition of affirmative action at the University of California system on GPA of college-bound students. In the Brazilian context, Assuncao and Ferman (2013) show that the effect of affirmative action at two Brazilian universities on students' pre-college effort was negligible, but there was a negative impact on performance for black students in Rio de Janeiro, a group that benefitted from relatively large quotas (with respect to the applicant population). Francis and Tannuri-Pianto (2012) detect a small increase in the number of attempts in the admission exam and in enrolling at preparatory courses by mulatto (mixed-race) applicants at University of Brasilia, following the implementation of a quota-based affirmative action policy. They interpret this as an increase in effort. However, it is a priori unclear whether these measures would be positively or negatively affected by applicants' effort provision.

[9] We discuss UNICAMP's admission exam in detail in Section 2.

[10] In the U.S., the end of race-based affirmative action is associated with small changes in application behavior by minority students (Long, 2004; Dickson, 2006), but does not seem to affect highly qualified minority students (Card and Krueger, 2005). In terms of college admission, Backes (2012) and Hinrichs (2012) find modest or null results of the ban on affirmative action on enrollment and graduation of minorities. See Holzer and Neumark (2000) for a review of the literature.

this paper. Sections 5 investigates whether the pool and composition of admitted students changed following the introduction of the affirmative action policy. Section 6 studies potential behavioral responses by applicants, and Section 7 concludes.

2 UNICAMP's Admission System and its Affirmative Action Policy

2.1 The Admission Process

UNICAMP is a public university located in the city of Campinas and state of Sao Paulo, Brazil. It is a large research-intensive university where half of its 37,000 students are at the graduate level. UNICAMP does not charge tuition fees (as is the case for all public Brazilian universities). UNICAMP is considered one of the best universities in the country; hence, admission is valued extremely highly by prospective students.

Admission at UNICAMP is governed by an entrance exam (*vestibular*). The exam registration takes place in September and successful candidates will start university in February of the following year.[11] When registering for the admission exam, candidates can apply to up to three majors (which they rank first, second, and third). As we will see, the ranking of these majors played a role in determining who was accepted and who was refused in virtue of the affirmative action policy. In particular, some (although very few) public high school applicants were refused due to the policy.[12]

The *vestibular* consists of two parts taken in sequential order, Phase 1 and 2 exams (henceforth referred to as P_1 and P_2, respectively). Only applicants who pass P_1 (about 30 percent of applicants) are allowed to take P_2. The exams are the same for all applicants (in both P_1 and P_2), regardless of their choice of major. They are composed of open questions (no multiple choice questions) aimed at testing the applicant's mastery of high school compulsory subjects.[13]

The P_1 exam consists of 12 general questions based on typical high school subjects and an essay. An applicant's score in P_1 is the maximum of (i) the raw performance on the general questions and the essay, and (ii) a weighted average of that raw performance and the applicant's high school exit exam score, *ENEM*, with a weight of 20 percent.[14] The fact

[11] Note that students who do not plan to join the university may take the *vestibular*. It is not unusual that students who will not finish high school in time for enrollment take the exam as "trainees" (*treineiros*) to practice. We exclude these students for most of our analysis.

[12] See Appendix B for more details about the way the major choices affect an applicant's rankings.

[13] Additionally, some majors, like Dentistry and Performing Arts, require an aptitude test as part of P_2.

[14] ENEM is an end-of-high-school exam that tests basic competencies and abilities.

that an applicant's *ENEM* performance can only count for up to 20 percent of her P_1 score highlights the importance of performing well on the general questions and the essay in order to advance to P_2.

An applicant automatically fails P_1 by obtaining a zero score in any of its components (i.e., essay and/or general questions). The pass score (*nota de corte*) for P_1 is set initially at 50%, but is then adjusted to guarantee that the number of candidates progressing to P_2 in each major is at most eight times the number of places offered in that major.[15] Hence, more popular majors will have P_1 pass scores higher than 50%. The P_1 pass scores are announced publicly in December along with the list of candidates that passed P_1.

P_2 is administered over four days and composed of eight parts, each based on a specific (compulsory) high school subject. Applicants automatically fail P_2 if they receive zero on (or are absent from) at least one of the eight exams. While P_2 tests are identical for all majors, the P_2 final score weighs each of the eight subjects (parts) differently, according to the major applied for. Each major typically has at least one "priority subject," a subject which is weighted more heavily in the P_2 score.

The overall score of the admission exam (NPO, for *nota padronizada de opção*) is computed using the standardized weighted average of (i) the P_1 score, (ii) the P_2 priority subject scores, and (iii) the P_2 non priority subject scores. While the P_1 score and each of the priority subject scores has a weight of 2 in the weighted average, each non-priority subject score has a weight of 1.[16] Finally, the university ranks candidates in decreasing order of their NPOs[17] in order to make its admission offers.[18] The small number of available seats relative to the number of applicants and the admission test structure makes these P_1 and P_2 entry exams very competitive.

2.2 The Affirmative Action Policy

UNICAMP's affirmative action program was implemented in 2005. Under the policy applicants who spent their last three years of high school *exclusively* in public schools can request the bonus points. Applicants have to state this explicitly when registering for the admission exam and must include proof of their public high school attendance.

[15]The score also has to ensure that the number of successful applicants is at least three times the number of places, which explains why the pass score is lower than 50% for less competitive majors. For calculation, only applicants who chose a major as their first choice and who are not trainees are considered.

[16]The aptitude test score is also part of the weighted average for Architecture and Urban Studies, Arts, and Dentistry.

[17]Note that the university computes an NPO score for each major the candidate applied for (up to three). We use the candidates' (up to) three NPO scores when identifying who was admitted in virtue of the affirmative action (and who was pushed out).

[18]See Appendix B for more details on the admission rules.

Applicants eligible for the affirmative action policy receive a 30-point 'bonus' on their NPO score, which corresponds to 30% of a standard deviation. If, additionally, these applicants declare themselves to be black, mulatto or native, they receive an additional 10 points on their NPO score (for a total of 40 points). Note that black, mulatto or native applicants from private secondary schools do not receive any bonus. In order to get a better idea of what an additional 30 points can represent, Figure 1 presents the distributions of NPO scores for applicants both from public and private high schools for the years prior to the affirmative-action policy (2001-2004). Applicants from public high schools were performing worse than applicants from private schools. Adding 30 points shifts the distribution of NPO scores of applicants from public institutions to the right, so that it now peaks at the same point as the private school applicant distribution. In the absence of any behavioral response from applicants this large shift in NPO distribution should lead to a sizable increase in the share of public high school graduates among UNICAMP students.

3 Theoretical Pointers

As mentioned in the Introduction, one could imagine that the affirmative action policy put in place by UNICAMP would induce behavioral responses, both in terms of the decision to participate in the admission exam (extensive margin) and the choice of preparation effort (intensive margin). In this section, we follow the established theory on affirmative action in contests and tournaments (see e.g., Stein, 2002; Franke, 2012) to sketch a simple contest model and derive theoretical predictions about the applicants' possible behavioral responses to the policy change.

To keep the model tractable while allowing for sufficient heterogeneity among contestants, suppose that four students compete for a single slot at university. Each student i has a value V_i for the slot and is characterized by their ability of exam taking α_i. Suppose that $\alpha_1 > \alpha_2 > \alpha_3 > \alpha_4 > 0$, where higher parameter values correspond to higher ability. These individuals could represent applicants with 1) majority background and from private schools, 2) minority background and from private schools, 3) majority background from public schools, and 4) minority background from public schools, respectively. Such a ranking is consistent with what we observe in our data (in terms of admission rates), prior to UNICAMP's affirmative action policy.

Success at the admission exam is stochastic, and increases in own effort x_i spent on exam preparation and decreases in the other players' effort choices. Specifically, individual i's probability p_i of winning the contest and being admitted is given as follows:

$$p_i = \frac{\alpha_i x_i}{\sum_{j=1}^{4} \alpha_j x_j}.$$

That is, students compete in a Tullock contest for the slot, and individual effort choices are strategic substitutes.[19]

Following Stein (2002) we will examine the effects of an increase in the individuals' values of winning the contest V_i and strengths α_i on participation, effort choice and winning probabilities in a Nash equilibrium of the contest game. This captures the working of the affirmative action policy in stage P_2 (by increasing the strength of the favored) and P_1 (by increasing the continuation valuation for the favored).

Extensive Margin: Participation

For participation (i.e., registering for the *vestibular*) we consider the effect of an increase on the strength of some applicants. For tractability we model the two-part entrance exam as one contest with common value of winning V, such that $V_i = V$. Following Stein (2002) all agents whose rank i satisfies

$$\alpha_i V > (i-2)\Big(\sum_{j \leq i-1} \frac{1}{\alpha_j V}\Big)^{-1},$$

will participate. Note that the condition is monotone in rank, yielding a threshold rank R, i.e., the highest rank for which the condition holds, such that students with a slightly lower rank will participate and students with higher rank will not participate. Two testable implications follow, as stated below.

Prediction 1. *Suppose that $\alpha'_j = (1+\delta)\alpha_j$ with $\delta > 0$ for all students who receive a bonus. Then (i) a bonus to non-participants increases participation, ceteris paribus, and (ii) a bonus to students who already participate decreases participation, ceteris paribus.*

This prediction implies that students whose strength does not increase will not become participators, and students who receive the maximum bonus will not drop out.

[19] This particular functional form for the winning probability (contest success function) arises, if effort x_i produces a score y_i according to $\ln y_i = \ln \alpha_i x_i + \eta_i$, where η_i is a random variable that follows a type I extreme value distribution (see, e.g., McFadden, 1974). Suppose that the noise terms η_i are independently distributed (with mean equal to the Euler-Mascheroni constant), see, e.g., Fu and Lu (2012) and Jia (2008) for details.

Intensive Margin: Effort

Turning to the intensive margin (i.e., effort), the effects of affirmative action are subtly different in stages P_1 and P_2. In P_2 eligible applicants receive a bonus while in P_1 the bonus increases the continuation value for eligible applicants by increasing the winning probability in stage P_2, as we will show below. That is, in P_2 the policy affects α_i, whereas in stage P_1 it affects V_i instead. Suppose that individual strengths and the intervention are such that all students participate, before and after a policy intervention, and that student 1 remains the strongest student after the intervention. Denote the post-intervention parameters by primes.

Following Stein (2002) again, if p_i is i's (equilibrium) winning probability, i's equilibrium effort is

$$x_i = p_i(1 - p_i)V_i.$$

Winning probabilities $p_i = \frac{\alpha_i x_i}{\sum_{j=1}^4 \alpha_j x_j}$ depend on equilibrium effort levels, which in turn depend on strengths α_i, so that in our setup

$$p_i = 1 - \frac{3}{\alpha_i V_i}(\sum_{j=1}^{4} \frac{1}{\alpha_j V_j})^{-1}.$$

The difference in winning probabilities before and after the policy intervention is

$$\Delta p_i = \frac{3}{\alpha_i V_i}(\sum_{j=1}^{4} \frac{1}{\alpha_j V_j})^{-1} - \frac{3}{\alpha_i' V_i'}(\sum_{j=1}^{4} \frac{1}{\alpha_j' V_j'})^{-1}.$$

That is, $\Delta p_i > 0$ if

$$\frac{\alpha_i' V_i'}{\alpha_i V_i} > \frac{\sum_{j=1}^4 \frac{1}{\alpha_j V_j}}{\sum_{j=1}^4 \frac{1}{\alpha_j' V_j'}}.$$

Hence, for any i whose strength α_i (value V_i) remains constant, increasing some α_j (V_j) will result in a decrease of p_i. If $p_i < 1/2$ this will also imply a decrease in effort x_i. Otherwise effort increases if V_i' remains sufficiently close to V_i. This property extends to measured performance $\alpha_i x_i$. The following prediction emphasizes the possibility of heterogeneous policy effects on those not favored.

Prediction 2. *Suppose student i's strength α_i remains constant, but some other student j receives a grade subsidy. Then p_i decreases. If $p_i < 1/2$, i's performance also decreases, otherwise i's performance increases if i's value V_i does not decrease too much after the intervention.*

For any i whose strength α_i (value V_i) increases, p_i will increase if the increase in α_i (V_i)

is sufficiently large compared to the increase of other agents' strengths, e.g., if the strength (value) of some agents increases by the same proportion. Again, if $p_i < 1/2$ this will also imply an increase in effort x_i. Since expected performance y_i is monotone in effort and strength, performance increases for agents whose strength (value) increases, and decreases for the remaining agents.

For our econometric approach it will be useful to determine the relative winning probability compared to the strongest student, i.e., $p_i - p_1$.

$$p_i - p_1 = \left(\frac{1}{\alpha_1 V_1} - \frac{1}{\alpha_i V_i}\right) \frac{3}{\sum_{j=1}^{4} \frac{1}{\alpha_j V_j}}.$$

Examining the effect of a change in either strength or value on the difference of winning probabilities $p_i - p_1$ yields also a statement on the difference in performances, as argued above. The following statement summarizes some comparative static properties of the equilibrium characteristics. The derivation can be found in Appendix A.

Prediction 3. *Suppose that $p_i < 1/2$ for all agents and that $\alpha'_j = (1+\delta)\alpha_j$ with $\delta > 0$ for all students $j = 3, 4$ who receive a grade subsidy. Then both in P_1 and P_2*

(i) for students who do not receive a bonus, the winning probability and performance decrease; winning probability decreases relative to the strongest student,

(ii) for students who receive a bonus, the winning probability and performance increase (also relative to the strongest student).

4 Data

Our main data source is a rich administrative dataset provided by UNICAMP, a large and highly ranked Brazilian university. This dataset contains information on all students who enrolled for UNICAMP's entrance exam (*vestibular*) in the years 2003 to 2008.[20] Every year, more than 40,000 applicants register for UNICAMP's admission exam. Our dataset contains background information for each of these applicants. In particular, we observe their gender, age, race (i.e., Asian, black, mulatto, native, or white) and whether they attended a public secondary school.[21] Importantly, the dataset also includes information on the applicant's

[20] We have data from 2001 to 2008, but the information about the applicant's race is only available beginning in 2003. We use the 2001-2008 data in Section 6.1 to investigate the pre-2005 trends in applicant characteristics.

[21] The categories are only private, only public, mainly public some private, mainly private some public, half and half, and none.

family characteristics such as her/his family income, and both of her/his parents' education levels and occupations. This will allow us to investigate whether students admitted in virtue of the affirmative action policy come from more disadvantaged backgrounds than the students that they displaced (i.e., the students who were refused due to the same policy).

Our data allow us to observe everything that happens during the admission exam: for each applicant, we observe their performance in each part of the exam they participated in (recall that passing P_1 is a necessary prerequisite for writing P_2) and whether they were admitted and enrolled at UNICAMP (and their major once enrolled). Observing the applicants' performance allows us to explore the black box of the admission process; namely, to investigate whether there is evidence of changes in relative performance of public high school applicants following the affirmative action bonus. Note that less than a third of these applicants (between 26 and 32 % depending on the year) progress to P_2. Hence, being able to observe student performance on both P_1 and P_2, as opposed to just P_2, will shed additional light on the admission process. As the affirmative action policy was implemented in 2005, the dataset allows us to examine exam performance of applicants several years before and after the policy intervention. This is convenient, for instance, to investigate potential differences between immediate and longer-run policy impacts.

We make a series of restrictions to concentrate on our population of interest. First, we discard students who do not take the exam for immediate admission (i.e., who take the exam as a practice test) and applicants who registered but did not write the exam. These two groups of individuals represent 4.5 and 4.6 percent of the original population, respectively. We next drop applicants who did not do their secondary education in Brazil (0.5 percent of the original population). Finally, we discard applicants for which there is important information missing (i.e., missing gender, age, type of secondary school attended, affirmative-action information, or parental education). Doing so eliminates 8.2 percent of the initial population.

To assess the distributions of private and public high school leavers at the state level we use data from the Brazilian School Census. The information on the School Census is collected every March, and covers the universe of all public and private schools in Brazil. We will focus on the School Census information for the state of Sao Paulo, which is where the large majority of applicants comes from.

Tables 1 and 2 present descriptive statistics of our data. Table 1 concentrates on the years immediately prior and after the policy intervention (2004 and 2005), whereas Table 2 covers the 2003-2008 period. Important differences can be observed following the introduction of affirmative action. First, the shares of visible minorities and public high school alumni have increased significantly, which could suggest that the pool of applicants was affected by the affirmative action policy. We also note that the overall level of parental education increased over time. Looking ahead, in Section 6.2 we investigate whether these differences seem to be the results of the policy or a more general trend by: 1) comparing evolution of these characteristics among private and public high school applicants, separately, and 2) comparing evolution of these characteristics using UNICAMP's main competitor for student intake, the University of Sao Paulo (USP), as a comparison group. Note that, although the share of applicants who attended a public high school increased in 2005 compared to 2004, this increase appears temporary, and tapers off in the years 2006 to 2008. We will also return to this observation in Section 6.2.

5 Overall Outcome: Admission

The central aim of the policy was to redistribute university places from applicants graduating from private high schools to applicants with similar academic ability (as measured, for instance, by their standardized ENEM score) coming from public high schools. This was motivated by a general consensus that applicants from public high schools have a lower probability of gaining university admission, when controlling for their academic ability. Therefore, our first step is to examine whether the policy has indeed been associated with a redistribution of university places. To do so we 1) investigate possible changes in applicants' admission probabilities based on their individual characteristics and 2) compare the characteristics of admitted applicants who would not have been admitted without the policy (the "displacing") to applicants who failed to be admitted but who would have been admitted in the absence of the policy (the "displaced").[22]

5.1 Individual admission probabilities

We use a difference-in-difference framework to examine potential changes in applicants' admission probabilities following the introduction of the policy. Denote the outcome by $A_{i,c,m,t}$, a binary variable equal to one if the applicant i from municipality m and applying to career choice c in year t was admitted, and zero otherwise. In our most basic specification, we regress $A_{i,c,m,t}$ on a series of binary variables indicating: whether the applicant is from a visible minority, V_i, went to a public secondary school, P_i, was observed during UNICAMP's affirmative-action years, AA_t, as well as their interaction terms. The interaction terms in-

[22]We focus on admission rather than enrollment to reflect the idea that policymakers' main concern is to ensure equal opportunity. Indeed, an individual's decision to enroll conditional on being accepted may be affected by many variables completely unrelated to our model. Nevertheless, the results for enrollment are similar to the ones for admission and are available upon request.

volving AA_t (e.g., $P_i \times AA_t$) are our variables of interest. $P_i \times AA_t$ captures the change in admission probability (following the affirmative action policy) for non-visible minority applicants from public secondary schools, relative to their private secondary school counterparts. We augment our base specification to control for the applicant's personal characteristics (i.e., gender, a quartic function of age, parental educational attainment, an indicator variable for previous university attendance), $\boldsymbol{X_i}$, as well as for municipality, career-choice, and year fixed effects ($\mu_m + \eta_c + \tau_t$). The main regression equation is given by:

$$\begin{aligned} A_{i,c,m,t} =& \alpha P_i + \delta V_i + \pi(P_i \times V_i) + \rho(P_i \times AA_t) + \beta(V_i \times AA_t) + \gamma(P_i \times V_i \times AA_t) \\ &+ \phi ENEM_i + \boldsymbol{X_i \Gamma} + \mu_m + \eta_c + \tau_t + \varepsilon_{i,c,m,t}, \end{aligned} \tag{1}$$

where $\varepsilon_{i,c,m,t}$ represents the error term. We allow our error terms to be two-way clustered, at the career choice and municipality levels (see e.g., Cameron et al., 2011; Cameron and Miller, 2015). This takes into account the potential correlation in error terms for students with similar career choice and from the same geographical region (who may well have experienced similar shocks in their prior education or entrance exam). Moreover, allowing for clustering at the career choice and municipality levels takes into account some of the serial-correlation issues related to difference-in-differences estimation raised by Bertrand et al. (2004).

Table 3 presents the results of estimating equation (1) for the years 2004 and 2005. Specifications (1) to (5) use an increasing set of control variables to assess the robustness of our findings. Before turning to possible policy effects, we investigate whether the common consensus that applicants from public high schools had worse admission prospects even when controlling for academic ability measured by ENEM is well founded empirically. Interestingly, Specification (3) seems to suggest that controlling for academic ability yields in fact a significantly higher admission probability for applicants from public high schools, and no difference for visible minorities. However, Specification (4) shows that this is due to selection on observables. Once we include program fixed effects, the Public High School coefficients revert to a negative sign, suggesting that applicants from public schools choose programs that are less competitive than their counterparts from private schools. Using our full set of controls in Specification (5) results in a sizable difference in admission rates depending on high school type: the private-public difference is 1.4 percentage points. This is substantial given an overall admission rate of 10.5 percent in 2004 (see Table 1).

Note also that the coefficient estimate for the ENEM score is highly significant: A one standard-deviation difference in ENEM score is associated with a 12.4 percentage point difference in admission probability. This is reassuring and gives some confidence that the ENEM score is a good proxy for academic ability.

Most importantly, Table 3 suggests that admission probabilities increased for students from public high schools, following the affirmative action policy. Focusing on Specification (5), we notice that white students from public high schools were about 1.4 percentage points less likely to be admitted than their counterparts from private schools prior to the policy. The private-public difference decreased by 2.8 percentage points for white students and thus became a 1.4 percentage-point advantage for public high school applicants after the affirmative action was put in place (although the p-value from testing the null hypothesis $H_0 : \alpha + \rho = 0$ is 0.0914). Despite the fact that visible minority applicants from public schools receive an additional 10 points (over and above the 30 points from being public high school graduates), the change in admission probability for these applicants is not different than the change observed for white applicants ($\beta + \gamma$ is not statistically different from zero at conventional confidence levels). In contrast, the white-minority gap increases significantly, by 1.6 percentage points, for applicants from private schools (a gap that was essentially zero prior to the affirmative action).

To sum up, the policy led to a substantial increase in admission probability for applicants from public schools. The main losers from the policy were visible minority students from private schools, as they experienced a decrease in admission probabilities. These results are remarkably similar to the ones we obtain when we extend the period of analysis to the years 2003-2008 (see Table 4), indicating that the observed changes in admission probabilities observed immediately following the affirmative-action policy do not fade away. In the absence of any confounding factors (based on unobservables) affecting the pool of applicants, our findings would suggest that the affirmative action had the intended effect of increasing the representation of students from public high schools.[23] Before turning to the possible interpretations of the coefficient estimates presented in Tables 3 and 4, we now take a closer look at the characteristics of the (potentially) displaced and displacing applicants.

5.2 Redistribution along socio-economic characteristics

In order to investigate the potential redistributive effect of the affirmative action policy, we perform a similar exercise as done by Bertrand et al. (2010). Bertrand et al. (2010) investigate whether a quota-based affirmative action policy targeting lower caste individuals

[23] We will address both the possibility that the pool of applicants changed due to factors unrelated to the affirmative action policy in Section 6.2 and the potential channels through which the affirmative action policy might have increased the effort provision of students from public high schools in Section 6.3 (other than through a purely mechanical effect). Our results indicate that these two potential channels are relatively weak and do not seem to explain the increase in admission probabilities.

in India resulted in admitting students from financially disadvantaged families.[24] They find that students admitted in virtue of the policy (the 'displacing' students) were from financially disadvantaged families when compared to the ones who were refused in virtue of the policy (the 'displaced' students).

Our evidence for redistribution of university access toward applicants from public schools is further corroborated by comparing the characteristics of displacing and displaced applicants. Recall that displacing applicants are those who would not have gained admission without the policy (the 30- or 40-point bonus) given the distribution of entrance exam scores, and the displaced are those applicants who would have gained admission in the absence of the policy. Comparing the two groups thus yields further insight on the dimensions along which the policy has redistributed university places.

Given the distribution of entrance exam scores in the year 2005, there are 268 applicants (the great majority from public high schools) who would not have been admitted without the bonus points awarded by the policy, and correspondingly 268 applicants (the great majority from private schools) who would have gained admission had the applicants from public school not been awarded their bonus.[25] This number represents 9.1% of the 2,934 available places.[26] The proportion is much higher for competitive majors, as the 30-point bonus generates a greater advantage when applicants' scores are more similar—the 30-point bonus represents a larger advantage in terms of (score) standard deviations in competitive programs. For example, in medicine this proportion is 11.8% and in electrical engineering it is 17.0%.

Table 5 depicts the characteristics of the 'displacing' and 'displaced' applicants. First, displacing applicants are more likely to belong to a visible minority and to come from a more disadvantaged background, reflected by parental education, occupation and income. For instance, while 53% of displaced candidates' mothers have a university degree, this number halves to 25% for the displacing group. Similarly, nearly 55% of displaced candidates' fathers had a medium-to-top or top occupation, while the corresponding number among the displacing group is only 23%. Indeed, all variables associated to parental education and occupation, as well as to financial constraints show significant differences. Hence, taken at face value, the policy seems to have been successful in broadening access to the university

[24] One of the concerns raised regarding affirmative action is that it could favor financially advantaged individuals from the 'disadvantaged group' over financially disadvantaged individuals from the 'advantaged group' (Bertrand et al., 2010).

[25] Note that due to the admission rules that depend sequentially on first, second, and third choices of major, some of the displacing students may be from private schools and some of the displaced may be from public schools. However, there were very few of those cases in 2005: 3 displacing were from private schools and 9 displaced were from public high schools.

[26] Note that 692 candidates admitted on the first list received the bonus associated with the affirmative action policy, but 61% of them would have been admitted even without the bonus points.

to applicants from disadvantaged backgrounds. Second, and perhaps surprisingly, displacing and displaced students do not differ significantly in their ENEM scores. That is, if one accepts the ENEM score as a viable proxy for academic ability, the policy seems to have redistributed places at UNICAMP from advantaged to less disadvantaged socio-economic backgrounds, but without compromising admitted students' academic ability.

5.3 Prediction of the policy effect ignoring behavioral response

From a policy evaluation point of view it is interesting to assess how well one could predict the policy 'effect' when ignoring potential behavioral responses to the policy. To do so one needs to compare the actual effect of the policy to a "naive" counterfactual that does not account for adjustments of students on the intensive (effort) or extensive (participation) margin. To construct the counterfactual we use 2004 data and compute the number of displaced and displacing applicants based on actual exam performance in 2004. This resulting change in admission amounts to 247 applicants who would have gained admission in 2004, representing 8.4% of the 2,934 available places.

That is, the naive prediction only slightly underestimates the observed effect. This suggests that behavioral responses are small in comparison to the mechanical redistributive effect of the policy, and that they magnify the policy effect, if anything. This is in line with our theoretical predictions, as a leveling of the playing field in tournament models is typically associated with behavioral responses amplifying the mechanical effect (see Section 3). This observation may be of considerable interest to a policymaker, since it suggests that the policy effects can be realistically simulated and predicted by focusing on past distributions of entrance exam scores.

6 Potential Behavioral Response & Confounding Factors

Section 5 finds that the policy intervention was followed by a substantial redistribution of places at UNICAMP to applicants with less advantaged socio-economic backgrounds. Before claiming that this redistribution was caused by the affirmative action policy, we have to rule out the possibility that other potentially confounding factors are driving our results. In Sections 6.1 and 6.2, we use data from UNICAMP's main competitor, USP, and from Brazilian School Census to investigate 1) the possibility that the changes observed following the affirmative action policy could be explained by confounding factors, and 2) whether there is evidence of applicant compositional changes that could be due to the policy. Economic theory, as for instance reviewed above in Section 3, would suggest that changes in admission will result in an equilibrium outcome, and are thus brought about both by mechanical effects of the rule change and behavioral responses by the applicants to the new rules.

Behavioral responses can be expected both on the extensive margin, as the policy could have attracted new applicants, and on the intensive margin, as the policy could have led to a change in the competitive environment, affecting applicants' propensity to exert preparation effort for the entrance exam. For instance, applicants not favored by the policy might respond by increasing their effort over-proportionally, thus partially mitigating redistributive effects of the policy.

The evidence presented in this Section will hopefully shed light on the potential mechanisms through which the affirmative action policy can affect university admissions, but it will also inform us on the validity of the comparison exercise presented in Section 5.2. In particular, when identifying the 'displaced' and 'displacing' applicants, we assume (as does Bertrand et al. (2010)) that student effort was not affected by the affirmative action policy. In Section 6.3, we will search for any evidence suggesting changes in effort provision.

6.1 Potential Confounding Factors

It is possible that some of the change in admission differential between public and private secondary school applicants is simply part of a general trend, unrelated to the affirmative action. For example, there could be an upward trend in the proportion of public secondary school graduates applying to UNICAMP. If these new applicants differ significantly in terms of unobservables, we could be incorrectly associating the changes in admission rates to the affirmative action policy. Even in the absence of trending compositional changes, students from public secondary school could become better at taking UNICAMP's admission exam. Note that in order to be problematic, the increased ability in taking the admission test should not be captured by the ENEM score.

By comparing the pre-reform evolution of the applicant pools at UNICAMP and University of Sao Paulo (USP), (as well as the trend in the number of public high school graduates from the state of Sao Paulo (where the large majority of applicants come from), and by looking at the pre-reform evolution of the ENEM and $P1$ private-public score gaps, we can address some of the issues raised above.

Figure 2 presents the evolution of the proportion of public secondary school graduates among enrolled applicants at UNICAMP and USP between 2001 and 2008. Clearly, the representation of public secondary school students increased significantly at UNICAMP (by about 8 percentage points) immediately following its affirmative action policy. Importantly, this observed change does not seem to be part of a trend. The proportion of public secondary school students among admitted candidates stayed relatively constant between 2001 and 2004 at both UNICAMP (between 20 and 22 percent) and USP (27 and 28 percent). Although there is a decrease in the public high school representation after 2005 at UNICAMP, it never went back to the pre-policy levels.

Figure 3 presents the evolution of the proportion of public high school applicants at UNICAMP and USP between 2001 and 2008. For both universities, we observe a very modest upward trend prior to the affirmative action policy. We do observe a more significant change in 2005, but the increase at UNICAMP is not out of line with what is observed at USP. Overall, we do not find any evidence suggesting that changes in the pool of applicants could explain the sharp increase in the share of public high school students among admitted candidates. Comparing the UNICAMP data to the number of high school graduates and the proportion of public school students among high school graduates in the state of Sao Paulo corroborates the UNICAMP-USP comparison (see Figure 4). In fact, if anything, the UNICAMP-Census data comparison suggests that the public high school representation is more stable than suggested in Figure 3. Note that Figure 3 only uses data for the programs offered at both UNICAMP and USP while Figure 4 uses all UNICAMP observations, which explains the small difference in trends across the figures.

The fact that the USP and Census data suggest that the representation of public high school applicants stayed relatively stable prior to the affirmative action policy does not guarantee that the pre- and post-policy applicants are comparable. Figure 5 presents the evolution of the applicants' normalized ENEM and $P1$ scores. For presentation purposes, we normalize scores such that, every year, the mean is 0 and the standard deviation is 1. We can therefore look at the evolution of private high school applicant relative scores to know what happens to the private-public score gap. Figure 5 shows that the relative ENEM and $P1$ scores follow each other relatively closely over the 2001 to 2008 period, particularly prior to the affirmative action policy. Note that over the 2001 to 2004 period neither the ENEM nor the $P1$ relative scores fluctuate significantly. If anything, the performance of private high school applicants improved slightly (given their average relative ENEM score) over the years leading to the affirmative action. This makes it unlikely that the change in admission rates observed in Tables 3 and 4 is due to an upward trend in average unobserved ability among public high school applicants.

6.2 Extensive Margin: Composition Effect

We now turn to potential behavioral responses to the affirmative action policy. We begin by investigating possible effects on the extensive margin, i.e., changes in the composition of applicants. We return to Figure 3, which compares the evolution of the proportions of public high school applicants in programs that exist in both universities. The trends in the proportions of public high school applicants were similar at both institutions between 2001 and 2005, indicating that the policy may not be the main explanation for the increase in public high school applicants at UNICAMP observed in 2005. By 2008, the proportions of public high school applicants had returned to pre-affirmative action levels (close to 30%) at UNICAMP and had decreased slightly (from 41% to 37%) at USP. If anything the decrease in the proportion of public high school applicants between 2004 and 2008 is marginally smaller at UNICAMP. Overall, comparing UNICAMP and USP does not suggest a significant increase in applications from public high school graduates following the introduction the affirmative action policy. Figure 4, which compares UNICAMP's applicants to high school graduates in the state of Sao Paulo, further suggests little reaction at extensive margin following of the affirmative action policy.

While neither applicant numbers nor the share of public-school applicants seem to have changed persistently, other characteristics distinguish the pre- and post-policy applicants. Tables 1 and 2 present the applicants' descriptive statistics before and after the intervention for the periods 2004-2005 and 2003-2008, respectively. One year after the policy change, applicants were more likely to come from a public school and belong to a visible minority, and were less likely to come from a technical high school. Applicants also scored substantially higher in terms of parental education, but were less likely to have previously attended university or an exam preparation course. Table 2 shows that these changes extend to the longer period analyzed (2003-2008), except for the proportion of public high school applicants that returned to pre-policy levels after 2005. We now investigate whether these changes are likely to be the result of UNICAMP's affirmative action policy.

Figure 6 shows the evolution of some of the applicants' socioeconomic characteristics over the 2001 to 2008 period, by high school type. Overall, the socioeconomic characteristics of applicants do not suggest significant compositional effects of the affirmative action policy. The evolution of the socioeconomic characteristics exhibit similar trends for public and private high school applicants and do not seem to change significantly following the policy, with the exception of the proportion of visible minorities. There is some evidence that the proportion of visible minorities among public high school applicants increased slightly more than expected immediately following the policy. Given that we only observe applicants' race after 2002, it is difficult to know whether this increase is in line with a pre-affirmative action trend or not. If this observed increase in visible-minority applicants was due to the policy, it was short-lived as the proportion of visible minorities plateaued after 2005 for both public and private high school applicants.

Interestingly, applicants' mean ENEM score was significantly higher after the policy change, as shown in Tables 1 and 2. This is corroborated by comparing the ENEM distributions pre- and post-affirmative action policy (Figures 8 and 9).[27] Indeed, Figure 8 suggests UNICAMP applicants have improved significantly relative to the universe of ENEM takers in the state of Sao Paulo. Part of this shift may have been caused by lower ability students taking the ENEM exam in the state. More interestingly, we can compare the relative shifts in the ENEM distributions of private and public school applicants in Figure 9. While both distributions shift to the right, the shift is larger for private school alumni. Although the magnitudes of the shifts are not large, they are all statistically significant (at the 1% confidence level) based on Kolmogorov-Smirnov Tests. Note that we can also notice this difference in shifts in Figure 5 where the private-public ENEM score gap increases modestly following the affirmative action policy. We cannot exclude that the policy has slightly changed the pool of applicants to UNICAMP. From a theoretical point of view, the simple contest model presented above predicts that high ability students, both those favored by the policy and those not favored, will still participate. For lower academic ability students, those that are favored may be encouraged, while those that are not favored may be discouraged, resulting in a larger (positive) shift in average ability for applicants not favored by the policy. In fact, when we compare the 2004 and 2005 representation of public high school applicants among ENEM score quartiles, we notice that the largest increases in the proportion of public high school applicants are observed in the lower two quartiles (from 45.8 to 50.3% and 30.8 to 33.0% in Q1 and Q2, respectively) while this proportion not change in the top quartiles (at conventional significance levels). For this reason, when looking at the intensive margin, we will look at the performance of all applicants, and of those in the top quartiles of the ENEM distribution (where the representation of public high school applicants did not change) to investigate whether selection could affect the robustness of our findings.

6.3 Intensive Margin: Effort

As mentioned above, the policy intervention may have generated behavioral responses on the intensive margin. Here we focus on effort in preparing for the entrance exam. Indeed, students typically prepare intensively for the exam. In an small scale survey conducted by Peluso et al. (2010), students reported the mean time studying reached up to 45 hours a

[27] The ENEM scores were normalized such that, every year, the ENEM score distribution of all ENEM takers in the state of Sao Paulo has a mean of 0 and a variance of 1.

week. Following the tournament logic laid out in Section 3 above, more preparation effort will translate in higher exam test scores, at least on average.

Since we cannot observe effort directly, we have to rely on the gap between the applicants' predicted entry exam scores (in P_1 or P_2) given their characteristics (i.e., the control variables used in regressions and their ability, as measured using their ENEM score) and their actual score.[28] The crucial assumption allowing for identification of the effort differential is that the link between student ability and the ENEM score (and therefore the link between the ENEM score and UNICAMP's admission exam performance) did not change differently over time for public and private high school graduates. In particular, we have to assume that if the introduction of the affirmative action policy distorted the link between academic ability and the ENEM score, it did so in the same way for all applicants.

We focus on the years 2004 and 2005, when applicants, we argue, did not have time to change their preparation effort for the ENEM exam, but had sufficient time and opportunity to adjust their preparation effort for both stages of the admission exam. The policy intervention is unlikely to have affected ENEM scores in the first year of its implementation (2004-2005) for the following reasons. Registration for UNICAMP's 2005 admission exam opened on August 30, 2004 and lasted for one month. The main source of information regarding the affirmative-action policy, which candidates received upon registration, was the applicant's manual (Comissao Permanente para os Vestibulares, 2005). This manual was published on August 27, 2004 while the 2004 ENEM exam (i.e., the latest ENEM score that could be used for UNICAMP's 2005 admission exam) took place on August 29, 2004.[29] Hence, students had, at most, two days to adjust their preparation to the ENEM exam, which is clearly insufficient for an exam covering the entire secondary school curriculum. On the other hand, UNICAMP's 2005 P_1 exam occurred on November 21, 2004 and P_2 by mid-Janurary 2005, roughly 3 and 4.5 months after the policy was announced in the manual, giving sufficient time for applicants to adapt their admission-exam preparation effort in reaction to the policy announcement. Therefore, if we observe a change in the public-private performance gap (conditioning on ability) following the introduction of the affirmative action, we will interpret this difference as evidence of a change in the public-private effort gap.

In order to investigate the possibility that public high school applicants might have changed their effort levels (relative to private high school applicants), we use the same regression framework presented in equation (1) where we simply replace the dependent variable

[28]A similar exercise is done in Morin (2015) when investigating the effect of increased competition on university performance.

[29]While the policy was approved at UNICAMP in May 2004, we did not trace any newspaper news that mentioned the policy before August 2004.

$A_{i,c,m,t}$ with the exam normalized[30] score $S_{i,c,m,t}$ of applicant i from municipality m who applies to career choice c in year t as a dependent variable. The only difference in terms of control variables is that we control for the ENEM score in all specifications, which is meant to control for the applicant's ability. We estimate these specifications for both P_1 and P_2 scores, separately. Note that, although the P_1 score enters in the final score for P_2, we exclude it from our P_2 performance measure to concentrate on what happened on the second part of the admission exam.

6.3.1 Phase P_1 Results

Table 6 presents the results regarding P_1 performance. Only a few coefficients are statistically significant at conventional levels. Not surprisingly, P_1 performance strongly correlates with the applicant's ENEM score. Interestingly, in all our specifications, candidates from public schools perform worse than those from private schools, and the difference is close to 25 percent of a standard deviation. This finding could indicate that public schools prepare students less well for the admission exam than private schools, which is consistent with anecdotal evidence.

More importantly, introducing the affirmative action policy does not seem to have had any discernable effect on students' relative effort and exam performance. While the sign of the coefficients associated to the policy intervention go in the direction predicted by economic theory in Section 3 (encouraging the favored and discouraging the unfavored), the effect is not significant and very close to 0. This suggests that, if applicants changed their effort provision, they have done so in the same way. Repeating the exercise for years 2003-2008 yields similar results with the exception that there was a statistically significant decrease in performance for visible minorities from private high schools after the intervention (see Table 7). Note that, although statistically significant, the coefficient estimate is small (5 percent of a standard deviation). These results should also be interpreted with care as, unlike the 2004-2005 analysis, the link between student ability and ENEM performance might have changed over the 2006-2008 period, which could in turn bias our results for the 2003-2008 period of analysis.

In Section 6.2, we mentioned that the observed increase in the proportion of public high-school applicants between 2004 and 2005 occurred exclusively in the bottom two quartiles of the ENEM distribution. In order to investigate whether the increased representation of public high schools among 'weaker' applicants could affect our results regarding effort changes, we re-estimated our P_1-performance regressions using only students in the top

[30] Both P_1 and P_2 scores are normalized such that, every year, they have a mean of 0 and a standard deviation of 1. Hence, the coefficient estimates can be directly interpreted as effect sizes.

two quartiles of the ENEM distribution.[31] Table A1 shows that, when we concentrate on 'stronger' applicants, there is a small but statistically significant performance improvement from white public high school applicants (relative to their private high school counterpart). The improvement is less than 5 percent of a standard deviation, but still suggest a relative increase in terms of effort for these 'stronger' applicants.

Although we observe an increase in (relative) performance from stronger public high-school applicants, this differential is not large enough to affect their likelihood to make it to P_2. Both Tables A2 and A3 show that none of the applicant groups increased their first-stage success (making it to P_2) following the affirmative-action policy–this is true whether we look at the overall sample or concentrate on the top two quartiles. This suggests that the representation of public and/or minority applicants qualifying for Phase 2 did not change following UNICAMP's policy (after conditioning on their ENEM score).

6.3.2 Phase P_2 Results

The composition of applicants competing in phase P_2 is determined by their P_1 success. So, P_1 filters applicants, in effect. We already saw that the results in Tables 6 and 7 suggest minimal changes in P_1 performance (public-private) differentials, casting doubt on the possibility that the composition of phase P_2 contenders changed substantially in terms of observables after the policy intervention. Tables A2, A3 and A4 all suggest that the few observed changes in relative performance are not large enough to affect the probability to pass P_1, and hence participate in P_2. Note that although the estimate for Visible Minority $\times$ Public HS $\times$ AA years is statistically significant at 5 percent, we cannot reject (at conventional confidence levels) the null hypothesis that public high school visible minorities experienced the same change in success probability than white (public or private high school) applicants, following the affirmative action policy.[32] Overall, we do not find evidence that the pool of P_2 participants changed significantly following the introduction of the policy.

By comparing the P_2 exam performance of public and private high school applicants, Table 8 further suggests minimal changes in the effort levels in response to the affirmative action. In particular, the grade bonus does not seem to have led to any discernible encouragement or discouragement effects on the performance of public high school applicants in Phase 2 of the entrance exam. Indeed, none of the parameters of interest are statistically significant and they are all very close to 0. Our findings are somewhat surprising as Phase

[31] The quartiles are computed separately for 2004 and 2005. We hence keep applicants half of the applicants, for each year.

[32] That is, we cannot reject the null hypotheses $H_0 : \gamma + \beta = 0$ or $H_0 : \gamma + \beta + \rho = 0$ at conventional significance levels.

2 counts for at least 80% of the final admission score, and the grade bonus is quantitatively relevant.[33]

Table 9 extends the analysis to the years 2003-2008. The results for this longer time period suggest a slightly different story. We find that white applicants from private high schools improved marginally following the affirmative action policy relative to the other applicants (visible minorities and public high school applicants). Note that, given the nature of the performance measure (normalized such that the mean is 0 every year), it is not possible to know whether, in absolute terms, one group of applicants improved or worsened. The relative improvement, about 4-5 percent of a s.d., is small and only statistically significant at the 10-percent confidence level. Interestingly, the small observed differences in performance improvement are not simply across affirmative action beneficiaries and non-beneficiaries, but also within these groups. For example, a performance gap emerges after 2004 between the visible minorities and whites within private high school graduates. We remain agnostic about how, controlling for the ENEM score, we would expect such difference to emerge from the affirmative action. But, as for all regressions over the 2003-2008 period, one has to be careful with the interpretation of the results, as the applicants' ENEM scores might have been affected by the policy, in the long run.

The results presented in Table 8 do not suggest large changes in relative performance in P_2. One could argue that only a small portion of applicants might see their admission probability affected by the bonus and hence, a majority of applicants might simply not react to the policy. In fact, the tournament environment presented in Section 3 suggests that the individual response in effort provision to receiving a bonus or not will depend on the individual's rank in the distribution.

In order to investigate this possibility, we extend our approach to verify whether there is evidence that students expected to be relatively close to their admission cutoffs (given the program they apply to) reacted differently to the policy compared to students farther from these cutoffs. For each student who applied in 2004 or 2005, we construct a "predicted distance to cutoff". We begin by estimating a regression of the P_2 performance on the same regressors found in equation (1) (except for the ones involving time) using 2004 second-stage candidates. From these regression results, we construct the "predicted distance to cutoff" by taking the difference between the previous-year cutoffs (i.e., 2003 for 2004 and 2004 for 2005), given the program applied to, and the predicted scores given the applicant characteristics. Both 2004 and 2005 predicted scores are based on the 2004 regression results to avoid being

[33] As a robustness check, we re-estimated the P_2-performance regressions separately for the top two and bottom two ENEM quartiles and found very similar results. Again, none the parameters of interest are statistically significant. These results are available upon request.

contaminated by the introduction of the affirmative action policy. We look only at 2004-2005 since the previous-year cutoffs are expected to be affected by the affirmative action policy for years after 2005. The predicted distance to cutoff, $D_{i,c}$, is normalized using the standard deviations of these distances (computed for every career-choice/year combinations). Note that each regression specification has its own vector of predicted-distance-to-cutoff values given that the predicted scores are computed using different sets of regressors.

Interacting our variables of interests (e.g., Public HS $\times$ AA Years) with our distance measure and its square will allow us to investigate whether there is evidence that applicants close to a cutoff reacted differently to the affirmative action than applicants who are farther from the cutoff. Specifically, we regress the individual P_2 performance score on the same variables as done above, but also include the distance $D_{i,c}$ (and its square):

$$\begin{aligned} S_{i,c,m,t} =& \alpha P_i + \delta V_i + \pi(P_i \times V_i) + \rho(P_i \times AA_t) + \beta(V_i \times AA_t) + \gamma(P_i \times V_i \times AA_t) \\ &+ D_{i,c} \times (\kappa_1 P_i + \kappa_2 V_i + \kappa_3(P_i \times V_i) + \kappa_4(P_i \times AA_t) + \kappa_5(V_i \times AA_t) + \kappa_6(P_i \times V_i \times AA_t)) \\ &+ D_{i,c}^2 \times (\nu_1 P_i + \nu_2 V_i + \nu_3(P_i \times V_i) + \nu_4(P_i \times AA_t) + \nu_5(V_i \times AA_t) + \nu_6(P_i \times V_i \times AA_t)) \\ &+ \theta_1 D_{i,c} + \theta_2 D_{i,c}^2 + \phi ENEM_i + \boldsymbol{X_i \Gamma} + \mu_m + \eta_c + \tau_t + \varepsilon_{i,c,m,t}. \end{aligned} \quad (2)$$

In order to take into account that we are using generated regressors ($D_{i,c}$ and $D_{i,c}^2$), the standard errors are computed using 500 block-bootstrap replications (at the career-choice level), where in each replication we compute new sets of expected distances to cutoff and the regressions of interest.

Table 10 presents the results from interacting the distance measures to our variables of interest. Overall, we do not find much evidence for heterogeneous reactions (based on predicted distances to the cutoffs) to the affirmative action policy. Once we control for program fixed effects (our preferred specifications), none of the parameters associated to our distance measures are statistically significant at conventional levels despite being relatively precisely estimated. Furthermore, the point estimates for our parameters of interest evaluated at the cutoff—at points that are usually far above the median performance—are relatively close to the point estimates found in Table 8. In the end, the findings from Tables 8 to 10 suggest minimal changes in exam relative performance following the affirmative action policy. These findings can explain why the naive predictions made in Section 5.3 are not far from what we actually observe in the data.

7 Conclusion

In this paper, we investigate the impact of UNICAMP's 2005 affirmative action policy on the pool of applicants and admitted students. Our results suggest a large increase in the representation of public high school students among UNICAMP's admitted students following the policy. The policy appears to have redistributed places at UNICAMP from those with more advantaged backgrounds to those with less advantaged socio-economic backgrounds. Despite benefiting from a large bonus on the admission test, there is no significant increase in the proportion of applicants coming from public secondary schools. Interestingly, the 2004-2005 regression results suggest that the policy had only small effects on relative effort provision in the first stage of the exam and these effects are not large enough to affect first-stage exam success. When we look at the 2004-2005 performance results for the second-stage exa, we do not find any evidence of change in relative effort provision even for applicants that are expected to be close to an admission cutoff point. When we extend the analysis to the 2003-2008 we find similar conclusions for the first-stage performance (and first-stage exam success) results. For the second-stage exam, the performance results over this period suggest a small improvement in relative performance (about 5 percent of a s.d.) by white applicants from private high schools. Note that the 2003-2008 results should be interpreted with care as the ability measure (the ENEM score) might have been affected after 2005. Overall, we find only small potential behavioral responses in reaction to UNICAMP's affirmative action policy, which do not seem large enough to affect who is admitted to the university. One possible explanation for our findings might be that the highly competitive nature of the admission exam already induced students to reach the 'limit' of their exam preparation time or capacity.

References

Antonovics, K. and Backes, B. (2014). The effect of banning affirmative action on human capital accumulation prior to college entry. *IZA Journal of Labor Economics*, 3:5.

Arcidiacono, P. and Lovenheim, M. (2016). Affirmative Action and the Quality-Fit Trade-Off. *Journal of Economic Literature*, 54(1):3–51.

Arcidiacono, P., Lovenheim, M., and Zhu, M. (2015). Affirmative Action in Undergraduate Education. *Annual Review of Economics*, 7(1):487–518.

Assuncao, J. and Ferman, B. (2013). Does affirmative action enhance or undercut investment incentives? Evidence from quotas in Brazilian public universities. *mimeo*, pages 1–42.

Backes, B. (2012). Do affirmative action bans lower minority college enrollment and attainment?: Evidence from statewide bans. *Journal of Human Resources*, 47(2):435–455.

Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *The Quaterly Journal of Economics*, 119(1):249–275.

Bertrand, M., Hanna, R., and Mullainathan, S. (2010). Affirmative action in education: Evidence from engineering college admissions in India. *Journal of Public Economics*, 94(1-2):16–29.

Calsamiglia, C., Franke, J., and Rey-Biel, P. (2013). The incentive effects of affirmative action in a real-effort tournament. *Journal of Public Economics*, 98(0):15–31.

Cameron, A. C., Gelbach, J. B., and Miller, D. L. (2011). Robust inference with multiway clustering. *Journal of Business and Economic Statistics*, 29(2):238–249.

Cameron, A. C. and Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of Human Resources*, 50(2):317–372.

Card, D. and Krueger, A. B. (2005). Would the Elimination of Affirmative Action Affect Highly Qualified Minority Applicants? Evidence from California and Texas. *Industrial and Labor Relations Review*, 58(3):416–434.

Coate, S. and Loury, G. C. (1993). Antidiscrimination enforcement and the problem of patronization. *The American Economic Review*, 83(2):92–98.

Comissao Permanente para os Vestibulares (2005). Manual do vestibular UNICAMP. http://www.comvest.unicamp.br/vest2005/download/manual.pdf.

Cotton, C., Hickman, B. R., and Price, J. P. (2014). Affirmative action and human capital investment: Evidence from a randomized field experiment. Working Paper 20397, National Bureau of Economic Research.

Dickson, L. M. (2006). Does ending affirmative action in college admissions lower the percent of minority students applying to college? *Economics of Education Review*, 25(1):109–119.

Francis, A. M. and Tannuri-Pianto, M. (2012). Using Brazil's racial continuum to examine the short-term effects of affirmative action in higher education. *Journal of Human Resources*, 47(3):754–784.

Franke, J. (2012). Affirmative action in contest games. *European Journal of Political Economy*, 28(1):105–118.

Fryer, R. and Loury, G. (2013). Valuing diversity. *Journal of Political Economy*, 121(4):747–774.

Fryer, R. and Loury, G. C. (2005). Affirmative action and its mythology. *Journal of Economic Perspectives*, 19(3):147–162.

Fu, Q. and Lu, J. (2012). Micro foundations of multi-prize lottery contests: A perspective of noisy performance ranking. *Social Choice and Welfare*, 38(3):497–517.

Gall, T., Legros, P., and Newman, A. F. (2015). College diversity and investment incentives. CEPR Discussion Paper No. DP10337.

Hinrichs, P. (2012). The effects of affirmative action bans on college enrollment, educational attainment, and the demographic composition of universities. *Review of Economics and Statistics*, 94(3):712–722.

Holzer, H. and Neumark, D. (2000). Assessing affirmative action. *Journal of Economic Literature*, 38(3):483–568.

Jia, H. (2008). A stochastic derivation of the ratio form of contest success functions. *Public Choice*, 135(3):125–130.

Long, M. C. (2004). College applications and the effect of affirmative action. *Journal of Econometrics*, 121(1-2):319–342.

Long, M. C., Saenz, V., and Tienda, M. (2010). Policy transparency and college enrollment: Did the Texas top ten percent law broaden access to the public flagships? *The Annals of the American Academy of Political and Social Science*, 627(1):82–105.

Martin, I., Karabel, J., and Jaquez, S. W. (2005). High school segregation and access to the University of California. *Educational Policy*, 19(2):308–330.

McFadden, D. (1974). The measurement of urban travel demand. *Journal of Public Economics*, 3(4):303–328.

Morin, L.-P. (2015). Do men and women respond differently to competition? Evidence from a major education reform. *Journal of Labor Economics*, 33(2):443–491.

Peluso, M. A. M., Savalli, C., Curi, M., Gorenstein, C., and Andrade, L. H. (2010). Mood changes in the course of preparation for the Brazilian university admission exam - a longitudinal study. *Revista Brasileira de Psiquiatria*, 32(1):20–36.

Schotter, A. and Weigelt, K. (1992). Asymmetric tournaments, equal opportunity laws, and affirmative action: Some experimental results. *The Quarterly Journal of Economics*, 107(2):511–539.

Stein, W. E. (2002). Asymmetric rent-seeking with more than two contestants. *Public Choice*, 113(3-4):325–336.

The Sutton Trust (2011). Degree of success - university chances by individual school. Technical report.

Appendix A – Mathematical Details

Proof of Prediction 3

The difference in differences of winning probabilities $p'_i - p'_1 - (p_i - p_1)$ is given by:

$$\left(\frac{1}{\alpha'_1 V'_1} - \frac{1}{\alpha'_i V'_i}\right)\frac{3}{\sum_{j=1}^{4}\frac{1}{\alpha'_j V'_j}} - \left(\frac{1}{\alpha_1 V_1} - \frac{1}{\alpha_i V_i}\right)\frac{3}{\sum_{j=1}^{4}\frac{1}{\alpha_j V_j}}. \tag{3}$$

Setting $V'_i = V_i$ and supposing that $\alpha_1 = \alpha'_1$ this becomes:

$$\frac{1}{\alpha'_i}\frac{3}{\sum_{j=1}^{4}\frac{1}{\alpha_j}} - \frac{1}{\alpha_i}\frac{3}{\sum_{j=1}^{4}\frac{1}{\alpha'_j}} + \frac{1}{\alpha_1}\left(\frac{3}{\sum_{j=1}^{4}\frac{1}{\alpha'_j}} - \frac{3}{\sum_{j=1}^{4}\frac{1}{\alpha_j}}\right).$$

The term in brackets is always positive. If $\alpha_i = \alpha'_i$, the entire expression will be negative, meaning that the winning probability of i decreased in relation to p_1. If $\alpha'_i = (1+\delta)\alpha_i$ for all i who receive a grade subsidy then the first difference is positive and the entire expression strictly positive. Hence, the winning probability of a recipient of the bonus will increase relative to p_1, and more so for lower α_j.

For P_1 suppose that $\alpha_i = \alpha'$, but V'_i differs fromV_i reflecting the change in winning probabilities in P_2 derived above, i.e., if 3 and 4 receive a bonus, $V'_i < V_i$ for $i = 1, 2$ and the opposite for $i = 3, 4$. Then (3) becomes

$$\left(\frac{1}{\alpha_1 V'_1} - \frac{1}{\alpha_i V'_i}\right)\frac{3}{\sum_{j=1}^{4}\frac{1}{\alpha_j V'_j}} - \left(\frac{1}{\alpha_1 V_1} - \frac{1}{\alpha_i V_i}\right)\frac{3}{\sum_{j=1}^{4}\frac{1}{\alpha_j V_j}}.$$

Since winning probabilities sum to 1, i.e. $\sum_{i=1}^{4} V'_i = \sum_{i=1}^{4} V_i$ and weak players get the bonus, $\sum_{j=1}^{4}\frac{1}{\alpha_j V_j} > \sum_{j=1}^{4}\frac{1}{\alpha_j V'_j}$. Therefore the expression is negative if $V'_i - V_i < V'_1 - V_1$ and positive if $V'_i - V_i$ sufficiently great, i.e., the bonus in stage P_2 great enough.

As for effort, which is given by $x_i = p_i(1-p_i)V_i$ the difference in differences is

$$x'_i - x'_1 - (x_i - x_1) = p'_i(1-p'_i)V'_i - p'_1(1-p'_1)V'_1 - [p_i(1-p_i)V_i - p_1(1-p_1)V_1].$$

For constant V_i across agents (corresponding to P_2), inspecting this expression shows that it is positive if $(p'_i - p'_1) > (p_i - p_1)$ and decreasing in p'_i, p_i, i.e. the strength of a student who receives a grade subsidy. Otherwise its sign is ambiguous. Hence, effort increases relative to student 1 for recipients of the bonus.

Turning to P_1, for $V'_1 < V_1$ and $V'_i > V_i$ we know that $(p'_i - p'_1) > (p_i - p_1)$ from above. Taken together this implies $x'_i - x'_1 > (x_i - x_1)$. For $0 > V'_1 - V_1 > V'_i - V_i$ we know that $(p'_i - p'_1) > (p_i - p_1)$, but the sign is ambiguous.

The change in exam performance $\alpha_i x'_i - \alpha_i x_i$, not taking into account possible grade subsidies, follows the behavior of effort x_i. The difference in differences is

$$\alpha_i x'_i - \alpha_1 x'_1 - (\alpha_i x_i - \alpha_1 x_1).$$

If $\alpha_i' > \alpha_i$ ($V_i' > V_i$) this expression must be positive (as $x_i' - x_i > 0 > x_1' - x_1$), though it does not necessarily decrease in students' strengths. Otherwise its sign is ambiguous.

Appendix B – UNICAMP Admission Rules

The final ranking of the applicants depends on the final grade (*nota padronizada de opção* (NPO)), which is calculated using the following standardized grades: (i) final grade of Phase 1 (that may include ENEM) with a weight of 2; (ii) grades of Phase 2 priority discipline exams, each receiving a weight 2; (iii) grade of the aptitude test for Architecture and Urban Studies and Arts (but not Dentistry) with a weight of 2, if applicable; (iv) grade of other Phase 2 non priority disciplines exams (and aptitude test for Dentistry) with a weight of 1. NPO is calculated for each of the major choices (up to three) made by the applicant.

The grades (i)-(iv) are standardized using the formula:

$$NP = \frac{(N - M) \times 100}{D} + 500, \quad (4)$$

where NP is the applicant's standardized grade, N is the grade the applicant received in the exam, M and D are the average grade and the standard deviation of the grades in the exam. Until 2003, the standardization of Phase 2 exams was done separately for applicants of majors within the four areas. Starting in 2004, the standardization considers the grades of Phase 2 exams of all students who participated in the exam. For the final grade of Phase 1, only the grades of candidates who passed Phase 1 are considered. Once grades (i)-(iv) are standardized, the NPO of a candidate is calculated as the weighted average of the standardized grades, with the weights given above.

Until 2003, only the applicants who obtained the priority discipline cutoff grade (*nota de corte prioritária*, (NCP)) were admitted. Eligible candidates were then ranked in decreasing order of NPO and were admitted until all slots were attributed for candidates choosing the major as first choice. Once all the eligible candidates who ranked the major as first option were admitted, candidates who chose the major as second option (and then third option) were admitted if they had not been admitted to their first option (or second option, respectively). If there were still some slots remaining, then the candidates who applied for (and have not been admitted for) other majors within the same group would be admitted. After this has been done or if there is only one major in the group, then they would admit applicants with NPO larger than the last candidate admitted under the criterion just explained, even if they do not satisfy the NCP criterion. Finally, if there are still slots available, candidates for other majors who were not admitted can be called. This is be done by forming new groups and recalculating the standardized grade within these new groups.

Since 2004, two grades are associated with the priority subjects, which are relevant for admission: the priority discipline cutoff grade (*nota de corte prioritária*, (NCP)) and the major minimum grade (*nota mínima de opção* (NMO)). From 2004 to 2006, these cutoffs were defined in terms of the non-standardized grades. In 2007 and 2008, the thresholds were established in terms of the standardized grades.

The candidates are ranked in decreasing order of NPO and accepted based on the following rules:

1. Those who opted for the major as first option and obtained, in the priority subjects, (non-standardized or standardized) grades that are larger or equal to the major's NMO are accepted.

2. If there are still slots available, applicants who opted for the major as second or third choice, with (non-standardized or standardized) grades in the priority subjects larger or equal to NMO, up to a maximum of 20% of the total slots available for the major.

3. If there are still slots available, applicants who opted for the major as first option and who obtained (non-standardized or standardized) grades that are larger or equal to the major's NCP.

4. If there are still slots available, applicants who opted for the course as second or third options and who obtained (non-standardized or standardized) grades that are larger or equal to the major's NMO.

5. If there are still slots available, applicants who opted for the course as second or third options and who obtained (non-standardized or standardized) grades that are larger or equal to the major's NCP.

6. If there are still slots available, candidates who opted for the major, independently of the choice rank.

7. If there are still slots available, applicants who opted for similar majors, as determined by the Office of the Vice-President, Research.

In case of a draw, the applicant admitted will be the one with the larger standardized grade in a priority subject in the order they are presented in the priority discipline list, or in the order the exams take place in the Phase 2.

Appendix C – Tables and Figures

Table 1: Descriptive Statistics 2004-2005

	2004	2005	Difference
Public High School (%)	30.0	31.7	1.6***
Visible Minority (%)	13.1	17.8	4.7***
Public High School × Visible Minority (%)	6.7	9.6	2.9***
Technical HS (%)	11.7	10.1	-1.7***
Female (%)	51.4	51.7	0.3
Age	19.2	19.3	0.0
	(2.2)	(2.2)	
Residence			
Sao Paulo state (%)	87.6	86.2	-1.4***
Other state southeast (%)	5.8	6.4	0.7***
Northeast (%)	2.2	2.7	0.5***
South (%)	1.8	1.8	0.0
Center West (%)	2.1	2.3	0.2**
North (%)	0.5	0.5	0.0
Mother without HS Degree (%)	24.9	24.2	-0.6**
Mother with HS Degree (%)	32.1	31.8	-0.3
Mother with Univ. Degree (%)	43.0	44.0	0.9***
Father without HS Degree (%)	24.5	23.8	-0.7**
Father with HS Degree (%)	28.5	28.5	-0.1
Father with Univ. Degree (%)	47.0	47.8	0.7**
Previous University Attendance (%)	6.4	5.5	-0.9***
Exam Preparation Course (%)	63.8	61.4	-2.4***
ENEM Score	88.8	89.0	0.2*
	(17.9)	(18.0)	
Normalized ENEM Score	1.1	1.3	0.2***
	(0.8)	(0.8)	
Pass Phase 1 (%)	33.4	27.2	-6.2***
Admitted (%)	10.5	10.3	-0.2
Enrolled (%)	6.7	6.6	-0.1
Observations	38,756	39,457	

Notes: Standard deviations are in parentheses. The normalized ENEM scores are computed as differences (measured in standard deviations) from the State of Sao Paulo average ENEM score in that specific year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2: Descriptive Statistics 2003-2008

	Pre Aff. Action	Post Aff. Action	Difference
Public High School (%)	29.4	29.3	-0.1
Visible Minority (%)	11.8	16.6	4.9***
Public High School × Visible Minority (%)	6.0	8.9	2.8***
Technical HS (%)	11.8	8.7	-3.2***
Female (%)	50.8	51.1	0.3
Age	19.2	19.3	0.0**
	(2.1)	(2.2)	
Residence			
Sao Paulo state (%)	86.9	89.1	2.1***
Other state southeast (%)	6.0	5.6	-0.4***
Northeast (%)	2.2	1.8	-0.4***
South (%)	2.1	1.1	-1.0***
Center West (%)	2.2	2.1	-0.1**
North (%)	0.6	0.3	-0.3***
Mother without HS Degree (%)	24.6	21.4	-3.2***
Mother with HS Degree (%)	32.2	31.7	-0.4**
Mother with Univ. Degree (%)	43.2	46.9	3.7***
Father without HS Degree (%)	24.2	21.8	-2.4***
Father with HS Degree (%)	28.1	29.0	0.9***
Father with Univ. Degree (%)	47.7	49.2	1.5***
Previous University Attendance (%)	6.4	6.0	-0.4***
Exam Preparation Course (%)	65.2	61.5	-3.6***
ENEM Score	82.1	82.7	0.6***
	(19.6)	(17.5)	
Normalized ENEM Score	1.3	1.6	0.3***
	(0.9)	(0.9)	
Pass Phase 1 (%)	32.4	31.3	-1.0***
Admitted (%)	10.3	12.3	2.0***
Enrolled (%)	6.6	6.9	0.3 **
Observations	70,512	148,760	

Notes: 'Pre Affirmative Action' refers to 2003-2004 while 'Post Affirmative Action' refers to 2005-2008. Standard deviations are in parentheses. The normalized ENEM scores are computed as differences (measured in standard deviations) from the State of Sao Paulo average ENEM score in that specific year. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3: Admission and Affirmative Action, 2004-2005

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.024*	-0.023*	0.017*	-0.011*	-0.014**
	(0.013)	(0.013)	(0.010)	(0.006)	(0.006)
Visible Minority	-0.013***	-0.011**	-0.000	0.001	0.002
	(0.004)	(0.005)	(0.004)	(0.005)	(0.006)
Visible Minority × Public HS	-0.013**	-0.017**	0.001	-0.001	0.000
	(0.006)	(0.008)	(0.008)	(0.009)	(0.009)
Public HS × AA Years	0.023***	0.021***	0.025***	0.027***	0.028***
	(0.006)	(0.007)	(0.007)	(0.007)	(0.006)
Visible Minority × AA Years	-0.004	-0.007	-0.012**	-0.013**	-0.016**
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Visible Minority × Public HS × AA Years		0.008	0.010	0.015	0.015
		(0.008)	(0.008)	(0.010)	(0.010)
Normalized ENEM Score			0.101***	0.122***	0.124***
			(0.015)	(0.015)	(0.015)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	78,213	78,213	78,213	78,213	78,213
Number of Program Clusters	59	59	59	59	59
Number of Municipality Clusters	1,540	1,540	1,540	1,540	1,540

Notes: The dependent variable is a binary variable equal to one if the applicant was accepted to UNICAMP, zero otherwise. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4: Admission and Affirmative Action, 2003-2008

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.019	-0.019	0.027***	-0.007	-0.010*
	(0.012)	(0.012)	(0.009)	(0.005)	(0.006)
Visible Minority	-0.009*	-0.006	0.003	0.004	0.005
	(0.005)	(0.007)	(0.005)	(0.005)	(0.005)
Visible Minority × Public HS	-0.014***	-0.019***	0.000	-0.003	-0.002
	(0.004)	(0.007)	(0.007)	(0.008)	(0.008)
Public HS × AA Years	0.020***	0.018***	0.025***	0.031***	0.031***
	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)
Visible Minority × AA Years	-0.011**	-0.014**	-0.016**	-0.015**	-0.017**
	(0.004)	(0.007)	(0.006)	(0.007)	(0.007)
Visible Minority × Public HS × AA Years		0.007	0.008	0.011	0.012
		(0.009)	(0.008)	(0.009)	(0.009)
Normalized ENEM Score			0.105***	0.130***	0.131***
			(0.017)	(0.016)	(0.016)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	219,272	219,272	219,272	219,272	219,272
Number of Program Clusters	62	62	62	62	62
Number of Municipality Clusters	2,076	2,076	2,076	2,076	2,076

Notes: The dependent variable is a binary variable equal to one if the applicant was accepted to UNICAMP, zero otherwise. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005 or above, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Descriptive Statistics of 'Displacing' and 'Displaced' (2005)

	Displacing	Displaced	Difference	Obs.
A. Applicant Characteristics				
Public High School (%)	98.85	3.49	95.36***	536
Visible Minority (%)	33.08	10.81	22.27***	519
Technical (%)	25.75	8.21	17.54***	536
Female (%)	47.39	47.39	0.00	536
Age	20.43	19.40	1.03***	536
	(3.66)	(2.43)		
ENEM Score	100.9	101.6	-0.6	504
	(11.00)	(10.62)		
Normalized ENEM Score	1.82	1.85	-0.03	504
	(0.48)	(0.47)		
Missing ENEM Score (%)	5.97	5.97	0.00	536
Financed by Family (%)	85.71	94.16	-8.45**	516
Financially Help Family (%)	9.27	3.11	6.15***	516
Work 32+ Hours/Week (%)	13.13	5.84	7.29***	516
B. Applicant Family Characteristics				
Mother with Manual Occ. (%)	12.79	3.15	9.64***	512
Mother with 'Mid-Top Occ.' (%)	8.91	29.92	-21.01***	512
Mother with 'Top Occ.' (%)	1.16	2.36	-1.20	512
Father with Manual Occ. (%)	20.70	3.16	17.54***	509
Father with 'Mid-Top Occ.' (%)	21.88	51.78	-29.90***	509
Father with 'Top Occ.' (%)	0.78	3.16	-2.38*	509
Mother without HS Degree (%)	39.22	13.73	25.49***	510
Mother with Univ. Degree (%)	25.49	52.94	-27.45***	510
Father without HS Degree (%)	37.80	16.54	21.26***	508
Father with Univ. Degree (%)	31.10	59.06	-27.95***	508
Family Income	2,212	4,152	-1,940***	503
	(1,896)	(3,185)		
Home Computer (%)	78.85	92.19	-13.34***	516
Applicants	268	268		

Notes: 'Top Occ.' is defined as an occupation in "high politics, business, or owner of a large company" while 'Mid-Top Occ.' is defined as "self-employed, manager, owner of a medium company." 'Manual O'cc. includes both specialized and non-specialized occupations. Standard deviations are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6: Performance in Phase 1, 2004-2005

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.354***	-0.352***	-0.294***	-0.248***	-0.240***
	(0.020)	(0.018)	(0.019)	(0.011)	(0.012)
Visible Minority	-0.045	-0.039	-0.021	-0.017	-0.049*
	(0.043)	(0.050)	(0.050)	(0.041)	(0.029)
Visible Minority × Public HS	-0.008	-0.020	-0.009	0.000	0.021
	(0.018)	(0.035)	(0.039)	(0.033)	(0.022)
Public HS × AA Years	0.004	0.001	0.009	0.012	0.017
	(0.019)	(0.019)	(0.018)	(0.019)	(0.019)
Visible Minority × AA Years	0.003	-0.007	-0.010	-0.013	-0.009
	(0.016)	(0.029)	(0.030)	(0.028)	(0.023)
Visible Minority × Public HS × AA Years		0.021	0.019	0.020	0.013
		(0.031)	(0.032)	(0.024)	(0.019)
Normalized ENEM Score	0.864***	0.864***	0.836***	0.790***	0.784***
	(0.042)	(0.042)	(0.040)	(0.041)	(0.041)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	78,213	78,213	78,213	78,213	78,213
Number of Program Clusters	59	59	59	59	59
Number of Municipality Clusters	1,540	1,540	1,540	1,540	1,540

Notes: The dependent variable is the normalized score on the general questions of Phase 1 on the admission exam. This score is normalized such that, every year, the mean and the variance of these scores are 0 and 1, respectively. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7: Performance in Phase 1, 2003-2008

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.305***	-0.301***	-0.253***	-0.213***	-0.209***
	(0.021)	(0.018)	(0.020)	(0.013)	(0.012)
Visible Minority	-0.035	-0.023	-0.007	-0.003	-0.024
	(0.029)	(0.040)	(0.039)	(0.033)	(0.025)
Visible Minority × Public HS	0.001	-0.023	-0.016	-0.011	0.004
	(0.012)	(0.031)	(0.035)	(0.030)	(0.023)
Public HS × AA Years	-0.004	-0.009	-0.006	-0.006	-0.003
	(0.015)	(0.013)	(0.013)	(0.012)	(0.012)
Visible Minority × AA Years	-0.036**	-0.051*	-0.053*	-0.054**	-0.052**
	(0.015)	(0.030)	(0.029)	(0.026)	(0.024)
Visible Minority × Public HS × AA Years		0.033	0.032	0.032	0.031
		(0.035)	(0.035)	(0.032)	(0.030)
Normalized ENEM Score	0.813***	0.813***	0.793***	0.751***	0.745***
	(0.028)	(0.028)	(0.028)	(0.029)	(0.029)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	219,272	219,272	219,272	219,272	219,272
Number of Program Clusters	62	62	62	62	62
Number of Municipality Clusters	2,076	2,076	2,076	2,076	2,076

Notes: The dependent variable is the normalized score on the general questions of Phase 1 on the admission exam. This score is normalized such that, every year, the mean and the variance of these scores are 0 and 1, respectively. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005 or above, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8: Performance in Phase 2, 2004-2005

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.417***	-0.419***	-0.295***	-0.115***	-0.120***
	(0.046)	(0.046)	(0.043)	(0.016)	(0.016)
Visible Minority	-0.078***	-0.085**	-0.044	-0.021	-0.026
	(0.026)	(0.035)	(0.035)	(0.024)	(0.024)
Visible Minority × Public HS	-0.009	0.007	0.029	-0.016	0.002
	(0.031)	(0.050)	(0.049)	(0.038)	(0.036)
Public HS × AA Years	0.009	0.014	0.015	0.007	0.014
	(0.026)	(0.029)	(0.029)	(0.023)	(0.022)
Visible Minority × AA Years	-0.009	0.004	0.005	-0.006	-0.023
	(0.021)	(0.028)	(0.029)	(0.024)	(0.026)
Visible Minority × Public HS × AA Years		-0.032	-0.034	0.013	0.010
		(0.057)	(0.052)	(0.043)	(0.043)
Normalized ENEM Score	1.155***	1.155***	1.151***	0.732***	0.737***
	(0.097)	(0.097)	(0.093)	(0.036)	(0.034)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	21,990	21,990	21,990	21,990	21,990
Number of Program Clusters	59	59	59	59	59
Number of Municipality Clusters	828	828	828	828	828

Notes: The dependent variable is the normalized Phase 2 test score, excluding Phase 1 performance. This score is normalized such that, every year, the mean and the variance of these scores are 0 and 1, respectively. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 9: Performance in Phase 2, 2003-2008

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.343***	-0.341***	-0.221***	-0.059***	-0.065***
	(0.038)	(0.037)	(0.030)	(0.020)	(0.021)
Visible Minority	-0.038	-0.029	0.007	0.019	0.002
	(0.033)	(0.042)	(0.038)	(0.028)	(0.024)
Visible Minority × Public HS	-0.019	-0.039	-0.019	-0.050	-0.033
	(0.025)	(0.043)	(0.042)	(0.036)	(0.032)
Public HS × AA Years	-0.023	-0.028	-0.031	-0.050**	-0.044*
	(0.022)	(0.025)	(0.025)	(0.025)	(0.025)
Visible Minority × AA Years	-0.049**	-0.060*	-0.054	-0.050*	-0.051*
	(0.023)	(0.036)	(0.036)	(0.028)	(0.027)
Visible Minority × Public HS × AA Years		0.029	0.027	0.056	0.052
		(0.048)	(0.046)	(0.037)	(0.034)
Normalized ENEM Score	1.031***	1.031***	1.027***	0.702***	0.700***
	(0.061)	(0.061)	(0.059)	(0.026)	(0.024)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	64,604	64,604	64,604	64,604	64,604
Number of Program Clusters	62	62	62	62	62
Number of Municipality Clusters	1,243	1,243	1,243	1,243	1,243

Notes: The dependent variable is the normalized Phase 2 test score, excluding Phase 1 performance. This score is normalized such that, every year, the mean and the variance of these scores are 0 and 1, respectively. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005 or above, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 10: P2 Performance, 2004-2005 (SD-Adjusted Distance to Cutoffs)

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.442***	-0.451***	-0.309***	-0.146***	-0.155***
	(0.080)	(0.082)	(0.072)	(0.035)	(0.033)
Visible Minority	-0.141***	-0.168***	-0.121***	-0.078*	-0.066*
	(0.032)	(0.040)	(0.039)	(0.041)	(0.037)
Visible Minority × Public HS	-0.001	0.068	0.098	0.031	0.057
	(0.047)	(0.080)	(0.076)	(0.079)	(0.079)
Public HS × AA Years	0.050	0.057	0.030	0.040	0.044
	(0.086)	(0.088)	(0.084)	(0.039)	(0.038)
Visible Minority × AA Years	0.044	0.068	0.060	0.040	0.001
	(0.033)	(0.044)	(0.042)	(0.046)	(0.044)
Visible Minority × Public HS × AA Years		-0.063	-0.055	-0.014	-0.022
		(0.077)	(0.072)	(0.081)	(0.080)
Normalized ENEM Score	1.12***	1.12***	1.13***	0.712***	0.736***
	(0.085)	(0.085)	(0.084)	(0.031)	(0.030)
Predicted Distance to Cutoff	0.039	0.037	0.045	-0.011	-0.004
	(0.046)	(0.046)	(0.046)	(0.011)	(0.012)
(Pred. Dist. to Cut.)^2	0.014**	0.014**	0.013**	6.53e-04	1.19e-04
	(0.006)	(0.006)	(0.006)	(0.001)	(0.001)
Pred. Dist. to Cut. × Public HS	0.071**	0.081**	0.071**	0.011	0.010
	(0.035)	(0.037)	(0.034)	(0.013)	(0.013)
(Pred. Dist. to Cut.)^2 × Public HS	-0.009**	-0.010**	-0.010**	-4.78e-04	-1.31e-05
	(0.004)	(0.005)	(0.004)	(0.001)	(0.002)
Pred. Dist. to Cut. × Vis. Min.	0.032	0.058**	0.054*	0.009	0.018
	(0.024)	(0.027)	(0.030)	(0.021)	(0.023)
(Pred. Dist. to Cut.)^2 × Vis. Min.	-0.003	-0.006	-0.006	1.89e-04	-0.002
	(0.004)	(0.004)	(0.005)	(0.003)	(0.004)
Pred. Dist. to Cut. × Vis. Min. × Pub. HS	0.043**	-0.026	-0.034	0.007	-0.011
	(0.019)	(0.037)	(0.041)	(0.034)	(0.038)
(Pred. Dist. to Cut.)^2 × Vis. Min. × Pub. HS	-0.008**	4.68e-04	0.002	-0.002	-3.95e-04
	(0.004)	(0.006)	(0.007)	(0.004)	(0.005)
Pred. Dist. to Cut. × AA Years	0.095**	0.099***	0.093**	-0.012	0.002
	(0.037)	(0.037)	(0.036)	(0.010)	(0.011)
(Pred. Dist. to Cut.)^2 × AA Years	-0.006	-0.006	-0.005	9.25e-04	0.003
	(0.005)	(0.005)	(0.005)	(0.003)	(0.003)
Pred. Dist. to Cut. × Public HS × AA Years	-0.040	-0.056**	-0.051**	0.002	-0.003
	(0.025)	(0.028)	(0.025)	(0.016)	(0.016)
(Pred. Dist. to Cut.)^2 × Public HS × AA Years	0.006	0.007	0.010	8.10e-04	0.001
	(0.006)	(0.006)	(0.006)	(0.004)	(0.005)
Pred. Dist. to Cut. × Vis. Min. × AA Years	-0.029	-0.066**	-0.061**	-0.019	-0.021
	(0.022)	(0.026)	(0.029)	(0.025)	(0.027)
(Pred. Dist. to Cut.)^2 × Vis. Min. × AA Years	0.004	0.007	0.008	0.003	0.006
	(0.005)	(0.006)	(0.007)	(0.005)	(0.006)
Pred. Dist. to Cut. × Vis. Min. × Pub. HS × AA Years		0.100**	0.107**	0.045	0.066
		(0.045)	(0.045)	(0.037)	(0.042)
(Pred. Dist. to Cut.)^2 × Vis. Min. × Pub. HS × AA Years		-0.009	-0.014	-0.004	-0.007
		(0.010)	(0.010)	(0.007)	(0.010)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	21,228	21,228	21,228	21,228	21,228
Number of Program Clusters	56	56	56	56	56

Notes: The dependent variable is the normalized Phase 2 test score, excluding Phase 1 performance. This score is normalized such that, every year, the mean and the variance of these scores are 0 and 1, respectively. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Predicted Distance to Cutoff is estimated using regressions using 2004 second stage candidates only to get a predicted second-stage score (for both 2004 and 2005 applicants) and the previous year's cutoffs (2003 for 2004 and 2004 for 2005). Predicted Distance to Cutoff is measure as last year's cutoff minus the predicted score, and normalized using the standard deviations of these differences (computed for every career-choice/year combinations). Each specification has its own vector of Predicted Distance to Cutoff values given that the predicted scores are computed using different sets of regressors. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Standard errors computed using 500 block-bootstrap replications (at the career-choice level) are shown in parentheses. Note that for each replication new sets of predicted scores are computed. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A1: Performance in Phase 1, 2004-2005 (Top Two Quartiles)

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.382***	-0.382***	-0.322***	-0.251***	-0.246***
	(0.024)	(0.022)	(0.021)	(0.013)	(0.012)
Visible Minority	-0.043	-0.046	-0.028	-0.019	-0.046*
	(0.040)	(0.045)	(0.045)	(0.036)	(0.025)
Visible Minority × Public HS	-0.021	-0.014	0.002	0.021	0.042
	(0.023)	(0.035)	(0.036)	(0.033)	(0.029)
Public HS × AA Years	0.033*	0.035*	0.038**	0.040**	0.048***
	(0.019)	(0.018)	(0.017)	(0.019)	(0.018)
Visible Minority × AA Years	0.004	0.008	0.002	-0.007	-0.006
	(0.023)	(0.032)	(0.034)	(0.033)	(0.029)
Visible Minority × Public HS × AA Years		-0.011	-0.007	-0.030	-0.040
		(0.040)	(0.043)	(0.037)	(0.037)
Normalized ENEM Score	1.318***	1.318***	1.298***	1.170***	1.160***
	(0.037)	(0.037)	(0.037)	(0.029)	(0.028)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	39,107	39,107	39,107	39,107	39,107
Number of Program Clusters	59	59	59	59	59
Number of Municipality Clusters	1,042	1,042	1,042	1,042	1,042

Notes: The dependent variable is the normalized score on the general questions of Phase 1 on the admission exam. This score is normalized such that, every year, the mean and the variance of these scores are 0 and 1, respectively. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A2: First-Stage Success and Affirmative Action, 2004-2005

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.067*	-0.067*	0.017	-0.046***	-0.046***
	(0.035)	(0.034)	(0.026)	(0.013)	(0.013)
Visible Minority	-0.036***	-0.035***	-0.015**	-0.012	-0.020**
	(0.008)	(0.008)	(0.006)	(0.009)	(0.009)
Visible Minority × Public HS	-0.029***	-0.031**	0.011	0.004	0.013
	(0.010)	(0.014)	(0.010)	(0.010)	(0.010)
Public HS × AA Years	-0.001	-0.002	0.007	0.011	0.013
	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)
Visible Minority × AA Years	0.005	0.004	-0.007	-0.006	-0.004
	(0.007)	(0.009)	(0.010)	(0.009)	(0.008)
Visible Minority × Public HS × AA Years		0.003	0.007	0.017	0.010
		(0.014)	(0.013)	(0.012)	(0.012)
Normalized ENEM Score			0.233***	0.276***	0.276***
			(0.031)	(0.026)	(0.025)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	78,213	78,213	78,213	78,213	78,213
Number of Program Clusters	59	59	59	59	59
Number of Municipality Clusters	1,540	1,540	1,540	1,540	1,540

Notes: The dependent variable is a binary variable equal to one if the applicant passed the first stage of UNICAMP's admission exam, zero otherwise. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A3: First-Stage Success and Affirmative Action, 2004-2005 (Top Two Quartiles)

	(1)	(2)	(3)	(4)	(5)
Public High School	0.027	0.027	0.037	-0.075***	-0.072***
	(0.051)	(0.051)	(0.046)	(0.014)	(0.013)
Visible Minority	-0.011*	-0.012	-0.016	-0.021	-0.029**
	(0.006)	(0.008)	(0.011)	(0.013)	(0.012)
Visible Minority × Public HS	-0.005	0.000	0.032	0.031	0.042*
	(0.016)	(0.022)	(0.023)	(0.021)	(0.022)
Public HS × AA Years	-0.016	-0.015	-0.004	0.001	0.001
	(0.017)	(0.016)	(0.018)	(0.016)	(0.015)
Visible Minority × AA Years	-0.016	-0.013	-0.018	-0.004	-0.001
	(0.016)	(0.016)	(0.017)	(0.013)	(0.013)
Visible Minority × Public HS × AA Years		-0.009	-0.023	-0.016	-0.027
		(0.028)	(0.028)	(0.026)	(0.026)
Normalized ENEM Score			0.415***	0.580***	0.577***
			(0.064)	(0.029)	(0.027)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
Test-Preparation Background Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	39,107	39,107	39,107	39,107	39,107
Number of Program Clusters	59	59	59	59	59
Number of Municipality Clusters	1,042	1,042	1,042	1,042	1,042

Notes: The dependent variable is a binary variable equal to one if the applicant passed the first stage of UNICAMP's admission exam, zero otherwise. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A4: First-Stage Success and Affirmative Action, 2003-2008

	(1)	(2)	(3)	(4)	(5)
Public High School	-0.059*	-0.057*	0.027	-0.045***	-0.046***
	(0.034)	(0.033)	(0.025)	(0.011)	(0.011)
Visible Minority	-0.033**	-0.026*	-0.010	-0.009	-0.014
	(0.013)	(0.014)	(0.007)	(0.012)	(0.011)
Visible Minority × Public HS	-0.021***	-0.035***	0.004	-0.001	0.004
	(0.006)	(0.006)	(0.005)	(0.009)	(0.009)
Public HS × AA Years	-0.014	-0.017**	-0.004	0.006	0.006
	(0.009)	(0.008)	(0.009)	(0.008)	(0.008)
Visible Minority × AA Years	-0.007	-0.016	-0.019**	-0.017	-0.016
	(0.009)	(0.012)	(0.010)	(0.012)	(0.012)
Visible Minority × Public HS × AA Years		0.020*	0.022**	0.027**	0.024**
		(0.010)	(0.009)	(0.010)	(0.010)
Normalized ENEM Score			0.216***	0.263***	0.263***
			(0.031)	(0.026)	(0.026)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Age and Gender Controls	No	No	Yes	Yes	Yes
Parental Education Controls	No	No	Yes	Yes	Yes
University Experience Control	No	No	Yes	Yes	Yes
Program Fixed Effects	No	No	No	Yes	Yes
Municipality Fixed Effects	No	No	No	No	Yes
Number of Observations	219,272	219,272	219,272	219,272	219,272
Number of Program Clusters	62	62	62	62	62
Number of Municipality Clusters	2,076	2,076	2,076	2,076	2,076

Notes: The dependent variable is a binary variable equal to one if the applicant passed the first stage of UNICAMP's admission exam, zero otherwise. The ENEM score is normalized each year using the Sao Paulo state-level average and standard deviation. Public High School is a binary variable equal to one if the applicant was enrolled in a public Brazilian school for the duration of her/his secondary education, and zero otherwise. Visible Minority is a binary variable equal to one if the applicant is black, mulatto or native, and zero otherwise. AA Years is a binary variable equal to one if the year is 2005 or above, zero otherwise. The university experience control consists of a dummy variable equal to one if the applicant has previous university experience, and zero otherwise. We control for age using a quartic function in age. 'Trainees' are excluded. Two-way cluster-robust standard errors (at the program and municipality levels) are shown in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

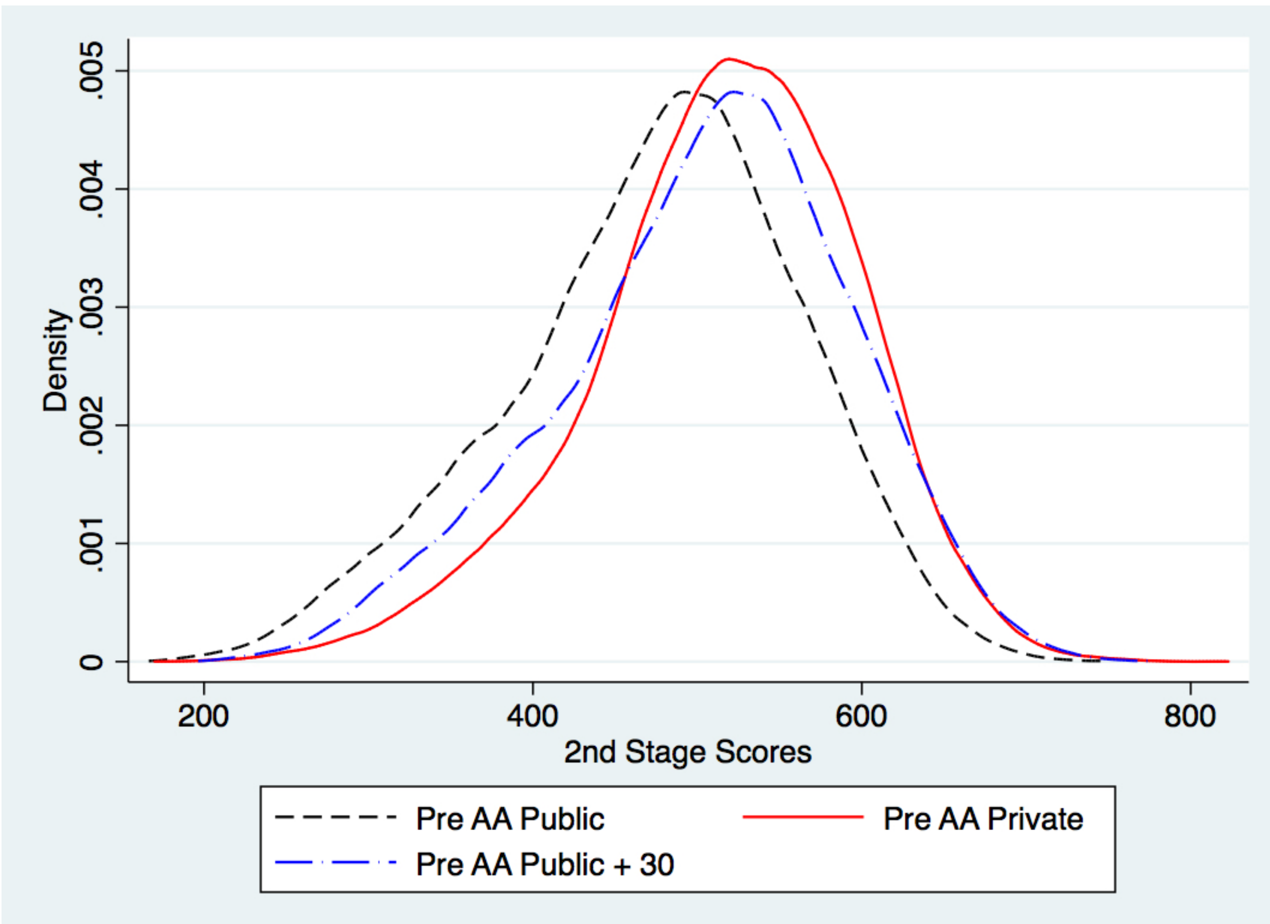

Figure 1: Distributions of Admission Exam Final Scores Prior to 2005

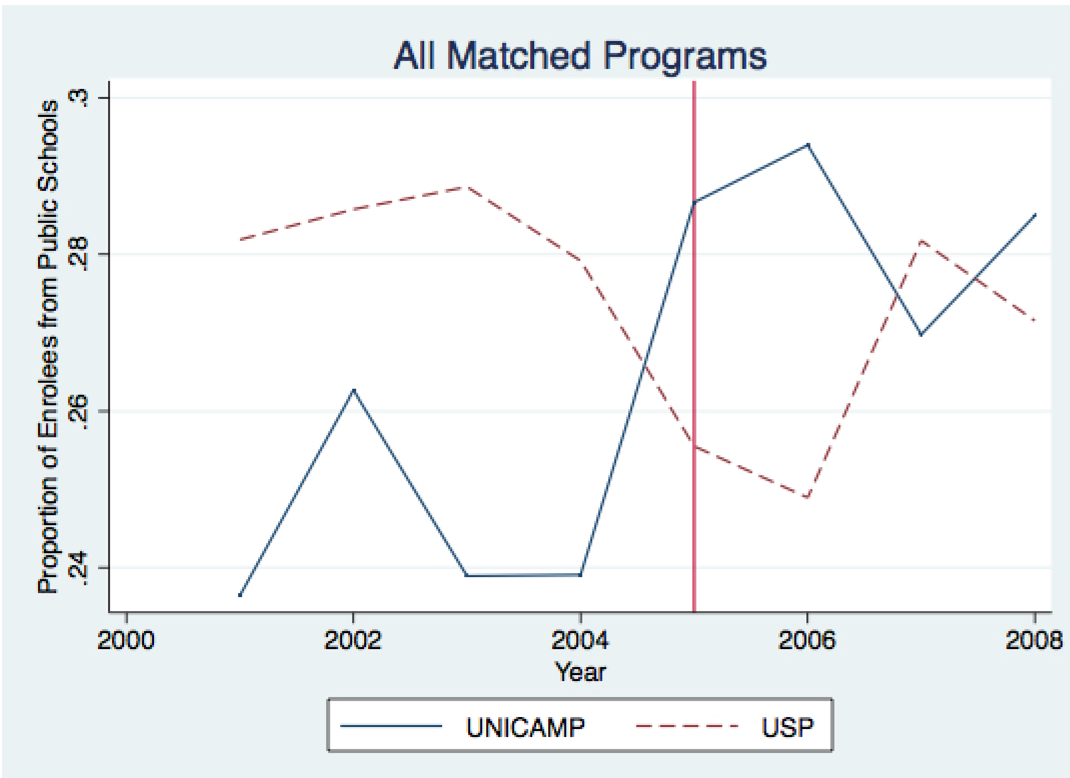

Figure 2: Proportion of Public HS Applicants Admitted

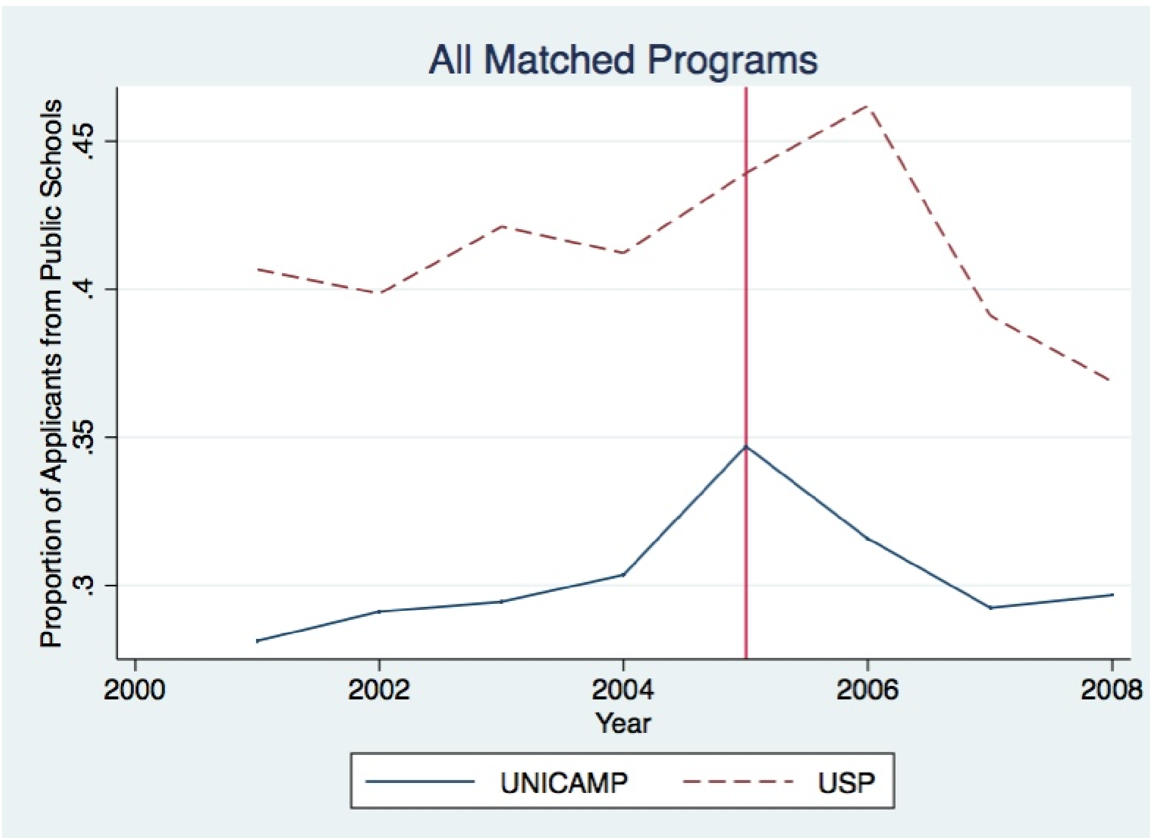

Figure 3: UNICAMP and USP Applicants

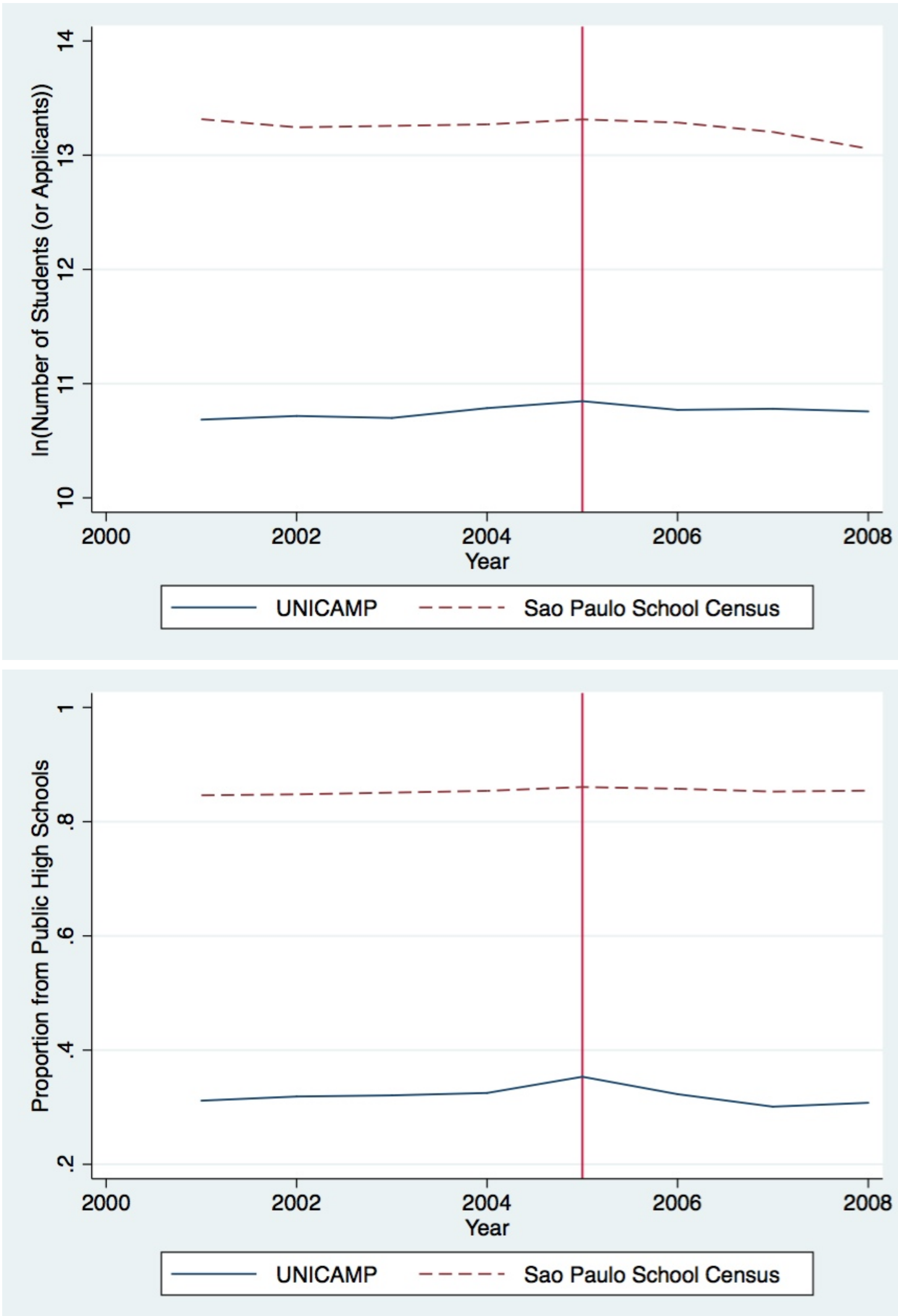

Figure 4: High School Seniors and UNICAMP Applicants

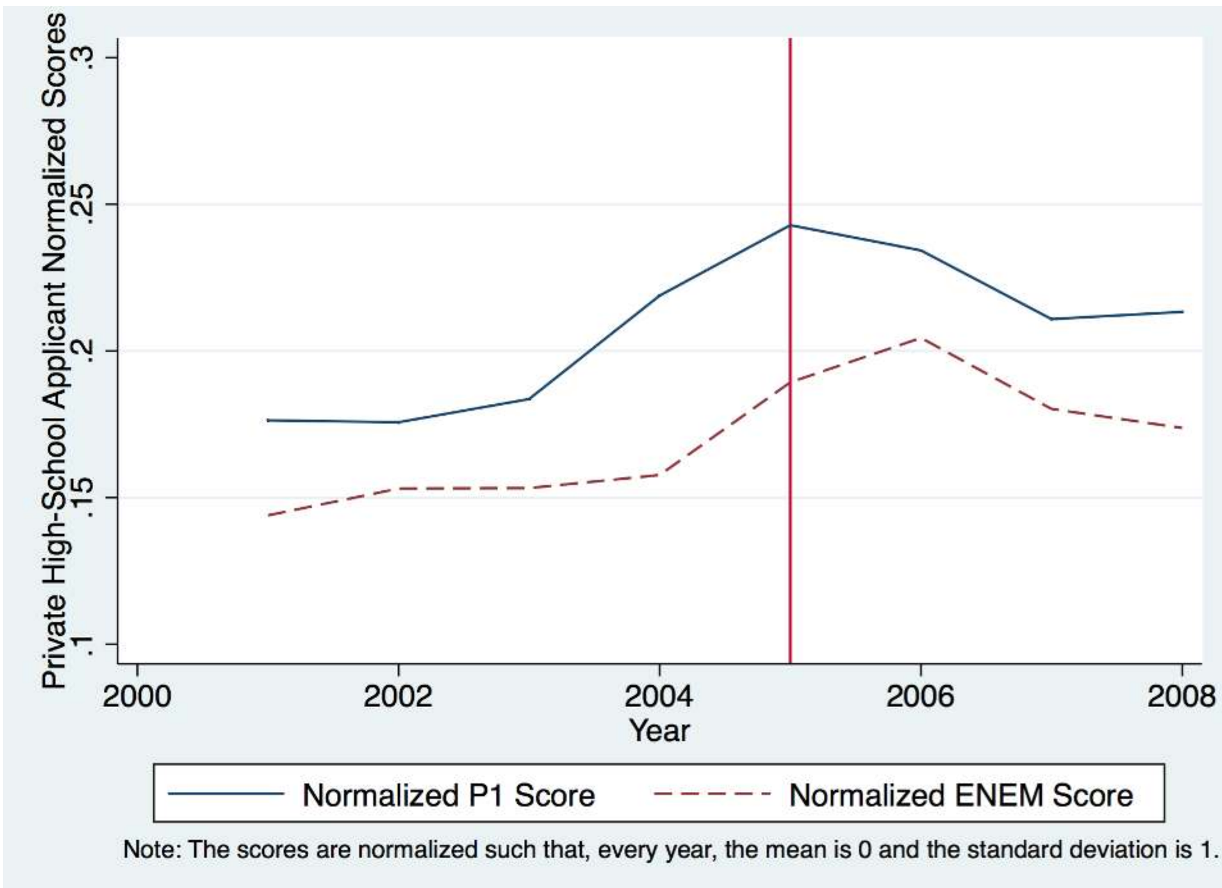

Figure 5: Private High School Applicants Normalized ENEM and P1 Scores

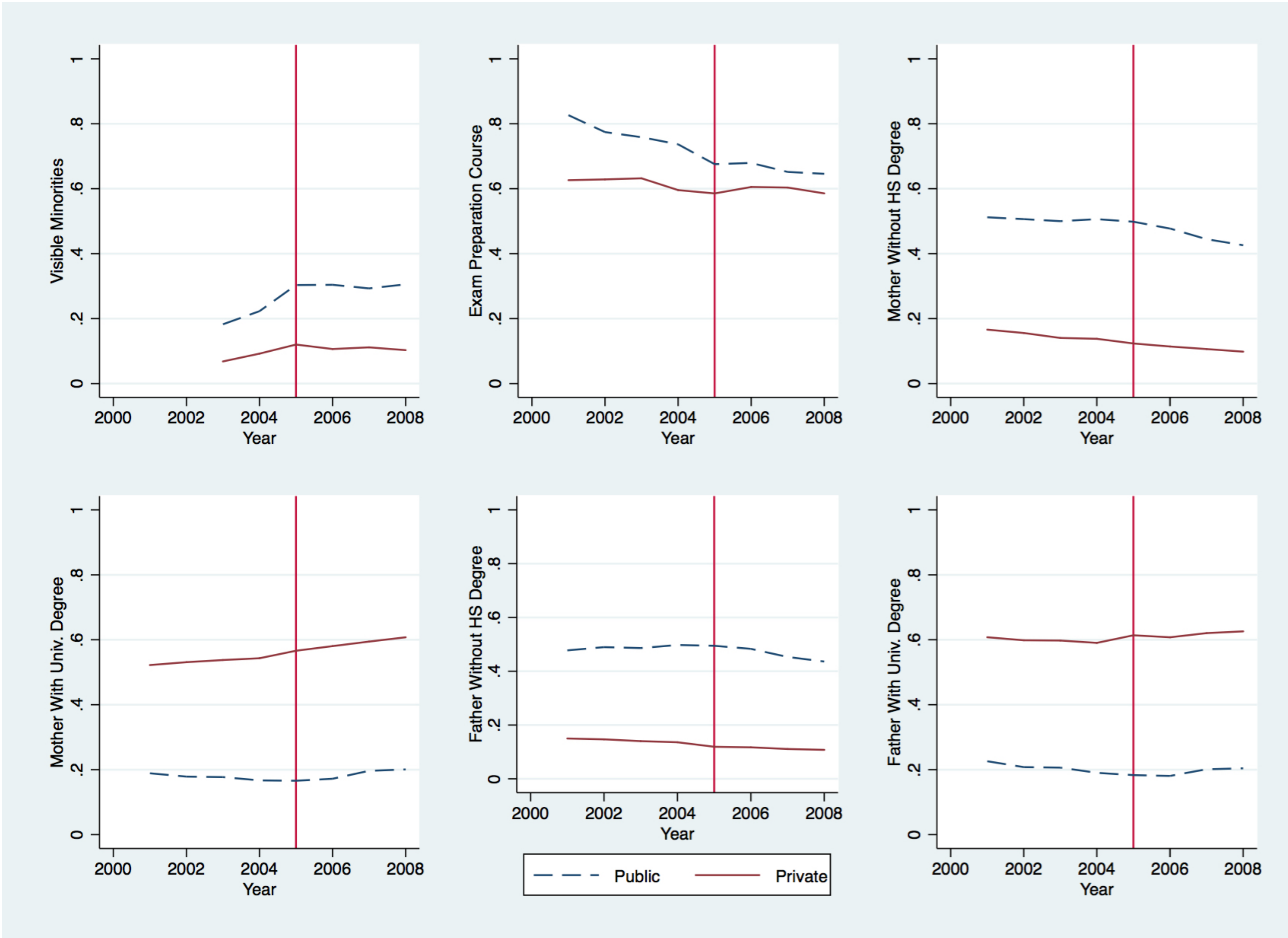

Figure 6: Evolution of Applicants' Socioeconomic Characteristics

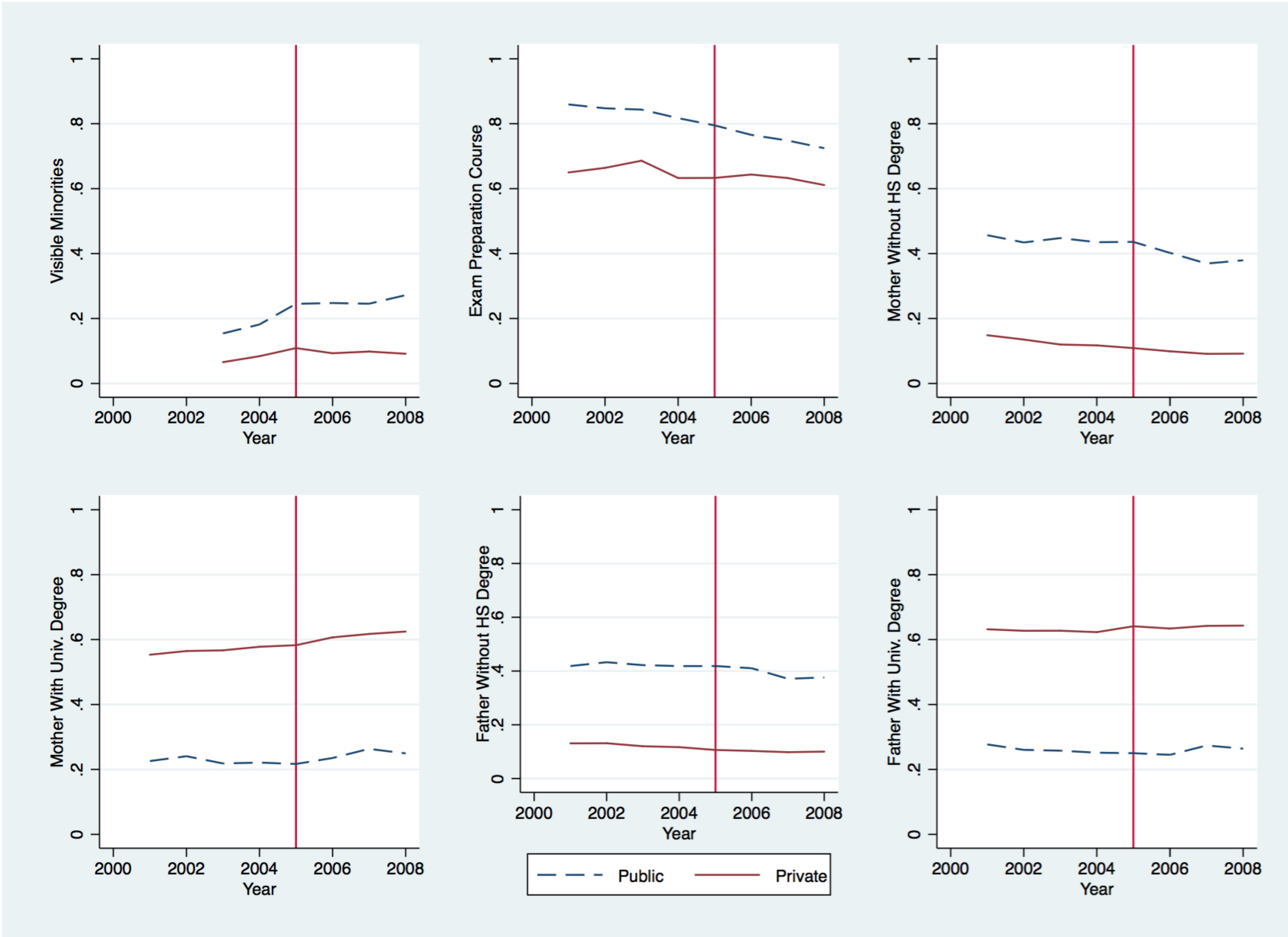

Figure 7: Evolution of P_1 Survivors' Socioeconomic Characteristics

2004-2005 2003-2008

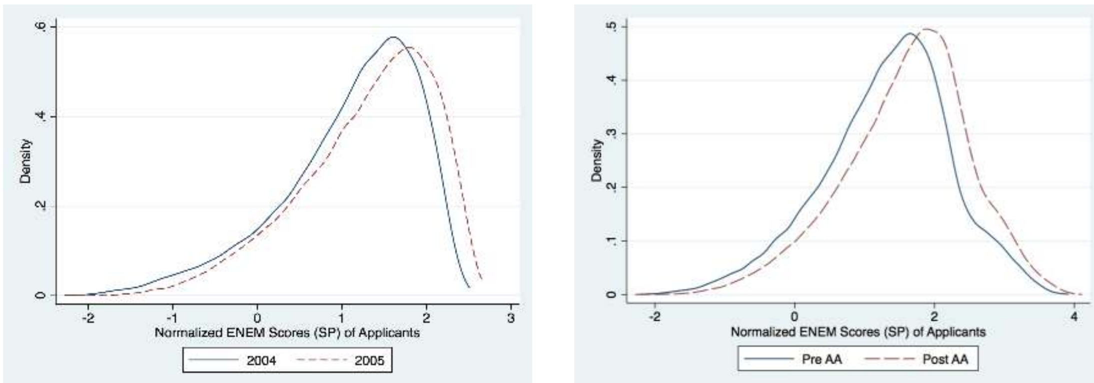

Figure 8: Normalized ENEM Scores

2004-2005 2003-2008

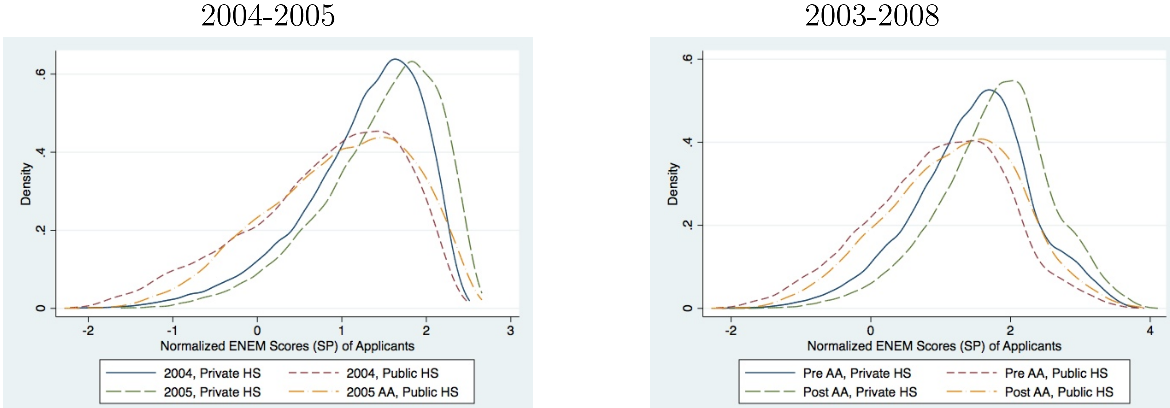

Figure 9: Normalized ENEM Scores by type of High School Attended