

# Affirmative action in university admission and high school students' proficiency

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## Abstract

Economic theory suggests that affirmative action can either reduce or enhance incentives to invest in human capital. Empirical evidence on this matter, however, is still lacking. Using 'difference in difference' estimates, this paper evaluates the effects of the quota system in the admission to Brazilian public universities on the proficiency of high school students. Our findings show that favored groups attained lower scores, suggesting a negative link between affirmative action and incentives for effort and skill acquisition.

## Introduction

Is affirmative action good or bad? What are the economic consequences of such policies? Do they undercut incentives? At first glance, it may seem that affirmative action only reduces the inequality between minority-majority groups to the detriment of economic efficiency. However, some theoretical arguments suggest that the effects of such policies are more complex.

Lundberg & Startz (1983) and Milgrom & Oster (1987) argue that minority groups may under-invest in human capital in anticipation of future

discrimination. In this context, affirmative action may serve to improve economic efficiency by encouraging minority groups to invest in their education. Notwithstanding, Coate & Loury (1993a, 1993b) state that there may be a reduction in investment incentives if firms are obliged to contract less qualified minority employees in order to meet affirmative action targets.

According to Fryer & Loury (2005), “it is theoretically possible that the existence of affirmative action could reduce incentives for effort and skill acquisition in the targeted group, because the policy could make effort and skill less important for achieving successful outcomes. On the other hand, affirmative action could enhance incentives for the targeted group by creating a situation where opportunities previously thought of as out of reach come to be perceived by the applicant as attainable, and thus worth the expenditure of effort to pursue.” Moreover, “confident *a priori* assertions about how affirmative action affects incentives are unfounded. Indeed, economic theory provides little guidance on what is ultimately a subtle and context-dependent empirical question. First principles, commonsense intuitions, and anecdotal evidence are simply inadequate to the task here.”

In this paper, we explore the initiative of some Brazilian public universities in introducing a system of quotas in their admission procedures as a unique opportunity to evaluate the effects of such affirmative actions. Such procedures, introduced in 2002, were restricted to three institutions until 2004: two universities in the State of Rio de Janeiro, the “*Universidade Estadual do Rio de Janeiro*” (UERJ) and the “*Universidade Estadual do Norte Fluminense*” (UENF); and one in the State of Bahia, the “*Universidade do Estado da Bahia*” (UNEB). In the 2003 selection process, 50% of the admitted students in UERJ and UENF had to have attended public schools and 40% had to be black or mulatto. In the 2004 selection process, 20% of the admitted students had to have attended public schools, 20% had to be black and 5% had to be students with disabilities. For UNEB, in the 2003 entry process and in the 2004 entry process, 40% of the admitted students had to be black or mulatto and had to have attended public schools.

We document the impact of these quota systems on the academic proficiency of favored high school students. We have used the methodology of differences in differences, exploiting the characteristics of this quasi-experiment to build two distinct comparison groups.

The first comparison group consists of favored group’s counterpart from states which had not introduced any kind of affirmative action until 2004. It is important to note that, since the number of students who migrate from their

states to attend undergraduate school in Brazil is very low, these students were not affected by the quotas implemented in Rio de Janeiro and Bahia.

The second comparison group comprises non-favored students from states that had introduced a system of quotas in this period. It can be argued that these students were less affected by these policies since there were also other public and private universities which had not implemented any system of quotas during this period. Although this hypothesis may appear controversial, our estimates suggest that, in fact, the impact of these systems of quotas on non-favored groups were not statistically different from zero.

Evaluating scores from senior high school students, our findings are that, in Rio de Janeiro, the scores of black students in public school were 5.7% lower as a consequence of the introduction of these quotas. In Bahia, the estimated effect of this policy on the favored group (black or mulatto public school students) was a reduction in their scores of roughly 2.7%. These results are independent of the comparison group used.

Like every study in economics which does not employ designed experiments, our analysis is subject to limitations. We have considered therefore different alternatives in order to check the robustness of the results. First, we show that the estimated impact of these systems of quotas on non-favored students in Rio de Janeiro and Bahia was insignificant. Second, we evaluate whether the proficiency of favored junior high school students changed from 2001 to 2003. Since it is reasonable to expect these students to be less affected than senior high school students by these systems of quotas, but to be equally affected by other states' unobserved characteristics, this provides a useful check for our identification hypothesis. Third, using data from 1999 and 2001, we tested if our results were driven by a time tendency, rather than by the systems of quotas implemented since 2002. Finally, the fact that some schools were surveyed both in 2001 and 2003 enabled us to control for unobserved characteristics of these schools.

We believe that our results contribute to a better understanding of the (ambiguous) relationship between affirmative action and incentives for effort and skill acquisition. Empirical evidence on this matter is lacking, even considering the experimental study of Schotter & Weigelt (1992). Although we could not assess the total effect of these quota systems on the economy, we have documented a (statistically significant) negative effect on incentives for effort and skill acquisition.

The paper is organized as follows. Section 1 presents the institutional background on the Brazilian experience with quota systems in some public

universities. Section 2 discusses theoretical issues regarding affirmative action and the incentive to learn. Section 3 describes the data with some basic statistics. Section 4 shows our empirical strategy, explaining the choice of the two comparison groups. Section 5 depicts the main empirical results for Rio de Janeiro and Bahia. Section 6 proceeds with robustness checks, and finally there are some concluding remarks.

## 1 Quotas in Brazilian Public Universities

The Brazilian public educational system is characterized by a combination of low quality schools and high quality universities, all of which free. The consequence of this is that few public school students are admitted to public universities, especially for highly demanded courses such as medicine, odontology, and engineering.<sup>1</sup>

To be admitted to a public university in Brazil the student must pass an admission test called the “vestibular” - there is no subjective assessment of the student. Public school students find it more difficult to get into a public university because of their lower level of education. As the vast majority of black students attend low quality public schools, only a few are admitted to public universities.

In 2002, two public universities from Rio de Janeiro, UERJ and UENF, and one from Bahia, UNEB, introduced a system of quotas in their selection process. In UERJ and UENF, in the 2003 process, the system was implemented by the government, without the consent of the universities. There were two laws that passed to regulate this. The first law stated that 50% of the admitted students had to have attended public schools, while the second one stated that 40% of the admitted students had to be (self-reported) black or mulatto. In the 2004 process, 20% of the admitted students had to have attended public schools, 20% had to be (self-reported) black and 5% had to be students with disabilities.

At the beginning of 2003, several news reports were published about the results of the UERJ and UENF 2003 admission process. First, data was presented showing that some favored students had been admitted with extremely low grades in the “vestibular” exam. In its edition of 02/08/2003, the newspaper “Folha de São Paulo” showed that the last non-favored student

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<sup>1</sup>In Brazil, different from the United States, students choose their major before entering college.

admitted in the odontology course scored 77.5 points out of a total of 100 points, while the last favored student admitted in the same course scored only 6.25 points. Moreover, the last favored student admitted in the civil engineering course scored 4 points, and last favored student admitted in the mathematics course scored 12 points.

The dissemination of this data certainly engendered a belief among favored students that it was not necessary to get a high score in the “vestibular” exam to be admitted to these public universities.

Secondly, during this period there was a fierce discussion about how the system of quotas should be implemented for the 2004 admission process, and there was uncertainty about which groups of students should be favored. In fact, changes were made in the UERJ and UENF’s system of quotas, and mulattos were no longer favored.

In UNEB, a system of quotas was implemented at the initiatives of the university itself. In both 2003 and 2004 admission processes, it was stated that 40% of the admitted students had to be (self-reported) black or mulatto and had to have attended public schools. In general, the Brazilian press did not cover the results of the UNEB’s system of quotas as they covered the results of UERJ and UENF’s system of quotas.

## 2 Quotas and Incentive to Learn

As the theoretical literature points out, it is likely that these affirmative action policies are changing incentives for effort and skill acquisition among favored high school students in Brazil, because there is a higher probability that they will be admitted to those public universities (that implemented a system of quotas). In other words, the probability of being admitted to these universities increases for any given level of effort.

A system of quotas may enhance favored students’ willingness to study because opportunities thought as unreachable become reachable. Consider some students who, in the absence of a system of quotas, will not try to enter university because they think that the cost will not result in them getting a place. A system of quotas might change this situation by increasing the probability of being accepted and, as a consequence, inducing a higher level of effort. However, as the system of quotas also increases the probability of their being admitted with low effort, it is possible that these students will not

make as much effort to gain entry to university. Thus, to encourage students to study, the entry requirement for inclusion in the quota system must be neither too demanding nor too lax.

As the system of quotas makes knowledge and effort less important to the outcome, if favored students are already trying to be admitted to university, and are making positive efforts by studying hard, it is likely that it will diminish their incentives to learn, especially if effort is costly and the system of quotas is too lax.

As pointed by Fryer & Loury (2005), the net impact of a system of quotas on favored students' incentive to learn is, *a priori*, ambiguous. In what follows, we study one aspect of this relationship using the Brazilian experience with the quota system.

### 3 Data

Our empirical analysis relies on the “Sistema Nacional de Avaliação da Educação Básica” (SAEB) survey data of 2001 and 2003. The data is a representative sample from elementary, junior high, and senior high school, consisting of about 300,000 students for each year. Each student's proficiency is evaluated through a Math or Portuguese exam. It is important to note that the SAEB's exam is totally independent of the university's admission exam (the vestibular). The proficiency measure is comparable over time as it is calibrated through the ‘item response theory’ methodology. The survey instrument contains a wide variety of information on the characteristics of students, teachers, and schools. Table 1 presents the description of the variables considered in our study.

[Table 1]

Our interest focused on senior high school students. Since they were expected to take the vestibular in the same year that they were surveyed, they were more affected by the new quota procedures than junior high or elementary school students. Descriptive statistics of the sample are presented in table 2 for Rio de Janeiro, Bahia, and other states that had not implemented a system of quotas during the analyzed period. Students are classified by race and type of school (public or private).

It can be seen from table 2 that the proportions of blacks and mulattos in public schools of Rio de Janeiro do not differ from those in other states, while these percentages are much higher in Bahia. The increase in the indicators from 2001 to 2003 in Rio de Janeiro and Bahia could, in principle, represent a change in the way students were describing themselves in order to be included in the program. However, we can reject this possibility for at least two good reasons. First, there is an overall and equivalent increase in the indicators for the remainder of the country, suggesting this is more related to a survey problem than something determined by the introduction of quotas. Second, a student could only benefit from declaring himself as black or mulatto on the university's application form, and not on the SAEB's questionnaire.

*[Table 2]*

Table 2 also depicts proficiency means of these groups of students. As expected, the proficiency of public schools is lower than that of private schools. Moreover, except in Bahia's public schools, the proficiency of whites is, on average, higher than that of blacks and mulattos, even after controlling for the type of school.

Another important statistic presented in table 2 concerns whether these students wanted to continue or to stop studying after senior high school. As shown in Section 3, the incentive effects of these quotas were more likely to be positive if favored students were not already trying to get into university in the absence of a system of quotas. Table 2 shows that, even in public schools, more than 70% of the students answered that they wanted to continue studying after senior high school in 2001. These percentages increased for all groups of students (both favored and non-favored) analyzed in 2003. We do not believe therefore that these changes were due to the system of quotas.

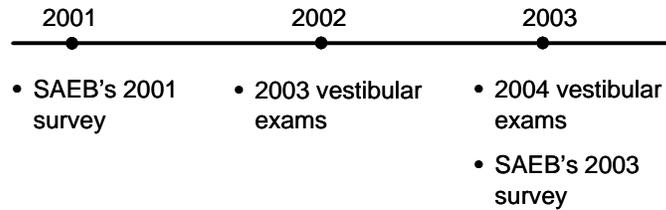
## 4 Empirical Strategy

To identify the impact of quotas on favored senior high school students' incentives to study, we exploited some characteristics of this quasi-experiment to construct two distinct comparison groups. In a difference in difference (DID) framework, we compare the difference in proficiency between the treatment and comparison groups after these systems of quotas were implemented (in

2003) with the same difference before these systems of quotas were implemented (in 2001).

A public university first implemented a system of quotas in the 2003 admission process (the vestibular exam for this process took place in 2002). Consequently, senior high school students surveyed in 2001 were not eligible to be favored in any system of quotas when they were taking their admission exams. Moreover, as rumors of a possible system of quotas in public universities only started to circulate at the beginning of 2002, it is unlikely that senior high school students adopted any kind of anticipation strategy by 2001.

Rio de Janeiro and Bahia’s senior high school students surveyed in 2003, on the other hand, were taking the 2004 vestibular exams at a time when a system of quotas had been implemented in some public universities of their states. They also knew that these public universities had applied a system of quotas in the previous admission process. These dates are summarized in the timeline below.



Timeline

The first comparison group consists of favored group’s counterpart from states which did not introduced affirmative action before 2004. It is important to note that it is unlikely that these students tried to be favored by these systems of quotas. In Brazil, each university has its own admission exam, and it generally takes place in the state where the university is located – this is true for UERJ, UENF, and UNEB. Consequently, the cost of taking this admission exam reduces the possibility that students, especially those who are poor, will try to get into universities in other states.

[Table 3]

Table 3 displays the percentage of undergraduate students who had previously lived in another state. This information is taken from the “Pesquisa Nacional de Amostra Domiciliar” (PNAD) for the years of 2001, 2002, and 2003. While these statistics do not show exactly the percentage of undergraduate students who migrated to attend undergraduate courses, this statistics are definitely an upper bound. In Rio de Janeiro, only 5.49% of undergraduate students had lived in another state at some time, while in Bahia this percentage is higher, at 11.07%. This percentage falls to 6.08% when only black students are taken into account. In summary, this data clearly shows that the number of students who migrate from their states to attend university in Brazil is very low, especially when compared with the United States.<sup>2</sup> It is reasonable to assume therefore that students from outside Rio de Janeiro and Bahia were not affected by these systems of quotas.

The second comparison group is comprised of non-favored students from Rio de Janeiro and Bahia. Since there were also other public and private universities which had not implemented any system of quotas during this period, it can be argued that the benefits granted to favored students were higher than the disadvantages imposed to non-favored students. For example, in Rio de Janeiro, UERJ and UENF admit 5664 students per year, of which about 2550 vacancies are for favored students. There are two other public universities in Rio de Janeiro (which did not employ a quota system) that admit a total of 9799 students per year. Thus, reserved vacancies correspond to roughly 17% of the vacancies in public universities. This percentage is even lower if we take into account private universities. Thus, it can be argued that the impact of these systems of quotas was higher for favored than for non-favored students. By analogy, if you drive to a parking lot and find that it is full up, the fact that there are free spaces for the cars of disabled drivers will not make any difference to your decision to stay or leave. However, these spaces certainly influence the decision of disabled drivers. As this hypothesis could be considered controversial, it is tested in Section 6.

Finally, some characteristics of the treatment group must be stressed. First, to be eligible to be included in the quotas as a public school student, both in Rio de Janeiro and Bahia, students should have completed all of their senior high school years in a public school. Since rumors of the possibility of a system of quotas in public universities started to circulate only at the

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<sup>2</sup>According to the U.S. Department of Education, 17% of first-time freshmen enrolled in degree-granting institutions are migrants from other states in 1996.

beginning of 2002, the decision about whether to enroll in a public or private school for students who were doing their third senior high school year in 2003 was not affected by such rumors.

Moreover, we must consider if favored third year senior high school students surveyed in 2003, in Rio de Janeiro and Bahia, were enrolled in senior high school because of these systems of quotas, since the new admission procedures increased the payoff of attending senior high school for the target group. It must be noted, however, that these students were attending their second senior high school year in 2002. Since drop out is more likely to occur when students complete junior high school and are expected to start senior high school than when they are already attending senior high school, it is unlikely that this is a major problem. According to PNAD, the number of students who stopped attending school after completing junior high school is roughly four times greater than the number of students who stopped studying in the first or the second senior high school year.

The basic DID estimate of the effect of these quota systems on the proficiency of favored students is obtained from the following ordinary least squares regression:

$$y_i = c + \alpha \cdot d_i^{2003} + \beta \cdot d_i^{Treat} + \gamma \cdot d_i^{2003} d_i^{Treat} + \delta' \mathbf{X}_i + \varepsilon_i,$$

where  $y_i$  refers to the logarithm of the proficiency variable;  $d_i^{2003}$  indicates whether student  $i$  was surveyed in 2001 or 2003;  $d_i^{Treat}$  indicates whether student  $i$  belongs to the treatment or comparison group; and  $\mathbf{X}_i$  is a vector of student, school, and teacher characteristics. The coefficient of interest is related to the interaction between  $d_i^{2003}$  and  $d_i^{Treat}$ ,  $\gamma$ , which can be interpreted as the average impact of the treatment on the treated - the percentual variation of proficiency of favored students due to the introduction of the quota system.

## 5 Empirical Results

### 5.1 Rio de Janeiro

At the beginning of 2003 there was broad media coverage of the experience of UERJ and UENF regarding the system of quotas implemented in the admission process of 2003. Their coverage focused on two main points. First, the fact that the vestibular scores of some of the favored students admitted

were very low. Second, they reported the possibility of changes in the configuration of the quota system, and this raised doubts among students as to whether or not certain classes of students would be eligible for inclusion in these quotas.

In Rio de Janeiro, only white and Asian students in private schools had no doubt about their status, since they would certainly not be favored. Black public school students were more likely to be favored, since they could be eligible if the system of quotas were either for black students, or for public school students, or both. All other groups could be significantly affected depending on whether quotas were established exclusively for black students or public school students. Consequently, different groups could, in principle, react differently to the system of quotas.

Table 4 shows estimates of the model using black students in public high schools in Rio de Janeiro as the treatment group. Estimates in columns 1 and 4 consider, as comparison groups, black students in public high schools of states that had not implemented a system of quotas during this period, and white and Asian students in private schools in Rio de Janeiro, respectively. No student, school, and teacher control variables were included. The estimated effect on proficiency of being favored by the system of quotas is a reduction of 4.8% (significant at 5%) or 1.5% (non-significant at 10%), depending on the comparison group used.

*[Table 4]*

However, these results simply reflect the difference of the difference between the proficiency mean of the treatment and comparison groups after these systems of quotas were implemented with the same difference before these systems of quotas were implemented. These results must be analyzed with caution. They may reflect changes in the composition of the groups or changes in factors other than effort that affect the proficiency of the students.

Columns 2 and 5 of table 4 show the same regressions where student characteristics were included. Among these characteristics, were indicators of student wealth, such as the number of televisions, the number of cars, and the number of bathrooms students have. Other characteristics considered were students' ages, if students had ever repeated a year, and if student had ever dropped out of school.

The estimated effect on proficiency of being favored by the system of quotas, after controlling for students' characteristics, is a reduction of 5.1%

(significant at 5%) or 4.6% (significant at 10%), depending on the comparison group used.

Another inherent problem of this analysis is that the fact that states other than Rio de Janeiro did not implemented a system of quotas during this period may reflect differences between Rio de Janeiro and other states that affect the proficiency of students. For example, government educational policies concerning public schools that may be correlated with the implementation of this system of quotas and affect student proficiency. To mitigate this problem, characteristics of schools and teachers were included in the regressions. Such characteristics included cases of class interruption and lack of teachers during the year. Moreover, there are a series of variables concerning school facilities, and teacher profile.

Results of these regressions, using two comparison groups, are presented in columns 3 and 6. The estimated effect on proficiency of being favored by the system of quotas is a reduction of 5.7%, regardless of the comparison group. These coefficients are statistically different from zero at 1% or 5% significance level, depending on the comparison group used.

In fact, a reduction in favored students' incentives to learn is reasonable if one takes into account the scenario in which this system of quotas was implemented. First, more than 75% of the black students in public schools surveyed in 2001 said that they would like to continue studying, even though in 2001 there was no system of quotas. Consequently, it is probable that only few students decided to try to be admitted as a consequence of this system of quotas, which could have lead to an increase in student effort. Furthermore, as stated in section 1, these students believed the score necessary for admittance to be extremely low, and this lead to a reduction in their incentives to learn, as studying is costly.

Table 5 displays the results of the model with other groups that were, or that could have been, favored in the 2004 UERJ and UENF's admission process. None of these groups presents a statistically different from zero effect of this system of quotas. These results may reflect the fact that these students were not sure that they would be eligible for inclusion in these quotas, and therefore did not want to run the risk of reducing effort and then not being eligible.

*[Table 5]*

Moreover, it is important to note that the percentage of black students in Rio de Janeiro is roughly 10%, and that 90% of these are public school students. More than 65% of the students in public schools of Rio de Janeiro are mulatto, white, or Asian. Since the system of quotas established that 20% of the admitted students should be black, and 20% of the students should be public school students, it means that there were relatively more quotas for black students than for public school students. If this fact was anticipated by these students, it is reasonable to assume that the effect of these quotas was higher for black public school students.

## 5.2 Bahia

The system of quotas implemented by UNEB favored black and mulattos in public schools alike. Table 6 is analogous to Table 4 and presents estimates of the model using blacks and mulattos in public schools in Bahia as the treatment group.

*[Table 6]*

The regression displayed in columns 3 and 6 include the full vector of student, school, and teacher controls. The estimated effect on proficiency of being favored by the system of quotas is a reduction of 2.6% or 2.8%, depending on the comparison group used. Note that these two coefficients are almost equal, although only the second is statistically different from zero.

Although our estimates suggest that the impact of quotas on incentives to learn in Bahia is also negative, the magnitude of this effect is lower than in Rio de Janeiro. These results may reflect the fact that the repercussion of the previous admission exam in Bahia was considerably lower than in Rio de Janeiro. Consequently, it may be the case that blacks and mulattos in public schools were not aware that they were eligible to meet these quotas. Moreover, news reports about the admission exam scores of the favored and non-favored students admitted in the previous year were only released in Rio de Janeiro. Thus, unlike favored students in Rio de Janeiro, Bahia's favored students did not believe strongly that the necessary score for admittance was extremely low.

In addition to this, even though blacks and mulattos make up more than 60% of Bahia's students, UNEB reserved only 40% of its vacancies for these

students. On the other hand, the situation in Rio de Janeiro is very different in that 20% of UERJ and UENF's vacancies were reserved for blacks, who make up only 10% of Rio de Janeiro's student population.

## 6 Caveats and Specification Checks

In this section, we check some of the hypothesis that were assumed throughout the previous analysis.

### 6.1 The effect of quotas on non-favored students

The consistency of our estimates when using non-favored students from Rio de Janeiro and Bahia relies on the hypothesis that these students' incentives did not change, or, at least, that they were less affected than favored students.

Although it may seem that non-favored students were as affected as favored students, since the probability of their being admitted to universities that implemented a system of quotas decreased, it has been argued that they were less affected than favored students as there were also other public and private universities in the same state that had not implemented any system of quotas during this period. This hypothesis may be checked by comparing the proficiency of non-favored students from states that had introduced a system of quotas with the proficiency of their counterparts from states that had not introduced a system of quotas.

Columns 1 and 2 of table 7 display the estimates for Rio de Janeiro and Bahia, respectively. For both states, the estimated effects of these quotas on non-favored students are virtually zero, supporting the hypothesis that non-favored students were not significantly affected.

*[Table 7]*

### 6.2 Unobserved characteristics of states

Could our estimates be reflecting unobserved changes in state characteristics associated with the implementation of quota systems? For example, if the government decreased public school transfers because quota systems reduced the demand for public school quality, then the proficiency of these students

could have lowered even though their efforts remained constant. This problem was partially addressed by including variables related to characteristics of schools and professors in the regressions.

In this section, we evaluate whether the proficiency of favored junior high school students changed from 2001 to 2003. As these students were three years from taking their admission exams, it is likely that their incentives to learn were less affected than favored senior high school students'. Nonetheless, both senior and high school students are equally affected by some state characteristics that affect proficiency. If previous results were driven by unobserved state characteristics, then it is likely that junior high school students would display the same pattern.

Table 8 displays DID estimates for junior high school students in Rio de Janeiro and Bahia, using two comparison groups for each state. None of these DID coefficients is statistically different from zero. These results suggest that our senior high school student estimates were not driven by changes in unobserved state's characteristics.

*[Table 8]*

### 6.3 Time Trend

Another caveat that we should be aware of is whether this lower proficiency of favored students occurred after the implementation of these quota systems or whether there was a negative trend in the proficiency of these students even before these quota systems were implemented.

To deal with this problem, we estimate a DID model with data from 1999 and 2001.<sup>3</sup> As we have already stated, there were no quota systems in any Brazilian public university in 1999 and 2001. Neither were there any rumors concerning such systems. Thus, if there was not a negative trend in the proficiency of favored students, it can be expected that the DID coefficient will not be statistically different from zero.

Table 9 displays these estimates. As expected, none of the DID coefficients are statistically different from zero, suggesting that changes in the proficiency of favored students took place after the implementation of these quota systems.

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<sup>3</sup>It was not possible to include all of the control variables used in the previous analysis due to incompatibilities between the two years datasets.

[Table 9]

## 6.4 Unobserved School Characteristics

Finally, we exploit the fact that some schools were surveyed both in 2001 and in 2003. Table 10 displays our DID estimates including a dummy variable for each school that was surveyed in both years, and one dummy for all other schools. By doing this, we are able to control our estimates for any timeless unobserved characteristics of these repeated schools that affect proficiency.

[Table 10]

In Rio de Janeiro, our DID coefficients suggest that the proficiency of black public school students was 3.7% lower (significant at 10%) due to this system of quotas when black public school students from other states are used as a comparison group. When non-favored students from Rio de Janeiro are used as a comparison groups, our DID coefficient suggested that the proficiency of black public school students was 4.7% lower (significant at 10%).

In Bahia, our estimates suggest that the proficiency of favored students was 2.7% lower (significant at 10%) when other states' students were used as a comparison group, and 2.9% lower (significant at 5%), when non-favored students from Bahia were used as a comparison group. These results are close to our findings in section 5.

## Conclusion

In 2002 and 2003, public universities from Rio de Janeiro and Bahia implemented a system of quotas in their admission procedures. This paper assesses the impact of these quota systems on the incentives to learn of favored senior high school students. Although the theoretical literature points out that affirmative action may affect incentives for effort and human capital investments, the direction and magnitude of this effect is unclear, and any clarification will depend on empirical study.

We estimate that, on average, the proficiency of black students from public schools of Rio de Janeiro was 5.7% lower, while there was a reduction of 2.7% in the performance of black and mulattos in Bahia. Other favored

students from Rio de Janeiro were not affected, which may reflect that they were not sure about their eligibility to be included in these quotas, and thus they did not want to run the risk of studying less and then not being eligible.

These results provide the first empirical evidence that affirmative action policies may reduce incentives for effort and skill acquisition. Although our results cannot be generally applied in other situations, analyzing the context and form in which these systems of quotas were implemented may provide useful insights into whether affirmative action is likely to lead to these negative effects.

Finally, it is important to stress that we are assessing the effects of affirmative action on incentives to effort and skill acquisition in only one dimension. We evaluate only one among many changes in incentive provided by the quota system. It is perfectly possible that the net effect of such policies on the human capital investment is even positive rather than negative.

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Table 1: Control Variables Description

**Student Characteristics**

1	Gender	male or female
2	Age	Integer
3	Do you live with your father (or another responsible)?	yes or no
4	Do you live with your mother (or another responsible)?	yes or no
5	How many books do you have at home?	none, 1 to 20, 20 to 100, 100 or more
6	Is there a home-help in your home?	no, 1, 2 or more, daily
7	Have you ever attended another school?	yes or no
8	In which kind of schools have you studied?	public, private, public and private
9	Have you ever had to repeat a school year?	yes or no
10	Have you ever dropped out of school?	yes or no
11	Do you have piped water at home?	yes or no
12	Do you have electricity at home?	yes or no
13	How many televisions do you have at home?	none, 1, 2, 3, 4 or more
14	How many radios do you have at home?	none, 1, 2, 3, 4 or more
15	How many cars do you have at home?	none, 1, 2, 3, 4 or more
16	Do you have a VCR at home?	yes or no
17	Do you have a refrigerator at home?	yes or no
18	Do you have a washing machine at home?	yes or no
19	Do you have a vacuum cleaner at home?	yes or no
20	How many bathrooms are in your home?	none, 1, 2, 3 or more
21	Do you have a computer at home?	yes or no

**Teacher Characteristics**

22	Gender	male or female
23	Age	24 or less, 25 to 29, 30 to 39, 40 to 49, 50 to 54, 54 or more
24	Race	White, Mulatto, Black, Asian
25	Do you have higher education	yes or no

**School Characteristics**

26	Was there a lack of teachers during the year?	no, yes but it was not a big problem, yes and it was a big problem
27	Were there class interruptions during the year?	no, yes but it was not a big problem, yes and it was a big problem
28	Conservation of the roof	Proper, regular, improper, or inexistent
29	Conservation of the walls	Proper, regular, improper, or inexistent
30	Conservation of the floor	Proper, regular, improper, or inexistent
31	Conservation of the bathrooms	Proper, regular, improper, or inexistent
32	Conservation of the kitchen	Proper, regular, improper, or inexistent
33	Conservation of the hydraulic facilities	Proper, regular, improper, or inexistent
34	Conservation of the wiring	Proper, regular, improper, or inexistent
35	Are the classrooms illuminated?	yes or no
36	Are the classrooms ventilated?	yes or no
37	Cleanliness of the entrance to the building	good or bad
38	Cleanliness of the external walls	good or bad
39	Cleanliness of the playground	good or bad
40	Cleanliness of the corridors	good or bad
41	Cleanliness of the classrooms	good or bad
42	Cleanliness of the bathrooms	good or bad

Table 2: Descriptive Statistics

		Rio de Janeiro		Bahia		Other States	
		2001	2003	2001	2003	2001	2003
Percentage of students	<b>Public School</b>	<b>74.62%</b>	<b>77.82%</b>	<b>88.95%</b>	<b>88.69%</b>	<b>84.02%</b>	<b>83.88%</b>
	White	32.55%	26.31%	22.96%	17.58%	45.63%	41.33%
	Mulatto	28.35%	34.86%	45.77%	49.27%	28.54%	32.29%
	Black	8.34%	11.61%	16.94%	19.06%	4.96%	6.34%
	Asian	5.38%	5.04%	3.28%	2.78%	4.89%	3.91%
	<b>Private School</b>	<b>25.38%</b>	<b>22.18%</b>	<b>11.05%</b>	<b>11.31%</b>	<b>15.98%</b>	<b>16.12%</b>
	White	17.37%	13.80%	5.10%	4.01%	11.18%	10.56%
	Mulatto	5.42%	6.93%	4.69%	5.61%	3.41%	4.28%
	Black	1.32%	0.89%	0.72%	1.30%	0.40%	0.50%
	Asian	1.27%	0.56%	0.54%	0.39%	0.99%	0.78%
Proficiency*	<b>Public School</b>	<b>263.1</b>	<b>269.5</b>	<b>252.8</b>	<b>252.3</b>	<b>259.7</b>	<b>262.8</b>
	White	269.1	280.7	252.9	265.3	265.6	268.3
	Mulatto	259.7	266.5	254.3	248.9	253.3	257.0
	Black	255.0	253.1	246.8	247.2	244.1	254.9
	Asian	257.4	269.3	264.0	266.9	258.1	265.5
	<b>Private School</b>	<b>320.0</b>	<b>324.0</b>	<b>311.1</b>	<b>322.5</b>	<b>325.9</b>	<b>328.8</b>
	White	326.6	329.7	317.1	332.5	331.0	334.3
	Mulatto	311.3	317.3	308.4	320.7	311.9	318.4
	Black	284.0	300.9	294.7	302.3	300.0	301.2
	Asian	303.6	303.7	299.9	313.6	327.5	328.7
Percentage of students that were willing to continue studying after high school	<b>Public School</b>	<b>77.61%</b>	<b>83.59%</b>	<b>73.33%</b>	<b>79.91%</b>	<b>78.02%</b>	<b>80.93%</b>
	White	79.57%	86.11%	75.45%	80.66%	80.04%	82.33%
	Mulatto	76.75%	84.10%	73.26%	80.31%	75.93%	80.43%
	Black	75.66%	80.41%	71.09%	77.13%	74.05%	75.81%
	Asian	73.23%	74.29%	71.10%	87.17%	75.31%	78.52%
	<b>Private School</b>	<b>86.42%</b>	<b>95.09%</b>	<b>83.14%</b>	<b>94.64%</b>	<b>88.19%</b>	<b>95.21%</b>
	White	87.33%	95.14%	79.08%	95.09%	88.91%	95.69%
	Mulatto	84.64%	96.32%	88.32%	94.34%	86.63%	95.04%
	Black	87.72%	82.46%	87.72%	93.71%	84.32%	90.83%
	Asian	80.18%	99.07%	70.42%	97.40%	87.09%	92.53%
Observations	<b>Public School</b>	<b>1476</b>	<b>1410</b>	<b>1845</b>	<b>1519</b>	<b>35737</b>	<b>24809</b>
	White	620	551	446	297	15622	10471
	Mulatto	569	589	934	851	15457	11094
	Black	173	204	392	327	2558	2064
	Asian	114	66	73	44	2100	1180
	<b>Private School</b>	<b>1226</b>	<b>1132</b>	<b>1258</b>	<b>1755</b>	<b>28776</b>	<b>20458</b>
	White	836	736	547	635	17148	12787
	Mulatto	259	312	545	874	8806	5971
	Black	66	49	99	183	947	714
	Asian	65	35	67	63	1875	986

Source: SAEB

\* This index ranges from 75 to 500

Table 3: Percentage of undergraduate students who had lived in another state previously

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	<u>Rio de Janeiro</u>	<u>Bahia</u>	<u>Other States</u>
White or Asian	5.77%	14.03%	8.96%
Mulatto	3.75%	10.73%	10.46%
Black	6.55%	6.08%	8.39%
<b>Total</b>	<b>5.49%</b>	<b>11.70%</b>	<b>9.24%</b>

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Source: PNAD 2001-2003

Table 4: Effect of the System of Quotas on Black Public School Students in Rio de Janeiro

Dependent Variable	Ln(proficiency)					
	Black Public School Students in Rio de Janeiro					
Treatment Group	Black Public School Students in Rio de Janeiro					
Comparison Group	Black Public School Students in Other States			White and Asian Private School Students in Rio de Janeiro		
	$d^{Treat} \times d^{2003}$	<b>-0.048**</b> <i>0.0240</i>	<b>-0.051**</b> <i>0.0210</i>	<b>-0.057***</b> <i>0.0220</i>	<b>-0.015</b> <i>0.0390</i>	<b>-0.046*</b> <i>0.0260</i>
$d^{2003}$	0.043*** <i>0.0120</i>	0.022** <i>0.0110</i>	0.01 <i>0.0100</i>	0.009 <i>0.0330</i>	0.01 <i>0.0180</i>	0.01 <i>0.0180</i>
$d^{Treat}$	0.042** <i>0.0180</i>	0.047*** <i>0.0150</i>	0.039** <i>0.0170</i>	-0.245*** <i>0.0240</i>	-0.100*** <i>0.0280</i>	-0.112*** <i>0.0330</i>
Exam	0.061*** <i>0.0110</i>	0.055*** <i>0.0100</i>	0.056*** <i>0.0100</i>	0.034*** <i>0.0120</i>	0.046*** <i>0.0110</i>	0.033*** <i>0.0120</i>
Student Characteristics	No	Yes	Yes	No	Yes	Yes
Teacher and School characteristics	No	No	Yes	No	No	Yes
N. Obs.	4999	4999	4999	2049	2049	2049
Adjusted R <sup>2</sup>	0.04	0.21	0.24	0.33	0.50	0.54

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 5: Effect of the System of Quotas on Other Groups of Favored Students in Rio de Janeiro

Dependent Variable	Ln(proficiency)									
	Mulatto Public School Students in Rio de Janeiro		White Public School Students in Rio de Janeiro		Asian Public School Students in Rio de Janeiro		Black Private School Students in Rio de Janeiro		Mulatto Private School Students in Rio de Janeiro	
Treatment Group										
Comparison Group	Outside RJ	In RJ	Outside RJ	In RJ	Outside RJ	In RJ	Outside RJ	In RJ	Outside RJ	In RJ
$d^{\text{Treat}} * d^{2003}$	<b>0.002</b>	<b>-0.027</b>	<b>0.026</b>	<b>0.015</b>	<b>0.021</b>	<b>0.009</b>	<b>0.042</b>	<b>0.000</b>	<b>-0.027</b>	<b>-0.015</b>
	<i>0.017</i>	<i>0.027</i>	<i>0.018</i>	<i>0.029</i>	<i>0.038</i>	<i>0.047</i>	<i>0.033</i>	<i>0.034</i>	<i>0.026</i>	<i>0.016</i>
$d^{2003}$	-0.001	0.000	-0.006	0.005	0.011	0.005	-0.007	0.010	0.002	0.011
	<i>0.005</i>	<i>0.021</i>	<i>0.006</i>	<i>0.021</i>	<i>0.013</i>	<i>0.021</i>	<i>0.015</i>	<i>0.019</i>	<i>0.007</i>	<i>0.019</i>
$d^{\text{Treat}}$	0.022**	-0.115***	0.027**	-0.096***	-0.010	-0.100**	-0.040*	-0.045**	0.015	0.007
	<i>0.011</i>	<i>0.030</i>	<i>0.011</i>	<i>0.025</i>	<i>0.025</i>	<i>0.040</i>	<i>0.024</i>	<i>0.020</i>	<i>0.014</i>	<i>0.011</i>
Exam	0.035***	0.027***	0.051***	0.043***	0.032***	0.036**	0.066***	0.060***	0.063***	0.063***
	<i>0.004</i>	<i>0.010</i>	<i>0.004</i>	<i>0.012</i>	<i>0.011</i>	<i>0.014</i>	<i>0.011</i>	<i>0.014</i>	<i>0.006</i>	<i>0.014</i>
Student Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Teacher and School characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N. Obs.	27709	2830	27264	2843	3460	1852	1776	1787	15348	2243
Adjusted R <sup>2</sup>	0.18	0.44	0.22	0.41	0.25	0.47	0.31	0.37	0.31	0.39

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 6: Effect of the System of Quotas on Black and Mulatto Public School Students in Bahia

Dependent Variable	Ln(proficiency)					
	Black and Mulatto Public School Students in Bahia					
Treatment Group	Black and Mulatto Public School Students in Bahia					
Comparison Group	Black and Mulatto Public School Students in Other States			Private School and White and Asian Public School Students in Bahia		
	$d^{Treat} * d^{2003}$	<b>-0.037</b>	<b>-0.028</b>	<b>-0.026</b>	<b>-0.071**</b>	<b>-0.040***</b>
<i>0.032</i>		<i>0.021</i>	<i>0.020</i>	<i>0.032</i>	<i>0.013</i>	<i>0.013</i>
$d^{2003}$	0.019***	0.003	0.001	0.052	0.013	-0.008
	<i>0.007</i>	<i>0.006</i>	<i>0.005</i>	<i>0.040</i>	<i>0.016</i>	<i>0.015</i>
$d^{Treat}$	0.001	0.022	0.023	-0.063***	0.002	-0.009
	<i>0.024</i>	<i>0.017</i>	<i>0.017</i>	<i>0.022</i>	<i>0.010</i>	<i>0.009</i>
Exam	0.045***	0.042***	0.043***	0.061***	0.058***	0.057***
	<i>0.004</i>	<i>0.003</i>	<i>0.004</i>	<i>0.009</i>	<i>0.009</i>	<i>0.010</i>
Student Characteristics	No	Yes	Yes	No	Yes	Yes
Teacher and School characteristics	No	No	Yes	No	No	Yes
N. Obs.	33677	33677	33677	6377	6377	6377
Adjusted R <sup>2</sup>	0.02	0.19	0.20	0.08	0.38	0.42

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 7: Effect of the System of Quotas on Non-Favored Students

Dependent Variable	Ln(proficiency)	
	Non-Favored Students From States that Had Introduced a System of Quotas	Students' Counterparts From States that Had Not Introduced a System of Quotas
	Rio de Janeiro	Bahia
$d^{\text{Treat}} * d^{2003}$	<b>-0.006</b> <i>0.022</i>	<b>0.002</b> <i>0.016</i>
$d^{2003}$	-0.007 <i>0.009</i>	-0.004 <i>0.005</i>
$d^{\text{Treat}}$	-0.003 <i>0.012</i>	-0.005 <i>0.011</i>
Exam	0.088*** <i>0.005</i>	0.059*** <i>0.003</i>
Student Characteristics	Yes	Yes
Teacher and School characteristics	Yes	Yes
N. Obs.	34468	82480
Adjusted R <sup>2</sup>	0.3	0.36

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 8: Junior High School Estimates

Dependent Variable	Ln(proficiency)			
	Black Public Junior High School Students in RJ		Black and Mulatto Public Junior High School Students in BA	
Treatment Group	Outside RJ	In RJ	Outside BA	In BA
$d^{\text{Treat}} * d^{2003}$	<b>-0.011</b>	<b>-0.029</b>	<b>0.022</b>	<b>0.002</b>
	<i>0.022</i>	<i>0.037</i>	<i>0.015</i>	<i>0.015</i>
$d^{2003}$	-0.030***	-0.005	-0.022***	-0.001
	<i>0.011</i>	<i>0.019</i>	<i>0.005</i>	<i>0.016</i>
$d^{\text{Treat}}$	0.034**	-0.135***	0.000	-0.015
	<i>0.015</i>	<i>0.030</i>	<i>0.011</i>	<i>0.010</i>
Exam	0.069***	0.052***	0.047***	0.032***
	<i>0.010</i>	<i>0.011</i>	<i>0.004</i>	<i>0.007</i>
Student Characteristics	Yes	Yes	Yes	Yes
Teacher and School characteristics	Yes	Yes	Yes	Yes
N. Obs.	9081	2698	58041	8454
Adjusted R <sup>2</sup>	0.18	0.49	0.16	0.27

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 9: 1999 - 2001 Estimates

Dependent Variable	Ln(proficiency)			
	Black Public Junior High School Students in RJ		Black and Mulatto Public Junior High School Students in BA	
Treatment Group	Outside RJ	In RJ	Outside BA	In BA
$d^{Treat} * d^{2003}$	<b>0.024</b>	<b>0.017</b>	<b>0.002</b>	<b>0.009</b>
	<i>0.031</i>	<i>0.030</i>	<i>0.021</i>	<i>0.017</i>
$d^{2003}$	-0.026	-0.125	-0.019	-0.014
	<i>0.040</i>	<i>0.082</i>	<i>0.025</i>	<i>0.058</i>
$d^{Treat}$	0.041	-0.094***	0.028***	-0.011
	<i>0.028</i>	<i>0.034</i>	<i>0.009</i>	<i>0.014</i>
Exam	0.035***	0.041***	0.044***	0.060***
	<i>0.012</i>	<i>0.012</i>	<i>0.005</i>	<i>0.010</i>
Student Characteristics	sim	sim	sim	sim
Teacher and School characteristics	sim	sim	sim	sim
N. Obs.	3532	1631	25058	4219
Adjusted R <sup>2</sup>	0.22	0.43	0.17	0.35

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Table 10: School Dummies

Dependent Variable	Ln(proficiency)			
	Black Public Junior High School Students in RJ		Black and Mulatto Public Junior High School Students in BA	
Treatment Group	Outside RJ	In RJ	Outside BA	In BA
$d^{Treat} * d^{2003}$	<b>-0.037*</b> <i>0.022</i>	<b>-0.047*</b> <i>0.025</i>	<b>-0.027*</b> <i>0.015</i>	<b>-0.029**</b> <i>0.014</i>
$d^{2003}$	0.020** <i>0.010</i>	0.002 <i>0.016</i>	0.004 <i>0.005</i>	-0.002 <i>0.015</i>
$d^{Treat}$	0.033* <i>0.018</i>	-0.106*** <i>0.033</i>	0.015 <i>0.013</i>	-0.007 <i>0.009</i>
Exam	0.060*** <i>0.010</i>	0.036*** <i>0.012</i>	0.043*** <i>0.004</i>	0.058*** <i>0.010</i>
Student Characteristics	Yes	Yes	Yes	Yes
Teacher and School characteristics	Yes	Yes	Yes	Yes
School Dummies <sup>†</sup>	Yes	Yes	Yes	Yes
N. Obs.	4999	1949	33677	6377
R <sup>2</sup>	0.31	0.59	0.23	0.44
Number of School Dummies	165	15	219	21

Robust standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

<sup>†</sup> Only for Schools that were surveyed both in 2001 and 2003