Affirmative Action and the Choice of Schools

BSE Working Paper 1285| September 2021

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August 23, 2021

Abstract

Race-neutral affirmative action in higher education has gained importance following the controversies over their race-based alternatives. In many settings, these interventions use a school-based criterion that selects beneficiaries relative to their peers. Exploiting a nationwide quota policy in Brazil that reserved a large share of vacancies in higher education for public-school students, I show that the reform increases the private-to-public school transitions, especially among students of low-performing private schools. In addition to a direct decrease in returns of the private-school investment, spillovers on indirectly exposed cohorts and general equilibrium effects in the school system might also explain the results.

JEL Codes: I23, I28.
Keywords: Affirmative Action, School Choice.

*Institute for Economic Analysis (IAE-CSIC) and Barcelona Graduate School of Economics (BGSE). I am grateful to Jan Stuhler for his guidance and support. I also thank Ana Rute Cardoso, Fernanda Estevan, Ricardo Mora, Daniele Paserman, Luigi Minale, Matilde Machado, Nazarii Salish and participants of the 2021 European Society for Population Economics, the 25th Spring Meeting of Young Economis, the GEP/CEPR Education Economics Workshop, the University of Brasilia Seminar Series, the PUC-Rio Seminar Series, the 2021 Royal Economic Society Meeting, the 2020 European Winter Meeting of the Econometric Society, the 42^{nd} Meeting of the Brazilian Econometric Society, the Workshop on Causal Analysis of School Reforms, the EALE/SOLE World Conference, the Warsaw International Economic Meeting, the Applied Young Economist Webinar, the SBE Seminar in Applied Economics, the University of Barcelona Seminar Series, the UC3M Applied Reading Group, the IAE Internal Seminar, the 17^{th} Barcelona GSE Trobada and the HCEO Summer School in Socioeconomic Inequality for helpful comments and suggestions. I acknowledge financial support from the Severo Ochoa Programme for Centres of Excellence in RD (CEX2019-000915-S) and the 2017 SGR 1359 Secretaria d'Universitats i Recerca-Generalitat de Catalunya. All errors are my own. Correspondance email: ursula.mello@iae.csic.es

1 Introduction

Affirmative action (AA) policies in higher education have been adopted in different countries to mitigate inequality in access, performance, and graduation. These policies are divided into race-conscious, race-neutral or mixed types, which have received heterogeneous degrees of support or scrutiny depending on the institutional and historical context of the country. In the US, for example, the traditional race-based policies that started in the 1960s were subject to many legal disputes leading to its ban in eight states in the 1990s (Akhtari et al., 2020). As a response, some of these states adopted the so-called "Top N-percent Plans", a race-neutral affirmative action that benefits students that graduated in the top N% of their school.[1] In other settings, such as Brazil, Israel, Chile, France and the UK, affirmative action policies targeting low-SES schools have also been implemented as an alternative or as a complement to race-based AA.[2]

By using the school as a criterion for affirmative action eligibility, this type of intervention increases individuals' incentives for choosing an institution that improves their likelihood for acceptance in higher education. In this context, the literature has shown that the Top Percent Plans increase students' movements across high schools and high school integration (Cullen et al. (2013) and Estevan et al. (2019)). However, despite the increasing popularity of this type of initiative worldwide, little is known about their effects on school choice and school systems beyond the context of the Top Percent Plans in the US. Moreover, little is known about the mechanisms that drive the changes observed in individuals' decisions. This paper helps to fill this gap by analyzing how and why a large nationwide affirmative action targeted at public-school students in Brazil induces changes in school choice decisions.

On August 29th 2012, the federal government approved the so-called "Quota Law" (hereafter QL). It established that 50 percent of vacancies in each major of each federal higher education institution has to be reserved for students that attended all three years of upper-secondary education in a public school.[3] Furthermore, it stipulates subquotas, within these 50 percent, to racial and economic-based minorities. Federal tertiary education institutions in Brazil are widely recognized in the country for their high quality and are free of any charge. Therefore, competition for a spot is fierce. By reserving a substantial percentage of vacancies to certain demographic groups, the federal government increased incentives for public-school attendance in high school, especially for non-white and low-income individuals interested in progressing to higher education.

[1]See Fryer et al. (2008) and Ellison and Pathak (2021) for comprehensive analysis of color-conscious versus color-blind affirmative action in education in the US. See Horn and Flores (2003) for a comparison of the "Top N-percent Plans" adopted in three large states (Florida, Texas, and California).

[2]See Alon and Malamud (2014), Gallegos (2016), Thibaud (2019) and Sen (2021) for analysis of affirmative action policies with a socioeconomic criterion related to the individual's school in Israel, Chile, France and the UK.

[3]Public school attendance is used as a proxy of socioeconomic status. In Section 2, I give more details about public schools and how they compare to their private counterparts.

The adoption of QL creates a differential impact on each of the 94 federal institutions in Brazil, depending on their pre-reform levels of quotas. For example, some institutions already reserved as much as 50 percent of their vacancies to public-school students (e.g. Federal University of Juiz de Fora - UFJF). Others, however, had no quotas whatsoever (e.g. Federal University of Pernambuco - UFPE). In sum, QL exogenously imposes that all institutions adjust their quota levels to 50 percent, creating cross-sectional variation across institutions and a continuous treatment variable. My baseline analysis focuses on the universe of students of 9th grade, since transitions to the public system need to occur exactly between 9th and 10th grade for AA eligibility, of the fifty microregions in Brazil where there is at least one federal university. Although the effect of QL in each federal institution is observed, I do not know how a student in middle school is exposed to treatment affecting tertiary institutions. To circumvent this limitation, I construct a measure of exposure to treatment for students in 9th grade based on observed choices of pre-reform cohorts and on factors that affect college choice, such as place of residence and size of institutions.

I then use a two-way fixed effects model that compares changes in the average transition rates between the private and the public systems of 9th graders within the same school and microregion across time. The treated units are the schools located in microregions that experience variation in their levels of exposure to quotas. The controls, in contrast, are the schools located in microregions in which these levels stayed invariant. I estimate a dynamic specification with pre and post-periods, and show that coefficients for trends in pre-periods are close to zero and not significant.

Baseline results show that full exposure to QL increases movements of 9th graders from a private middle school to a public high school by 4.7 p.p. or 31% considering post years 2012 to 2016 jointly. This effect is stronger for non-whites, who benefit from an additional subquotas, and for females, who have a higher rate of persistence to higher education. I then show that movements are much higher among students attending 9th grade in low-SES and low-performing schools, and schools with a low probability of future federal higher education attendance. Movements also come entirely from the microregions with lower levels of segregation in the high school system. Taken together, these results suggest that individuals that choose to move from the private to the public system are the ones who likely benefit the least from private education and who face lower costs of transitioning to the public system.

I proceed by investigating what mechanisms explain these patterns of change in school choice. I show that the adoption of QL directly increases the probability of federal higher education attendance for public-school students and decreases the probability for private-school students. Also, students that move from the private to the public system induced by the reform indeed trade down and enroll in lower-SES and lower-performing public schools than their counterparts that stay in private schools. This shows that, as predicted by classical human capital theory, the decrease in returns to private-school investment pushes individuals at the margin to the public system. Second, I show that QL also increases movements to the public system among individuals of 10th or 11th grades, who are not directly affected by a change in the probability of higher education attendance. This suggests the existence of spillover effects on indirectly exposed cohorts, such as an increase in peer quality or an overall change in expectations regarding the quality of the public system. Finally, I show that the reform leads to private-school closure in the affected microregions three years after its implementation, suggesting that, in later periods, movements from private to public schools could also be rationalized by general-equilibrium effects in the school system.

My paper broadly contributes to the literature that investigates how AA in undergraduate education impacts pre-college outcomes. One strand of this literature focuses on how such policies affect human capital investments. Bodoh-Creed and Hickman (2018) develop a structural model of college admissions framed as a contest in which the outcome is decided by the students' choice of human capital. Cotton et al. (2018) use a simple version of this model to derive testable predictions and find, through an experimental approach, that AA increases effort levels of the benefited group, while not affecting the non-benefited students. Akhtari et al. (2020) shows that the reinstatement of race-based AA in Texas increases the pre-college human capital investment of minorities and decreases the racial gap in graduation. In contrast, Antonovics and Backes (2014) find no evidence that banning AA at the University of California affected human capital accumulation for high school students. In Brazil, Francis and Tannuri-Pianto (2012) and Estevan et al. (2019) find no behavioral effects of AA policies implemented in two different Brazilian universities on pre-college human capital accumulation, while Assunção and Ferman (2015) find that an AA policy implemented by the State University of Rio de Janeiro decreased investments by black students, the target group.

More related to this paper, a second strand of this literature investigates how AA policies in higher education that use the school as a criterion for eligibility affect students' choices and the school system. To the best of my knowledge, the two contributions in this topic focus on the consequences of the Top N-percent Plans in the United States. Cullen et al. (2013) compare students in Texas with and without strategic school choice opportunities before and after the policy change. They show that among the one-quarter of individuals identified as having the opportunity to change schools, 1.3% alter their choice. Among those also likely to be interested in attending a flagship university, the implied take-up rate is 5.8%. The authors argue that in the short run analyzed, the numbers of students affected is small enough that the impact on the distribution of peer quality across high schools is negligible. They recognize, however, that in the longer run, these changes in high school choice might become more systemic, and lower-achieving schools might be indirectly affected. Estevan et al. (2019) provide a framework that rationalizes some empirical regularities observed following the Top N-percent Plans and show theoretically that, due to general equilibrium effects in the form of a cascade, movements of students will not be confined to the ones close to the N% threshold in their original school. Empirically, they show that the Top N-percent policy in

Texas affects the high school system in the form of a decrease in ethnic segregation in 12th grade compared to 9th grade. Finally, they find that students who have moved schools in the 12th grade were more likely to choose their new school strategically than students in lower grades.

My paper adds to the literature in two key dimensions. First, I exploit a nationwide policy experiment and rich administrative datasets both at the individual and the school level, allowing the identification of mechanisms that were not previously shown in the literature. Both Cullen et al. (2013) and Estevan et al. (2019) use data of the state of Texas only and define their control group as students not directly affected by the Top Percent Plan (students without opportunity for strategic school choice in the former, and students in lower grades in the latter). These control groups, however, could be indirectly affected by spillover and general equilibrium effects of the policy, such as changes in peer quality or the segregation of schools, as both papers discuss. In my paper, instead, the nationwide QL reform allows me to define my control group as students of the same grade as the ones from the treated group, but that live in regions not exposed to the policy change. I then show clear causal evidence on the existence of indirect effects on students that, in principle, are expected to be unaffected - students in 10th and 11th grade in my case. Finally, I show that QL also leads to school closure within three years, showing that the potential for general equilibrium effects could be larger and more immediate than first anticipated in the literature.

Second, I provide clear evidence of the existence of changes in school-choice decisions following school-based AA in a context beyond the US. This gap in the literature is important, considering the increase in race-neutral AA interventions across the globe and that, in many settings, race-based AA is not legal or politically feasible (See Alon and Malamud (2014), Gallegos (2016), Thibaud (2019) and Sen (2021) for policies in Israel, Chile, France and the UK respectively). Despite some similarities in terms of overall objectives between QL and the Top N-percent Plans, the two AA initiatives are substantially different in terms of policy design and the institutional context in which they have been implemented. While the Top N-percent Plans are localized - as they were implemented at the state level -, QL is a nationwide aggressive quota-type policy that affected all federal institutions, including some of the best universities in the country, in a setting of high inequality and substantial returns to higher education. On the one hand, the institutional context in Brazil provides high incentives for a change in school choice, which might lead to larger policy effects. On the other hand, the substantial inequality of the country creates a highly segregated school system with a large public-private gap, increasing the costs for transitions between the public and the private system.[4] Therefore, it is not clear a priori whether this type of policy would lead to

[4]Brazil is the 11th most unequal country according to its Gini Index (World Development Indicators, 2019). One of the main roots of this inequality is, precisely, the educational system. In contrast with most developed countries, Brazilian educational expenditures are concentrated in tertiary, not on basic education. Brazil spends 3.8 thousand USD annually per student in primary education, while the OECD average is 8.7. In contrast, Brazil spends 11.7 thousand USD per student in tertiary education, similarly to European countries such as Italy (11.5) and Spain (11.8).

similar effects in settings of such heterogeneous costs and returns.

Finally, as with other papers in this literature, my work also contributes more generally to the study of unintended effects of educational policies in which individuals are graded relative to a certain group of peers. Calsamiglia and Loviglio (2019) shows that having better peers leads to worse grades in internal evaluations. When these grades are important determinants of future outcomes, movements to schools with relatively worse peers might occur. Since internal grades are used solely or as part of the admissions to determine access to subsequent education levels in many institutional contexts,[5] such unintended consequences on school choice decisions should be considered also when evaluating the efficacy of these policies.

The remaining of this paper is organized as following. In Section 2, I provide a background of the Brazilian educational system and of the implementation of QL. In Section 3, I describe the main datasets and explain how I construct the main sample, the treatment variable by institution and the measure of exposure to treatment. In Section 4, I present the baseline empirical strategy and discuss the identifying assumptions. In Section 5, I show the main results regarding the individual's school-choice response to QL, while in Section 6, I discuss the mechanisms. Finally, in Section 7, I provide different robustness exercises and, in Section 8, I conclude and present some policy implications of my findings.

2 Institutional Background

2.1 Brazilian Educational System

The basic mandatory education system in Brazil is comprised of 12 years of education. Grades 1 to 5 correspond to primary education, grades 6 to 9 to lower secondary, and grades 10 to 12 to upper secondary.[6] Students start first grade at age 6 and should finish high school at ages 17 or 18, before entering university. Although the government offers universal access to all grades of basic education, the public system coexists with a large number of private schools. According to the

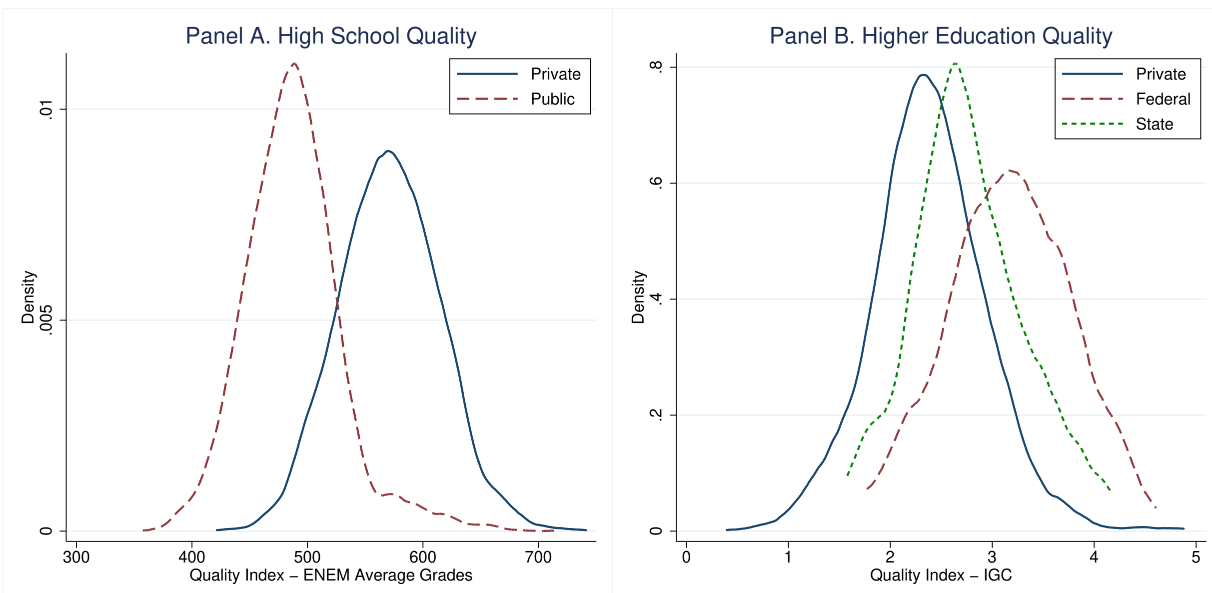
The OECD average is 16.1, due to countries with substantially higher average spending, such as the US (29.3) and the UK (24.5) (OECD, 2017). Nevertheless, access to higher education (especially public) is extremely unequal and returns are substantial. According to the Population Census of 2010, the share of college enrollment for individuals aged 18 to 22 is equal to 3.7 percent in the lowest quartile and 34.2 percent in the top quartile of family per capita income. In parallel, the earnings of workers with a tertiary degree are 2.5 times higher than the ones of workers with upper-secondary education. The OECD average is 1.56 (OECD, 2017). The adoption of QL aims, specifically, at mitigating this issue.

[5] According to Calsamiglia and Loviglio (2019) some examples of the use of internal grades in admissions include, for example: (i) Germany or Romania, where school track in secondary school depends on internal grades; (ii) Spain, Norway or Chile, where university admissions are determined through a centralized procedure for which a mix of internal and external grades determine priority in choosing major and university, or (iii) applications to selective institutions in USA or Canada that typically include GPA in high school.

[6] From 2013, pre-primary education for children aged 4 and 5 also became mandatory.

Census of Basic Education, in 2011, there were 151,544 active schools in Brazil, 82% offering only primary (grades 1-5) and lower-secondary education (grades 6-9), and the remaining 18% offering also upper-secondary levels (grades 10-12). Around 85% of those are public schools. Among the 26,944 schools that offer upper-secondary education, 71% are public. Apart from size, the public and private systems are very different in other key dimensions. Private schools are, on average, of better quality than their public counterparts. Of the top 100 high schools in Brazil, according to the National Standardized Exam of 2011 (ENEM), 93 are private. Moreover, from the 10,077 schools evaluated, the 4,799 private schools perform considerably better, as seen in Figure 1 Panel A. Additionally, private schools' socioeconomic level is substantially higher. For example, among the top decile of socioeconomic status, only 26% of schools are public, even if they represent 85% of all schools in the country.

Figure 1: Comparison between Private and Public Systems in Basic and Higher Education



Notes: Panel A shows the distribution of private and public high schools in Brazil according to the performance in the National High School Exam (*ENEM Escola 2011*). Panel B shows the distribution of private, federal, and state higher education institutions according to the performance in the *Índice Geral de Cursos 2012* (IGC), a quality index elaborated by the Ministry of Education based on performance evaluations of undergraduate and graduate programs.

In contrast, tertiary education presents an opposing scenario, with public institutions performing, on average, better than their private counterparts, as seen in Figure 1 Panel B. According to the Census of Higher Education, in 2012, right before the implementation of the Quota Law, the Brazilian higher education system was comprised of 2,416 institutions, 284 public and 2,132 private. The public system was a mix of Federal (103), State (116), and Municipal (65) institutions, corresponding, respectively, to 17, 9, and 1 percent of the total undergraduate enrollment of around 5.9 million students. Federal and State institutions are, by law, free of any charge. Private institutions, in contrast, charge tuition fees that may vary substantially, but were, on average, equal to 898 Brazilian Reais per month in 2017 (or 95.8% of the minimum wage)[7]. Public tertiary institutions (especially Federal) are widely recognized in the country for their average high quality. For instance, the federal institutions scored, on average, 3.2 on a scale of 0 to 5 of the *Índice Geral de Cursos 2012* (IGC), a quality index elaborated by the Ministry of Education based on performance evaluations of undergraduate and graduate programs. State institutions scored 2.8, and private institutions 2.4. Furthermore, among the universities only, 23 out of the best 25 are public, being 5 of the State administration and the other 18 Federal. On an alternative ranking - *Ranking Universitário Folha 2012*, elaborated by *Folha de São Paulo*, the newspaper of the highest circulation in Brazil - a similar pattern appears.[8] Among the top 25 universities, 17 are Federal, 6 are State, and 2 are private. Therefore, due to their high quality and free tuition, public tertiary institutions usually attract a large number of applicants.

2.2 The Quota Law in Higher Education

Access to public undergraduate education in Brazil is highly competitive. For example, according to the Centralized Admission System of 2016 (SISU 2016), 2,664,001 students applied to 242,864 vacancies in a Federal institution, a rate of 11 students per vacancy.[9] Therefore, only students with high grades can successfully obtain a spot in these competitive colleges.[10] As a consequence, access to public higher education in Brazil has historically been unequal. For instance, 85% of high-school students aged 16 to 18 go to a public school, while only 51% of incoming students in public higher education institutions are graduates from public high schools. Moreover, 47.5% of high-school students are non-white and go to a public school, while only 23% of first-year students in public universities come from the same demographic group (Brazilian Census 2010). From another angle, only 1.8% of students attending a public 9th grade in 2008 end up enrolling in a federal higher education in 2012, right after high school completion in a regular trajectory, contrasting with a rate of 12.8% for their private-school counterparts.

To improve equality in access to the federal tertiary education system, the government of Brazil

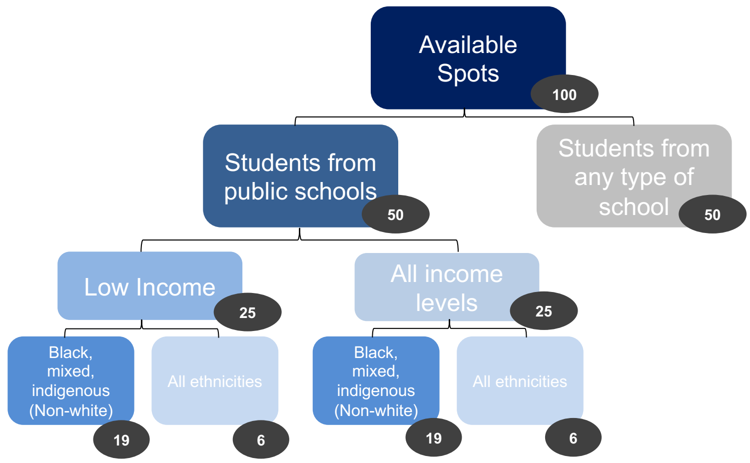
[7] According to data from *Mapa do Ensino Superior no Brasil 2017*, from the *Sindicato das Mantenedoras de Ensino Superior*. Information available at:https://educacao.uol.com.br/noticias/2017/08/28/mensalidade-de-curso-superior-no-brasil-custa-em-media-r-898-diz-estudo.htm .

[8] The yearly editions of the ranking can be obtained here: https://ruf.folha.uol.com.br/2012/rankings/rankingdeuniversidades/

[9] Considering SISU 2016.1 and 2016.2. In 2016.1 alone, the rate grows to 13.1 students per vacancy.

[10] Admissions processes to federal higher education institutions in Brazil are based, exclusively, on grades in one admission exam. Today, all federal institutions offer vacancies based on grades of the National Standardized Exam, mostly through a centralized admission system. Some of these institutions also offer part of their vacancies based on a specific exam elaborated by them. In any case, admissions are decided exclusively based on entrance exams, not taking into account high school performance.

Figure 2: Example of the Quota Law for the State of Bahia

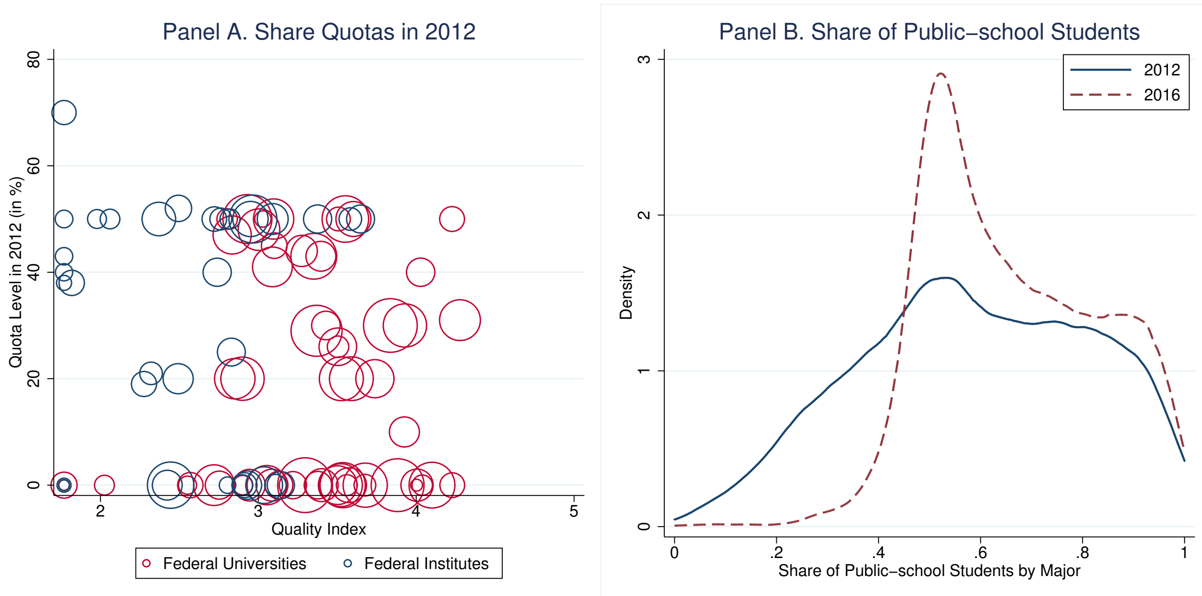


Notes: Of every 100 vacancies offered by each major in a federal institution, 50 are reserved to students that attended all three years of secondary education in a public school, while the other 50 are open for regular competitive entrance. From the vacancies reserved to public school students, half are also reserved to individuals from families of per capita income of less than 1.5 minimum wage. Finally, the State of Bahia has 77 percent of non-white individuals according to the Census of 2010. Therefore, 77 percent of the reserved vacancies have to be destined to the non-white. **Source:** own elaboration based on Law 12.711/2012.

approved Law 12.711 on August 29th 2012, the so-called "Quota Law" (QL). It establishes that 50% of all vacancies in each major at each federal institution has to be reserved for students that attended all three years of secondary education in a public school. Moreover, there are subquotas, within these 50%, destined to racial and economic minorities. Figure 2 shows an example of how QL was implemented in the State of Bahia. Take, for example, a major that offers 100 vacancies in the Federal University of Bahia. From these spots, 50 are reserved for students that attended all high school in a public school. Within these 50, 25 are reserved to public school students that belong to a family with a per capita income of less than 1.5 minimum wage. Also, within these 50, 38 are reserved to black, mixed, or indigenous students (non-white). The fraction of vacancies reserved for non-white students varies by state according to its share in the last Population Census.

By reserving 50 percent of vacancies at highly competitive institutions to public-school students, QL likely increases incentives for public-school attendance. Moreover, by establishing a national unique level of quotas for all federal institutions, it impacted differently each institution, depending on their pre-reform levels of quota adoption. For example, while some institutions already reserved as much as 50 percent of their vacancies to public-school students (e.g. Federal University of Juiz de Fora - UFJF), others had no quotas at all (e.g. Federal University of Pernambuco - UFPE). Figure 3 Panel A shows the level of quotas for public-school students adopted by each federal higher education institution in Brazil in the admission process of early 2012, before the national reform,

Figure 3: Descriptive Statistics of the Quota Law



Notes: Panel A plots the share of quotas reserved to public-school students by institution in 2012, before the implementation of the Quota Law. Each circle represents an institution and the size of the circle represents the number of incoming students in 2012. Panel B plots the share of public-school students by major-institution in the cohort of incoming students in the federal higher education in Brazil, in 2012 and 2016.

confirming the high degree of heterogeneity across institutions. Additionally, QL possibly creates a heterogeneous impact by majors within the same institution, depending on the actual share of public-school students enrolled in each program before the adoption. For instance, Figure 3 Panel B shows the distribution of public-school students by major in federal institutions in 2012, before QL, and in 2016, after the complete implementation of the policy. In 2012, a large portion of programs already had more than 50% of public school students. In spite of that, the distribution remarkably shifted to the right in 2016, largely as a result of the implementation of the reform. In sum, the adoption of QL creates a quasi-experiment for testing how affirmative action in undergraduate education impacts students' choices.

3 Data Sources and Construction

3.1 Census of Basic Education

This paper uses two main datasets. The first one is the Brazilian Census of Basic Education (CBE) from years 2008 to 2017. This is an administrative individual data of the universe of students enrolled in primary and secondary schools in Brazil. It is collected yearly by the National

Institute of Educational Studies and Research (INEP) of the Brazilian Ministry of Education and is publicly available. The individual module of the CBE contains basic demographic characteristics of students (e.g. gender, age, ethnicity) and unique individual and school identifiers. This allows for the construction of a panel dataset both at the individual and the school level across time.

To construct the main sample of analysis, I select all individuals enrolled in the final year of primary education - 9th grade - in year *t* from 2008 to 2016. Then, using the individual *id*, I link students from the CBE of cohort *t* with their own information in year *t+1* from 2009 to 2017. This allows the identification of students that advanced to the first year of upper-secondary education, 10th grade. Furthermore, I can identify whether individuals changed schools and, more importantly, whether they moved from their original educational system (from private to public or vice-versa). The transition between private to public schools between 9th and 10th grade is exactly the one that needs to occur for AA eligibility. This is why I focus on students from 9th grade in my baseline analysis. Later, in Section 6, I extend the sample and analyze transitions of other grade levels to study indirect mechanisms. Finally, to abstract from potential confounding effects, I drop all students that moved microregions from year *t* to *t+1*.

Since around 84% of individuals that attend higher education in Brazil do so in the same municipality where they resided around age 14 (Census of 2010), I restrict the sample to students that reside in a microregion where there is a federal *university*. Although only 50 out of the 509 microregions in Brazil have a federal university, these locations contain 45% of the country's total population, including all the State capitals and the Federal District (See Figure 4 for their location). By selecting this specific group of students, I focus on students that are more likely to attend federal higher education and, thus, are more directly exposed to the QL treatment.

Table 1 plots some descriptive statistics for the students of 9th grade of my baseline sample. Between 2008 and 2016, the share of students in the private system decreased from 83.5 to 79.1%, while movements from the private to the public system between 9th and 10th grade increased from 15.7% in 2008 to 20.7% in 2016. Movements from public to private schools remained relatively stable in a much lower level, varying from 1.8 to 1.4%. Finally, students from the private system are less likely to be non-white and female, more likely to live in urban areas and are on average younger than students from the public system.

I also use the CBE to construct a school-level panel dataset from 2008 to 2017 to study potential effects of QL on the school system. More details on this sample are presented in Section 6.

3.2 Treatment Data

The second main dataset used in this study is the Affirmative Action Quotas Data (Mello, 2021). It contains detailed information on the number of vacancies destined to each category of affirmative

Table 1: Descriptive Statistics

Cohort	Observations	Share	Move School	Non-white	Female	Urban	Age
Panel A: Individual-level Data - 9th Grade Private School							
2008	216,454	83.5	15.7	33.6	50.6	99.4	14.4
2009	228,906	83.0	15.2	33.7	50.6	99.3	14.4
2010	241,417	81.9	15.1	34.3	50.6	99.2	14.4
2011	253,370	81.0	15.3	34.1	50.6	99.3	14.4
2012	260,846	80.5	17.5	34.6	50.7	99.1	14.4
2013	266,720	80.2	18.4	34.6	50.7	98.9	14.4
2014	267,615	79.4	20.2	34.5	50.7	98.8	14.4
2015	249,721	79.5	20.8	35.5	50.5	98.7	13.9
2016	252,515	79.1	20.7	34.6	50.3	98.7	14.0
Panel B: Individual-level Data - 9th Grade Public School							
2008	1,094,923	16.5	1.8	58.0	52.2	92.7	15.4
2009	1,117,484	17.0	2.0	58.1	52.1	92.6	15.3
2010	1,094,331	18.1	2.1	58.4	51.9	92.1	15.2
2011	1,080,944	19.0	2.1	58.6	51.9	91.9	15.2
2012	1,077,766	19.5	1.8	58.6	51.4	91.7	15.2
2013	1,082,408	19.8	1.9	58.1	51.2	91.5	15.0
2014	1,032,519	20.6	1.6	58.7	50.9	91.3	15.0
2015	966,532	20.5	1.5	59.5	50.9	90.6	14.5
2016	955,062	20.9	1.4	59.5	50.7	90.7	14.5

Notes: This table plots descriptive statistics for each cohort of 9th graders, originally from private (Panel A) and from public schools (Panel B). *Share* refers to the proportion of the group in the population. *Move School* is the proportion of students that moved to the alternative system of education. For example, in panel A, it refers to the proportion of private-school students that moved to a public school in 10th grade. In panel B, it refers to the proportion of public-school students in 9th grade that moved to a private school in 10th grade.

action quotas at each public higher education institution in Brazil from 2010 to 2015. I constructed this dataset by collecting information on public documents of admission processes (*Editais*) and by directly contacting institutions through the Electronic System of Information of the Federal Government (e-SIC). The data is complemented with the Census of Higher Education of 2012, in which I gather information of the type, municipality, and state of the institution.

I keep only information of AA adoption of the admission processes for incoming students in 2012, the last one before the implementation of the Quota Law. Since QL only directly affects federal institutions, I drop all state universities from the sample. I compute variable $Q_{u,2012}$, which measures the percentage of quotas at institution u of microregion m destined to students that attended all secondary education in a public school in year 2012. I, then, construct variable

$Treat_{u,m} = 2(0.5 - Q_{u,2012})$, that measures how institution u is treated by the QL reform. If the institution had no quotas in 2012 ($Q_{u,2012} = 0$), $Treat_{u,m} = 1$. On the other hand, if it already had 50 percent of reserved vacancies before the implementation of the law, then $Treat_{u,m} = 0$. If $0 < Q_{u,2012} < 0.5$, $Treat_{u,m}$ will assume a value between zero and one. Intuitively, $Treat_{u,m}$ measures how each federal institution in Brazil was exposed to QL, based on their pre-reform level of quota adoption. Although different institutions had different levels of quotas $Q_{u,2012}$ due to specific (probably non-random) university policy, the adoption of the national law forces all institutions to reach the same level of 50%. This adjustment creates a specific pattern of variation across institutions and microregions that is unlikely to be correlated with other time-varying confounders, providing an exogenous variation used to identify the causal effects of the policy.

Although I directly observe how the QL reform affects all Brazilian tertiary federal institutions that offered vacancies in 2012, I do not know how students in middle or high school respond to changes happening at the higher education level. To obtain a proxy for that, I proceed in two steps. First, I create a measure of treatment by microregion by aggregating all $Treat_{u,m}$ of the same locality:

$$Treat_m^1 = \frac{\sum_{u=1}^{n} Weight_{u,m} x Treat_{u,m}}{\sum_{u=1}^{n} Weight_{u,m}}. \tag{1}$$

where $Weight_{u,m}$ is the size of each institution, measured by the number of new vacancies offered by the institution in 2012. Note that if the microregion has only one federal university, $Treat_m^1 = Treat_{u,m}$.

According to the Population Census of 2010, 84% of individuals that attend higher education report no inter-municipal migration after age of 15. Thus, since location of residence is such an important determinant of future higher education attendance, $Treat_m^1$ could be used directly as a proxy of how students of 9th grade are exposed to treatment happening at the higher education level. Yet, I construct a more comprehensive measure of exposure that incorporates the possibility that individuals might be affected by institutions outside their microregion m. I use the Census of 2010 and restrict data to individuals aged 25 or less that report to currently attend college. Then, I observe the municipality where individuals used to live *before college*.[11] Using this information, I construct the following measure:

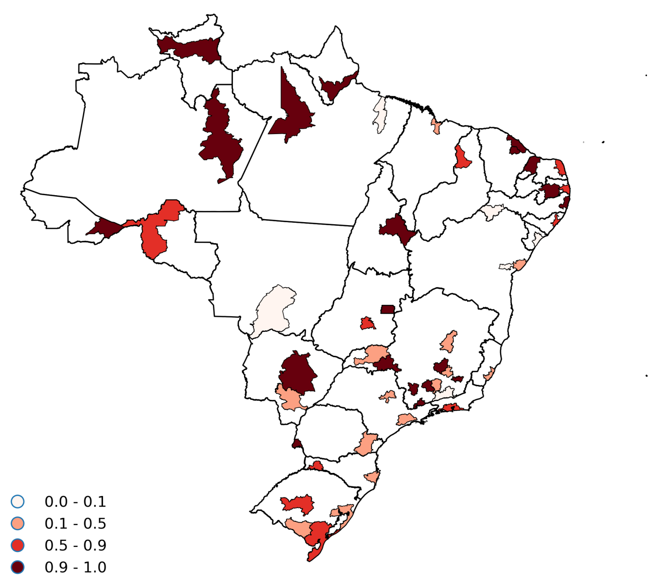
$$Treat_m^2 = \theta_m x Treat_m^1 + \sum_{r \neq m} \theta_r Treat_r^1 \tag{2}$$

In this case, the variable $Treat_m^1$ for microregion m is weighted by θ_m, the percentage of

[11] Among all the students that attend college in the Census of 2010, 64 percent report to do so in the same municipality where they were born, while 20 report to have moved to their current city before age 15. The remaining 16 percent of students report having moved from age 15 onwards. These are the ones I assume could have moved specifically for college.

individuals that lived in m before college and stays in m to attend a public higher education institution. Additionally, it includes component $\sum_{r \neq m} \theta_r Treat_r^1$, where θ_r is the percentage of individuals that lived in m before college and moved to r (any of the other 49 microregions) to attend a public college. Take, for example, the case of the microregion of *Chapecó*, located in the State of *Santa Catarina*, south of Brazil. Of all students that used to live in *Chapecó* before college and that attend a public tertiary institution, 81.2 percent do so in *Chapecó*. Additionally, 14.7 percent move to *Florianópolis*, the capital of *Santa Catarina*, 1.5 percent move to *Curitiba*, 1.5 percent to *Juiz de Fora* and 1 percent to *Pelotas*. Moves to all other cities are negligible (less than 0.5 percent). Therefore, variable $Treat_{Chapeco}^2$ is based on the weighted average that attributes 81.2 percent for the microregion of *Chapecó* itself and 18.8 percent to all these other microregions, accordingly. Note that, out of the 50 microregions considered, θ_m for the median one is 96.8 percent. Therefore, while $Treat_m^2$ is conceptually a better measure, results are very similar to specifications that use $Treat_m^1$. For the sake of simplicity, I only report the complete set of results for treatment as defined in $Treat_m^2$ and, in the remaining of this paper, I refer to $Treat_m^2$ as simply $Treat_m$. Results with treatment defined as in $Treat_m^1$ are presented in Table B.1.

Figure 4: Distribution of Treatment Variable



Notes: This map shows the location of the 50 microregions in Brazil with a federal university. The microregions are colored according to their level of treatment $Treat_m^2$, which can vary from zero (not-treated) to 1 (fully-treated).

Figure 4 shows the distribution of variable $Treat_m$ and the location of the 50 microregions with a federal university. First, note that they are spread in different regions of Brazil. As determined by federal law, all states need to have at least one federal university. Second, note that they are relatively far from each other, minimizing concerns of spillover effects. Third, note that variable $Treat_m$ is sufficiently distributed between values zero and one. Although 20 out of 50 microregions are highly treated ($Treat_m > 0.9$), 30 microregions have values of $Treat_m$ that vary from 0 to 0.9. It is this variation that allows for the causal identification of the effect of QL.

3.3 Other Datasets

Additionally, this paper uses numerous smaller supporting datasets. Microregion time-varying controls such as population and local public spending are obtained from IPEAdata. GDP per capita and value-added by sector are obtained from the Brazilian Institute of Geography and Statistics (IBGE). Different moments of local income of the formal sector (mean and percentiles 5, 10, 25, 50, 75, and 90) are computed from the RAIS Microdata. Finally, school characteristics such as the performance in the National Standardized Exam (*ENEM Escola*) and the socioeconomic status index (*INSE*) are gathered from the INEP School Indicators.

4 Empirical Strategy

I use a dynamic differences-in-differences design to study how the QL reform affects school choice. My main empirical model is:

$$Y_{imst} = \beta_t \sum_{t=2008}^{2010} Year_t Treat_m + \beta_t \sum_{t=2012}^{2016} Year_t Treat_m + \gamma X_{imst} + \delta X_{mt} + \alpha_s + \alpha_t + \varepsilon_{imst} \quad (3)$$

where Y_{imst} is the outcome of student i, microregion m, school s and time t. Equation (3) is estimated separately for students attending 9th grade in a private and a public school. For students attending a private (public) school, Y_{imst} takes the value 1 if he or she moved to a public (private) school for 10th grade, and value zero if he or she advanced to 10th grade but stayed in a private (public) school. The treatment variable $Treat_m$ defines how individual i was exposed to the QL reform, depending on the microregion where he or she attended 9th grade, as explained in the previous section. This variable is interacted with a dummy for each cohort t from 2008 to 2016. The reform was announced in August of 2012. Therefore, the first cohort I expect to be influenced is exactly the one finishing 9th grade in that year.[12] In this specification, years 2008 to 2010 serve as pre-periods, 2011 is the baseline year (which is omitted from the regression) and cohorts 2012 to 2016 are treated.

[12]Note that to benefit from QL, students need to stay the full 3 years of high school in a public institution. Therefore, students already enrolled in secondary education cannot benefit from the Quota Law.

The vector X_{imst} identifies individual controls, such as gender, age, ethnicity, and urban status. Time-varying microregion controls, defined by vector X_{mt}, include local population, GDP per capita, value-added of agriculture, industry, service and public administration, total public spending and public spending in education (at the microregion and the state levels), and different moments of labor income of the formal sector of the locality (mean and percentiles 5, 10, 25, 50, 75 and 90). The inclusion of these covariates aims to control, mainly, for changes in the economic activity of the locality that might affect the decisions of families to enroll their children in a public school in lieu of the private system. Finally, I include school fixed effects α_s (which also absorb microregion fixed effects) and time-fixed effects α_t. Standard errors are clustered at the microregion level.

The main identifying assumption for causal interpretation of parameters β_{2012} to β_{2016} is that dynamics in the outcome variable for treated and control units would have been similar in absence of the treatment. The presence of school-microregion fixed effects absorbs all unobservable time-invariant characteristics at school or microregion that might be correlated with the outcome. However, the existence of time-varying unobservable characteristics that are correlated with the outcome could still be a threat to causal identification. To minimize this concern, I include pre-periods 2008 to 2010. If pre-trends are parallel, I expect to find coefficients β_{2008}, β_{2009} and β_{2010} to be close to zero and insignificant. This would provide suggestive evidence that trends between treated and control microregions, in absence of treatment, would likely have been parallel also between 2011 and post-reform years.

Results are presented in the form of event-study graphs following the specification of equation (3) and through regression tables following the specification below, in which years 2008 to 2010 are aggregated in the dummy $Before_t$ and post periods 2012 to 2016 are aggregated in the dummy $Post_t$:

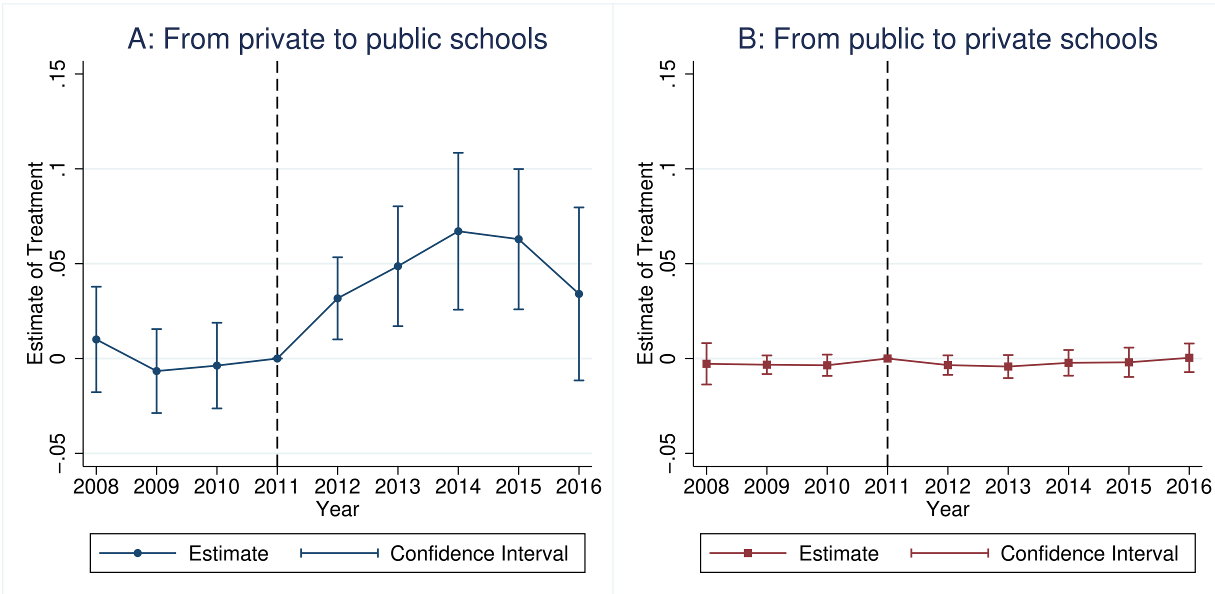
$$Y_{imst} = \beta_1 Before_t Treat_m + \beta_2 Post_t Treat_m + \gamma X_{imst} + \delta X_{mt} + \alpha_s + \alpha_t + \varepsilon_{imst}. \tag{4}$$

5 High School Choice

5.1 Main Results

Figure 5 shows the event-study graph from an OLS regression of equation (3). According to Panel A, a full adoption of QL increases movements of 9th graders from private to public schools by 3.2 p.p. in 2012, 4.9 p.p. in 2013, 6.4 p.p. in 2014, 6.3 p.p. in 2015 and 3.4 p.p. in 2016. All coefficients are highly statistically significant, except the one for the cohort of 2016. Moreover, the coefficients for years 2008, 2009 and 2010 are close to zero and insignificant, corroborating the identifying assumption of parallel trends between treated and control groups.

Figure 5: Estimate of Treatment Effects between School Systems



Notes: This figure plots the estimates of the treatment effects of QL on movements of 9th graders to secondary school following equation (3). Year 2011 is the baseline, 2008 to 2010 are pre-periods and 2012 to 2016 are treated periods. CI are 95% confidence intervals. Specifications include cohort and school FE, individual and microregion time-varying controls, as defined in Section 4.

Since the reform was approved on August 29th 2012, the cohort of 9th graders of 2012 had less time to respond to changes, if compared to later cohorts. The academic year in Brazil goes from February to December and children need to enroll in public schools around October of the preceding year. Therefore, the 2012 cohort had approximately two months (September and October) to respond to the policy change. Later cohorts, on the other hand, had over a year to adjust. This could partially explain the difference in magnitude between the estimates for year 2012 and later years. The full effect of the reform is observed three to four years after adoption, in the cohorts of 2014 and 2015. Finally, the effect seems to reduce in 2016. It is possible that, as time passes, part of the movements between private to public schools occur in earlier grades, reducing the magnitude of the movement from 9th to 10th grade in the cohort of 2016.

In turn, one could expect that due to the increase in incentives for public-school attendance, movements from the public to the private system would decrease. Panel B shows that this does not occur. This is possibly due to the fact that, before QL, these movements were already too low. In 2011, only 2.2 percent of 9th graders that attended a public school moved to a private school in 10th grade.

Table 2 shows the results of the OLS estimation of different specifications of equation (4). Column (1) includes only time and microregion fixed effects. Column (2) adds school fixed effects.

Table 2: Effects of QL on School Movements

	(1)	(2)	(3)	(4)
	Panel A: Moves from Private to Public School			
$Treat_m.Before_t$	-0.010	-0.010	-0.010	-0.000
	(0.010)	(0.009)	(0.009)	(0.009)
$Treat_m.Post_t$	0.054**	0.051***	0.050***	0.047***
	(0.022)	(0.017)	(0.016)	(0.014)
N	1932553	1932498	1932498	1932498
	Panel B: Moves from Public to Private School			
$Treat_m.Before_t$	-0.001	-0.002	-0.002	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)
$Treat_m.Post_t$	-0.003	-0.003	-0.003	-0.003
	(0.004)	(0.003)	(0.003)	(0.003)
N	7034547	7034484	7034484	7034484
Time FE	Yes	Yes	Yes	Yes
Microregion FE	Yes	Yes	Yes	Yes
School FE		Yes	Yes	Yes
Individual Controls			Yes	Yes
Microregion Controls				Yes

Notes: This table plots the estimates of the treatment effects of QL on movements of 9th graders of a private (public) school to a public (private) secondary school. The year 2011 is the baseline, 2008 to 2010 are pre-periods (Before) and 2012 to 2016 are treated periods (Post). Standard errors are shown in parenthesis and are clustered at the microregion level. Individual controls include gender, age, ethnicity, and urban status. Time-varying microregion controls include local population, GDP per capita, value-added of agriculture, industry, service and public administration, total public spending, and public spending in education (at the microregion and the state levels), and different moments of labor income of the formal sector of the locality (mean and percentiles 5, 10, 25, 50, 75 and 90). * p<0.1, ** p<0.05, *** p<0.01.

Column (3) includes individual-level controls for gender, age, ethnicity and urban status. Finally, column (4) adds an extensive vector of microregion time-varying controls related to the economic and demographic structure of localities. Results are extremely robust across all specifications. According to column (4) of Panel A, the QL reform increased movements from private to public schools by 4.7 percentage points considering post periods 2012 to 2016 jointly. This represents an increase of 30.7% compared to the movement rate of 15.3% in 2011.

5.2 Heterogeneity

As mentioned previously, in addition to the quotas destined to public-school students, the QL reform reserved subquotas to individuals self-declared as black, mixed, or indigenous (non-white). Therefore, this demographic group has higher incentives for a change in the choice of school. This pattern is confirmed in Table 3 Columns (2) and (3). Full adoption of QL increases moves from private to public school by 7.1 p.p. for non-whites, compared to 3.6 p.p. for whites. Estimates are statistically different at the 1% level. The event study graph is shown in Figure A.1 in the Appendix.

Table 3: Effects of QL on School Movements by Ethnicity and Gender

	(1)	(2)	(3)	(4)	(5)
	All	Non-white	White	Female	Male
$Treat_m.Before_t$	-0.000	0.001	-0.002	0.003	-0.003
	(0.009)	(0.016)	(0.007)	(0.009)	(0.011)
$Treat_m.Post_t$	0.047***	0.071***	0.036***	0.054***	0.039**
	(0.014)	(0.018)	(0.012)	(0.014)	(0.015)
N	1932498	311799	639719	991765	940564
Mean in Baseline	0.153	0.209	0.125	0.149	0.156
Test difference between groups		F(1,49) = 8.90 Prob>F = 0.0044		F(1,49) = 3.69 Prob>F = 0.0607	

Notes: This table plots the estimates of the treatment effects of QL on movements of 9th graders of a private school to a public secondary school by gender and ethnicity. The year 2011 is the baseline, 2008 to 2010 are pre-periods (Before) and 2012 to 2016 are treated periods (Post). Standard errors are shown in parenthesis and are clustered at the microregion level. All columns include time, microregions, and school fixed effects, in addition to individual and microregion controls, following equation (3). Individual controls include gender, age, ethnicity, and urban status. Time-varying microregion controls include local population, GDP per capita, value-added of agriculture, industry, service and public administration, total public spending, and public spending in education (at the microregion and the state levels), and different moments of labor income of the formal sector of the locality (mean and percentiles 5, 10, 25, 50, 75 and 90). The F-test tests whether coefficients for groups are statistically different. * p<0.1, ** p<0.05, *** p<0.01.

Table 3 Columns (4) and (5) compare the heterogeneity of results by gender. Full adoption of QL increases moves from private to public school by 5.4 p.p. for males, compared to 3.9 p.p. for females, although estimates are only statistically different at the 10% level. This heterogeneity could be rationalized by the fact that females are more likely to enroll and complete high school, and, later, enroll in higher education.[13] Therefore, since females are ex-ante more likely to aspire to enroll in tertiary education, it could be expected that they are the subgroup more affected by changes in higher education policy.

[13]The rate of completion of higher education among Brazilians aged 27 to 30 was 25.6% among females and 18.7% among males in 2019 (IBGE).

Table 4: Effects of QL on School Movements by School Characteristic

	(1)	(2)	(3)	(4)
	A: School Socioeconomic Status		B: School Probability of Higher Ed Attendance	
	Top Quartile	Below Top Quartile	Prob > 5%	Prob <= 5%
$Treat_m.Before_t$	0.008	-0.004	-0.002	0.015
	(0.005)	(0.009)	(0.008)	(0.019)
$Treat_m.Post_t$	0.005	0.064***	0.018**	0.108***
	(0.005)	(0.017)	(0.009)	(0.023)
N	563435	928740	837918	814649
Mean in baseline	0.04	0.15	0.09	0.19
	C: School Performance in National Exam		D: School System Segregation Level	
	Above Median	Below Median	Above Median	Below Median
$Treat_m.Before_t$	0.000	-0.005	-0.006	0.011
	(0.006)	(0.016)	(0.010)	(0.010)
$Treat_m.Post_t$	0.030***	0.063***	0.000	0.085***
	(0.008)	(0.022)	(0.008)	(0.020)
N	953101	979397	948707	983791
Mean in baseline	0.08	0.23	0.12	0.18

Notes: This table plots the estimates of the treatment effects of QL on movements of 9th graders of a private school to a public secondary school by (a) Panel A: school socioeconomic status (INSE 2011-2013); (b) Panel B: school probability of future federal higher education attendance; (c) Panel C: school performance at the ENEM National Exam (ENEM Escola 2011) and (d) Panel D: School system segregation level (Duncan Index 2011). The year 2011 is the baseline, 2008 to 2010 are pre-periods (Before) and 2012 to 2016 are treated periods (Post). Standard errors are shown in parenthesis and are clustered at the microregion level. All columns include time, microregions, and school fixed effects, in addition to individual and microregion controls, following equation (3). Individual controls include gender, age, ethnicity, and urban status. Time-varying microregion controls include local population, GDP per capita, value-added of agriculture, industry, service and public administration, total public spending, and public spending in education (at the microregion and the state levels), and different moments of labor income of the formal sector of the locality (mean and percentiles 5, 10, 25, 50, 75 and 90). * p<0.1, ** p<0.05, *** p<0.01.

In Table 4, I exploit heterogeneity of results with respect to students' school of origin. Panel A shows that movements from private to public schools come entirely from students attending schools at the bottom of the distribution of socioeconomic status, as measured by the INSE 2011-2013 (*Índice de Nível Socioeconômico das Escolas de Educação Básica*), an index computed by INEP. In Panel B, I use pre-reform data from the cohort of 2008 to compute the predicted probability that a student from 9th grade of each school in Brazil will enroll in federal higher education.[14] Results show that movements from private to public schools induced by QL are of 1.8

[14] I use data from the cohort of 2008, which was not affected by QL, to predict the likelihood that students from a certain middle school will enroll in federal higher education. I regress a dummy that takes the value one if the 9th grader enrolls in federal higher education upon conclusion of high school on individual characteristics (ethnicity, gender, urban status, age, and disability) and on a vector of school fixed effects. Then, I divide schools into two groups, based on these predicted fixed effects.

p.p. in schools with a high probability of federal higher education attendance (more than 5%) and of 10.8 for students coming from schools with a low probability (less than 5%). Similarly, Panel C Column (2) shows that movements are much higher (6.3 p.p.) among students coming from schools below the median of the distribution of performance in the National Standardized Exam (*ENEM Escola 2011*).

Taken together, results from Table 4 Panels A-C show that movements from private to public schools come from students enrolled at 9th grades of comparatively lower socioeconomic status, lower predicted probability of federal higher education attendance, and lower-performing schools. This suggests that, by increasing the *value* of public school, QL pushes some students from the private to the public system. These are individuals interested in public tertiary education, but that, most likely, benefit the least from the investment in private-school tuition. In contrast, students that stay in private schools are the ones with a stronger preference for this type of institution, even after QL increased the value of public school for all individuals. These are, likely, individuals that benefit more from private school attendance.

Finally, Panel D shows results separately by the level of segregation of the high school system of the microregion of the student. Using pre-reform data from 2011, I compute the Duncan Index of School Segregation at 10th grade based on students' school status (public or private) in 9th grade. Results show that movements from private to public schools come almost entirely from microregions of lower segregation. These are microregions with less unequal (more integrated) high school systems. Thus, the costs of moving away from the private system are likely to be lower in these localities.

6 Mechanisms

Direct effects: Changes in Returns to Investments. Different mechanisms could explain the results observed in Section 5. According to classical human capital theory (Becker, 1994), non-credited constrained families would invest in private-school tuition to maximize children's future productivity. This increased productivity could come from higher value-added acquired by attending a (higher quality) private school or a (higher quality) federal higher education institution.

However, QL directly changes the probability of federal higher education attendance depending on the type of high school. Table 5 shows that QL decreases in 4.9 p.p. the probability of federal higher education attendance for the cohort of 9th graders attending a private school in 2012, while it increases in 1.2 p.p. the probability of federal higher education attendance for a 9th grader of a public school. Therefore, if families value federal higher education attendance, QL decreases the value of investing in private-school tuition.

This would lead individuals that are at the margin (who benefit less from the investment in

Table 5: Enrollment in Federal Higher Education

	(1)	(2)	(3)	(4)	(5)	(6)
	Private School Students			Public School Students		
	All	Switchers	Stayers	All	Switchers	Stayers
Treat x [2012]	-0.049***	-0.002	-0.061***	0.012**	-0.054	0.012***
	(0.015)	(0.02)	(0.018)	(0.005)	(0.043)	(0.004)
N	310165	54904	255261	1202687	22656	1180031

Notes: This table plots the estimates of the treatment effects of QL on the probability of enrollment in federal higher education for the cohort of 2012 of students from 9th grade. Year 2008 is the baseline. Standard errors are shown in parenthesis and are clustered at the microregion level. Individual controls include gender, age, ethnicity and urban status. Time-varying microregion controls include local population, gdp per capita, value added of agriculture, industry, service and public administration, total public spending and public spending in education (at the microregion and the state levels), and different moments of labor income of the formal sector of the locality (mean and percentiles 5, 10, 25, 50, 75 and 90). * p<0.1, ** p<0.05, *** p<0.01.

private schools) to shift to the public system. They would trade part of the value-added obtained from a private school for a higher probability of future federal higher education attendance obtained from public schools. Unfortunately, I cannot observe individual performance to compute school value-added. However, in Table 6, I provide suggestive evidence that students that move from private to public schools indeed trade down and move to poorer and lower-performing schools. To do so, I use a pre-reform measure of school socioeconomic status and performance. Specifically, each individual is matched to the socioeconomic status and performance grade of the school he or she decided to attend in 10th grade. Importantly, I use a school outcome computed based on pre-reform cohorts. Then, I estimate the following OLS regression:

$$DestinySchoolLaggedOutcome_{imst} = \beta MovePublic_{imst} + \gamma X_{imst} + \delta X_{mt} + \alpha_s + \alpha_t + \varepsilon_{imst}, \quad (5)$$

where $DestinySchoolLaggedOutcome_{imst}$ is the pre-reform time invariant school outcome defined for the high school in which student i, who attends 9th grade at school s, enrolls in 10th grade. As before, subscript m defines the microregion of treatment and subscript t the year of cohort. The parameter β measures the effect on the outcome if student i moves from a private to a public school. In a standard OLS specification, β would be biased, since individuals that move from a private to a public school are different in both observables and unobservables from the ones that decide not to move. However, the introduction of QL exogenously pushes students to public schools, compared to their counterparts in cohorts and regions not affected by the reform. Therefore, I use the introduction of QL as an instrumental variable (IV).

The instrument is exactly the interaction between $Treat_m$ and the dummy $Post_t$, which takes

Table 6: Characteristics of School of Destiny (10th Grade)

	(1)	(2)	(3)	(4)
Estimation	1st Stage	Red. Form	IV	OLS
Panel A:	Move to Public	*School of 10th Grade Socioeconomic Status*		
Move to Public			-0.979***	-0.930***
			(0.161)	(0.059)
$Treat_m x Post_t$	0.044***	-0.043***		
	(0.013)	(0.011)		
N	1835447	1835447	1835447	1835447
Kleibergen-Paap rk LM statistic			7.538	
Kleibergen-Paap F statistic			11.70	
Panel B:	Move to Public	*School of 10th Grade Performance National Exam*		
Move to Public			-0.824***	-0.449***
			(0.262)	(0.079)
$Treat_m x Post_t$	0.031***	-0.025***		
	(0.008)	(0.009)		
N	1316608	1316608	1316608	1316608
Kleibergen-Paap rk LM statistic			8.186	
Kleibergen-Paap F statistic			15.17	

Notes: This table shows how QL impacts the characteristics of the school of destiny (in 10th grade) of students affected by the reform in 9th grade. In Panel A, the school of destiny outcome is the average lagged pre-reform level of the socioeconomic index (INSE 2011-2013). In Panel B, it is the lagged school performance in the National Standardized Exam (ENEM Escola 2011). Column (1) shows how the introduction of QL affects movements from private to public schools. Column (2) shows how QL affects the school of destiny outcome (reduced form equation). Column (3) shows the IV results, in which movements from public to private schools are instrumented by the QL reform. Column (4) shows the OLS equation (5). All specifications include time and school fixed effects, individual and regional controls. * p<0.1, ** p<0.05, *** p<0.01.

the value zero for pre-periods 2008-2011 and the value 1 for post-periods 2012-2016. Panel A shows results in which $DestinySchoolLaggedOutcome_{imst}$ equals the time-invariant pre-reform school of 10th grade socioeconomic index (INSE 2011-2013). Column (1) shows the first stage: the introduction of QL increases movements from private to public schools by 4.4 p.p. on average. Column (2) shows the reduced form estimates. The adoption of QL induces private-school students to attend high schools that are, on average, 0.04 standard deviations lower in terms of their socioeconomic index. Finally, Column (3) presents the IV estimates, in which movements from private to public schools are instrumented by QL. It shows that movements from private to public schools driven by QL induce students to attend a high school that is 0.98 standard deviations lower in terms of its socioeconomic index than their comparable counterparts.

Table 6 Panel B shows results analogous when $DestinySchoolLaggedOutcome_{imst}$ is the time-invariant pre-reform school of 10th-grade average performance at the National Standardized Exam (ENEM Escola 2011). Column (3) shows that movements from private to public schools driven by QL induce students to attend a high school that is 0.82 standard deviations worse in terms of grades. In sum, these results show that movers (compliers) end up attending high schools that are poorer and worse in overall performance than the schools they would have attended in absence of QL. They are in line with what Cullen et al. (2013) and Estevan et al. (2019) found in the analysis of the Top Percent Plan in Texas.

Taken together, results from this Section show that by increasing the probability of federal higher education attendance between public-school students, QL induces movements from private to public schools for individuals at the margin. These individuals are willing to trade the higher value-added obtained from a private school for an increase in the probability of attending higher quality federal higher education.

Indirect effects: Peers and Expectations. In addition to its direct effects on returns to investment, QL might also lead to indirect effects through changes in peer composition and expectations. For instance, students coming from private schools might increase the peer quality of public schools, increasing the overall *value* of public schools beyond what would have been expected only through an increase in the probability of federal higher education attendance. Similarly, even if the initial quality of peers stays invariant, families might expect future positive changes in peer quality and network, since more peers from the public school will likely enter federal higher education. Unfortunately, I cannot directly test whether QL impacts peer quality or families' expectations. Yet, Table 7 shows some suggestive evidence on the existence of these indirect effects.[15]

It shows movements from private to public schools of students from grades 6th to 11th. In baseline, I focused on movements from 9th to 10th grade because students needed to move exactly on this transition to become beneficiaries of QL. Yet, Table 7 shows that QL also induces an increase in movements to public schools in other grades. Columns (1) to (3) show that QL has an effect of around 2 p.p in movements to public schools among cohorts of students from 6th to 8th grade. Since moving to a public school might be costly in terms of value-added (as shown in Table 6), one could expect that families would delay this transition as much as possible. Thus, the existence of such movements in grades 6th to 8th could imply a more generalized increase in the value families give to public schools (although an anticipation effect of families that want to save on private-school tuition could not be ruled out in these cases.)

Results from columns (5) and (6) show more transparent evidence corroborating this argument. QL leads to an increase in 1.4 percentage points in movements from private to public schools in 10th and 11th grades. Importantly, individuals moving in these transitions *cannot* directly benefit

[15]Figure A.2 shows the analogous even-study graph.

from QL due to the rules determined by the policy (individuals need to transition in 9th grade at the latest). Thus, the existence of movements in these specific grades can only occur in presence of indirect incentives, such as an increase in the quality of peers at the school level or an increase in the subjective value of public schools.

Table 7: Moves from Private to Public School in All Grades

	(1)	(2)	(3)	(4)	(5)	(6)
	6th	7th	8th	9th	10th	11th
$Treat_m.Before_t$	0.006	0.008*	0.006	-0.000	0.002	0.002
	(0.004)	(0.004)	(0.004)	(0.009)	(0.004)	(0.004)
$Treat_m.Post_t$	0.018***	0.023***	0.021***	0.047***	0.014***	0.014***
	(0.005)	(0.005)	(0.006)	(0.014)	(0.005)	(0.004)
N	2227171	2144248	2071978	1932498	1668277	1578383
Mean in Baseline	0.046	0.040	0.035	0.153	0.038	0.027

Notes: This table plots the estimates of the treatment effects of QL on movements of 9th graders of a private school to a public secondary school for grades 6th to 11th separately. The year 2011 is the baseline, 2008 to 2010 are pre-periods (Before) and 2012 to 2016 are treated periods (Post). Standard errors are shown in parenthesis and are clustered at the microregion level. All columns include time, microregions, and school fixed effects, in addition to individual and microregion controls, following equation 3. Individual controls include gender, age, ethnicity, and urban status. Time-varying microregion controls include local population, GDP per capita, value-added of agriculture, industry, service and public administration, total public spending, and public spending in education (at the microregion and the state levels), and different moments of labor income of the formal sector of the locality (mean and percentiles 5, 10, 25, 50, 75 and 90). * p<0.1, ** p<0.05, *** p<0.01.

Spillovers and General Equilibrium Effects. Finally, there is the possibility of spillover and general equilibrium effects on the school system that might generate additional effects on school movement. For example, movements from private to public schools might induce changes in school size, in the value of private-school tuition, and finally, on the number of schools in the market.

To investigate that, I build a balanced panel data containing all the schools that offered high school education in year 2009 and follow them until 2017. Then, I estimate the following model at the school level:

$$Y_{smt} = \beta_t \sum_{t=2009}^{2011} Year_t Treat_m + \beta_t \sum_{t=2013}^{2017} Year_t Treat_m + \delta X_{mt} + \alpha_m + \alpha_t + \varepsilon_{smt}, \qquad (6)$$

where the outcome Y_{smt} for school s, from microregion m, at time t is either the number of students at the school (from grades 6th to 12th) or a dummy that takes the value 1 if the school remains active or the value zero if it becomes inactive or closes. In this case, 2012 is the baseline year, as effects at school level are only expected from the school-year beginning from year 2013 on. Years 2009 to 2011 are the pre-periods. The model includes microregion and year fixed effect and time-varying microregion controls.

Table 8: Effects on the High School System

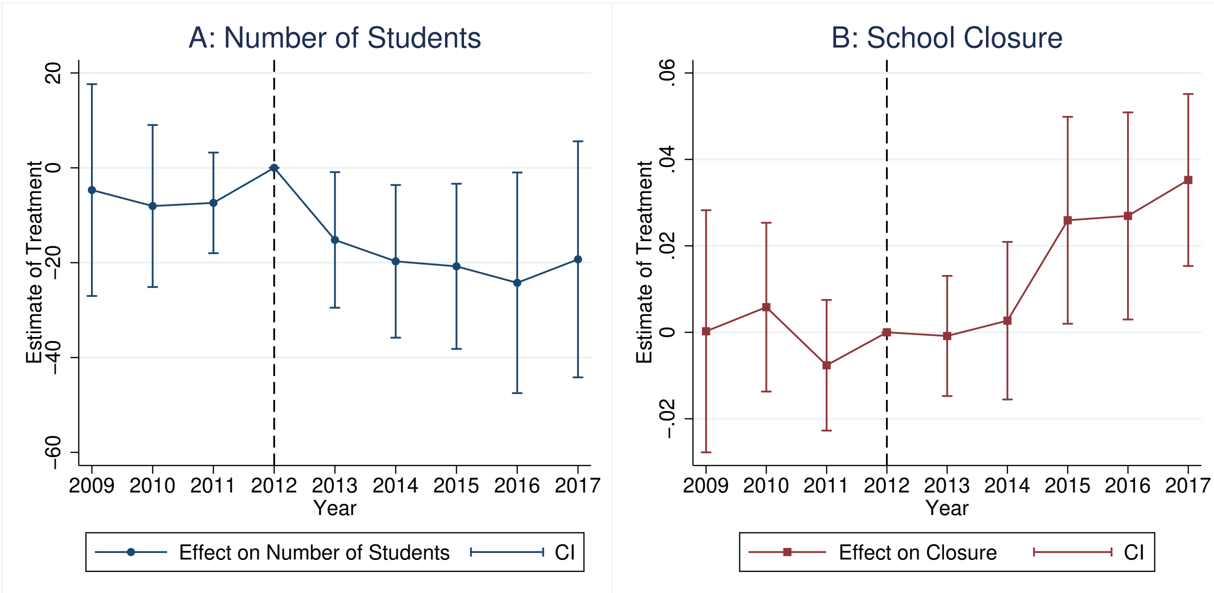
	(1)	(2)	(3)	(4)
	Number of Students		School Closure	
$Treat_m.Before$	-1.403	-6.887	0.003	-0.001
	(6.784)	(7.599)	(0.012)	(0.009)
$Treat_m.Post$	-24.751**	-19.413**	0.027***	0.016*
	(9.264)	(8.238)	(0.010)	(0.008)
N	39705	39705	39705	39705
Mean in baseline	288	288	0.043	0.043
Time FE	Yes	Yes	Yes	Yes
Microregion FE	Yes	Yes	Yes	Yes
Microregion Controls		Yes		Yes

Notes: This table plots the estimates of the treatment effects of QL on the number of students per school and school closure. The year 2011 is the baseline, 2008 to 2010 are pre-periods (Before) and 2012 to 2016 are treated periods (Post). Standard errors are shown in parenthesis and are clustered at the microregion level. Time-varying microregion controls include local population, GDP per capita, value-added of agriculture, industry, service and public administration, total public spending and public spending in education (at the microregion and the state levels), and different moments of labor income of the formal sector of the locality (mean and percentiles 5, 10, 25, 50, 75 and 90). * p<0.1, ** p<0.05, *** p<0.01.

Results from Table 8 column (2) show that QL decreases the average number of students at private schools by 19.4 students or 6.7% in period 2013 to 2017. This effect starts right after approval of QL, affecting the school-year of 2013 and increasing with time, as shown in Figure 6 Panel A. Column (4) shows that QL also increases the likelihood of school closure by 1.6 percentage points or 37% in post periods. This effect, however, is not immediate, as seen in Figure 6 Panel B. QL does not impact the probability of school closure in the two first years following the policy implementation, 2013 and 2014. Only in the third year after losing students to the public system, private schools start to close.

Taken together, these results suggest that the movements from the private to the public system induced by QL become large enough to generate spillover and general equilibrium effects in the school system. These effects, in turn, might become an additional mechanism that induces movements from private to public schools.

Figure 6: Effect of QL on School Size and School Closure in the Private System



Notes: This figure plots the estimates of the treatment effects of QL on school size and school closure. The year 2011 is the baseline, 2008 to 2010 are pre-periods and 2012 to 2016 are treated periods. CI are 95% confidence intervals. Specifications include cohort and school FE and microregion time-varying controls.

Discussion. In sum, the implementation of QL in federal higher education increases movements from private to public schools through different channels. First, by directly changing the returns to investment in private-school tuition, QL induces movements from students that benefit the least from private schools and were on the margin of public-school attendance. Those were the students that attended low-SES and lower quality private schools in 9th grade and that are willing to trade the additional value-added from private schools for a higher probability of future (high quality) federal higher education attendance. Second, movements from private to public schools are also observed (although in lower magnitudes) in grades 10th and 11th. Students in these transitions have no direct incentives to move school systems since the policy rules require that changes occur in grade 9th or earlier. The existence of such effects provides, thus, suggestive evidence on the existence of indirect channels that increase the value of public schools. These effects might include an increase in the quality of peers or an increase in families' subjective expectations about the quality of the public system. Finally, in the third year following the implementation of QL, there is evidence of larger adjustments in the private school system through school closure. Since schools close, some individuals that would attend these specific private schools could be forced to change to the public system (for example, if they do not find a substitute private school nearby). Importantly, the channel of school closure only affects the cohorts of 9th graders from 2014 onward, and, indeed, the full effect of QL is only observed in years 2014 and 2015, as shown in Figure 5 Panel A.

7 Robustness

7.1 Alternative Definitions of Treatment

In Appendix Table B.1, I investigate whether results are robust to alternative definitions of variable $Treat_m$. Column (1) shows the baseline results, in which the treatment variable equals $Treat_m^2$ in equation (2), i.e., individuals are considered to be exposed to treatment happening in any of the 50 microregions of the country where there is a federal university. Column (2) shows the results in which treatment equals $Treat_m^1$ in equation (1), in which students are only exposed to treatment in their microregion of residence. Column (3) shows results in which students are exposed to treatment in all microregions, but that the treatment of each institution is weighted not only by size, as in baseline, but also by an index of quality.[16] The intuition is that higher quality institutions attract more applications and, therefore, may have a higher effect on students' choices. Finally, Column (4) considers the baseline treatment definition (2), but varies the definition of the pre-reform flows θs. Instead of considering movements to attend higher education in public colleges, as in baseline, Column (4) considers also movements to attend private higher education. In any case, results are extremely similar in all three definitions of treatment.

Note that in columns (1) to (4), treatment at the university level is defined based on the difference between the quotas defined by the national law (50%) and the level of quotas determined by institutional policy before QL. In Appendix B.1, I investigate whether results vary if, instead, I define treatment as the difference between the quotas defined by the national law and the *actual shares* of public-school students enrolled at each program-university before QL. Appendix Section B.1 explains the differences between the two definitions in detail. Table B.1 Column (5) shows that, when treatment is defined with this alternative measure exploiting the actual gap, full adoption of QL increases movements from private to public schools by 9.6 p.p., almost twice the magnitude of the baseline coefficient. In Table B.1 Column (6), I perform an exercise in which both treatment variables are included simultaneously. This approach explores whether each variable captures a different channel through which the reform affects students' choice of school. Point estimates of both are positive. Yet, only the baseline coefficient $Treat_m.Post_t$ remains statistically significant. Since results exploiting the gap between QL and actual shares of public-school students yield results of a similar pattern as the baseline, but of a higher magnitude, I choose a more conservative approach to use $Treat_m$ in the baseline. Thus, the results presented in the paper could be seen as a lower bound.

[16] *Índice Geral de Cursos*, a linear index from 1 to 5 computed by INEP.

7.2 Alternative Samples of Microregions

In Section B.2, I test whether the results are robust to the exclusion of microregions where local universities changed their Affirmative Action (AA) policy in the years preceding the national law, as shown in Table B.3. I gradually drop from the baseline sample the microregions with the most recent changes. Table B.2 shows that results are virtually the same regardless of whether they are estimated in the baseline sample of the 50 microregions with a federal university, or whether they are leveraged from the 17 microregions that experienced no changes in the local AA policy in the period ranging from 2006 to 2012 (Column (8)). This robustness test provides reassuring evidence that the effect of QL is not driven by specific changes observed in particular microregions in pre-periods. Instead, the unique pattern of variation driven by the differences between the 50%-share determined by the national law and the local policies is what allows the identification of the causal effects of QL.

7.3 Dropout and Repetition

Finally, in Table A.1, I test whether QL affects dropout and repetition rates in the transition between 9th and 10th grades. Column (1) and (3) show that QL does not affect dropout rates of private or public-school students respectively. Column (2) shows that QL has a moderate negative effect on repetition rates of private school students, while column (4) shows no effect for their public-school counterparts. Rather than a direct effect of the reform, the decrease in repetition rates for private-school students is likely a consequence of the change in school choice. When students move from a private to a public school, it is possible to be reclassified to the next grade in the new school, instead of repeating the year in the school of origin.

8 Concluding Remarks

I study how a national affirmative action initiative that reserved a large share of vacancies in Brazilian federal higher education for graduates of public high schools impacted school choice decisions. By changing incentives for admissions to the most competitive tertiary institutions in the country, the government encouraged public high school attendance. Leveraging the cross-sectional variation generated by the difference between the national quotas and the pre-reform levels established by local institutions, I construct a measure of exposure to treatment for students attending 9th grade. Using a dynamic two-way fixed model, identification comes from the within-school variation across cohorts of students exposed or not to QL depending on the microregion of residence.

Results show that full adoption of QL increases movements from private to public schools by 31% percent considering all the post-periods jointly, while coefficients for the pre-periods are close to zero and insignificant, strengthening the assumption of parallel trends required for identification. This aggregate effect masks important heterogeneity. Movements are much larger for non-whites, who benefit from additional specific subquotas, and for females, who have higher rates of persistence to higher education. Movements also come largely from students attending low-SES and low-performing private schools, and schools with a low probability of future federal higher education enrollment. Finally, transitions to the public system also come entirely from microregions with less segregated high school systems, suggesting that movers are, mostly, individuals at the margin of public-school attendance and that face lower costs of changing school systems.

I proceed to investigate the mechanisms behind the observed changes. First, I show that individuals' that move from private to public schools due to QL are trading, on average, a higher performance private school for a higher probability of attending a higher quality tertiary education institution in the future. This provides evidence that QL indeed changes the returns to the investment in private education by directly decreasing the probability of higher education attendance of private-school students. I also find that QL increases movements to private schools among cohorts of 10th and 11th graders, who are not directly affected due to the policy rules. This suggests the existence of spillover effects that could involve an increase in peer quality at the school level or a change in the expectations of families regarding the quality of public schools. Finally, I show that in the third year following the policy, there is a positive effect on private-school closure, suggesting that, with time, general equilibrium effects might also increase the transitions to the public system.

Important policy recommendations come from these findings. Affirmative action policies that use the school to determine eligibility are becoming a useful tool to target low-SES students without explicitly asking for information about family income or ethnicity. However, as with other education policies that evaluate individuals relative to their peers at the school level, they have been shown to cause unintended consequences, such as a change in school choice decisions. Understanding the extent and the mechanisms behind these unanticipated effects is important for an efficient policy design. This paper gives an important step in this direction by uncovering different channels through which these unintended consequences operate. However, the reduced-form approach and the unavailability of more detailed data regarding individuals' and peer grades still limits a more precise quantification of the importance of each of the mechanisms separately. As these policies become more popular as an alternative or a complement to race-based affirmative action, this emerges as an important avenue for future research.

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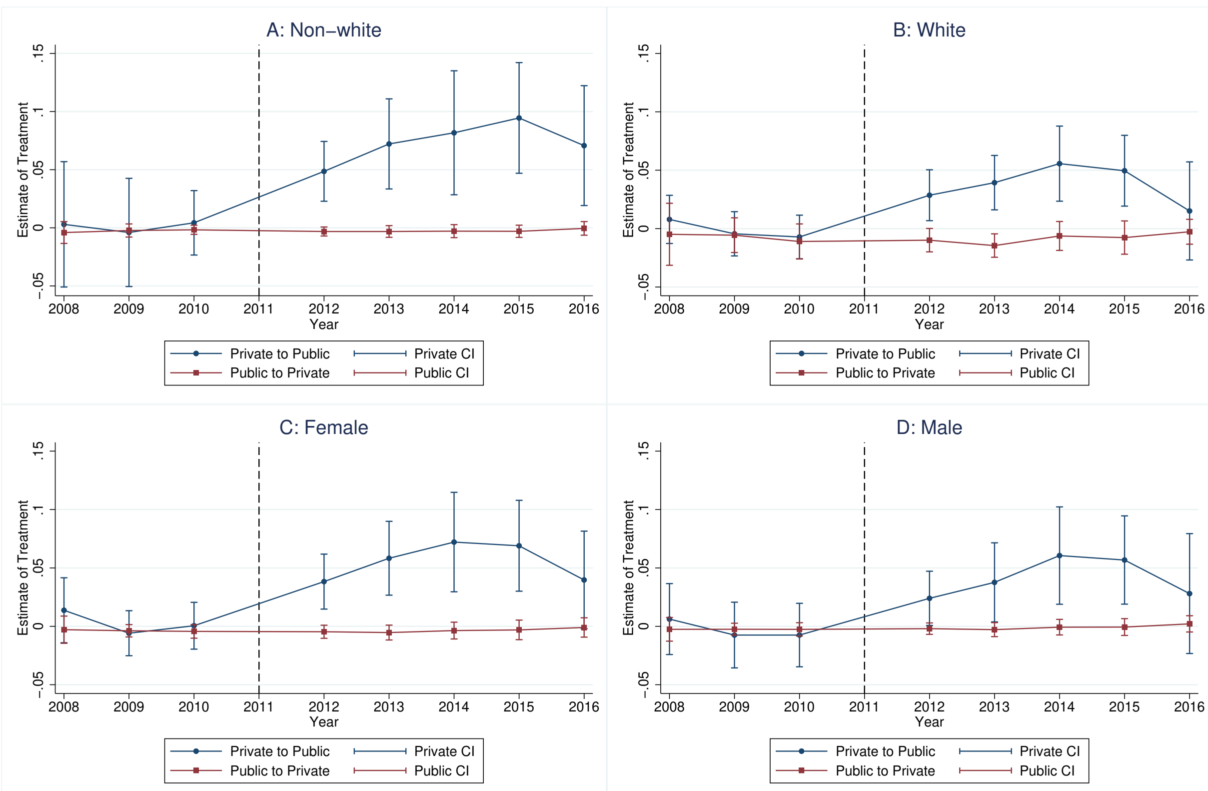
Online Appendix

Affirmative Action and the Choice of Schools

Ursula Mello

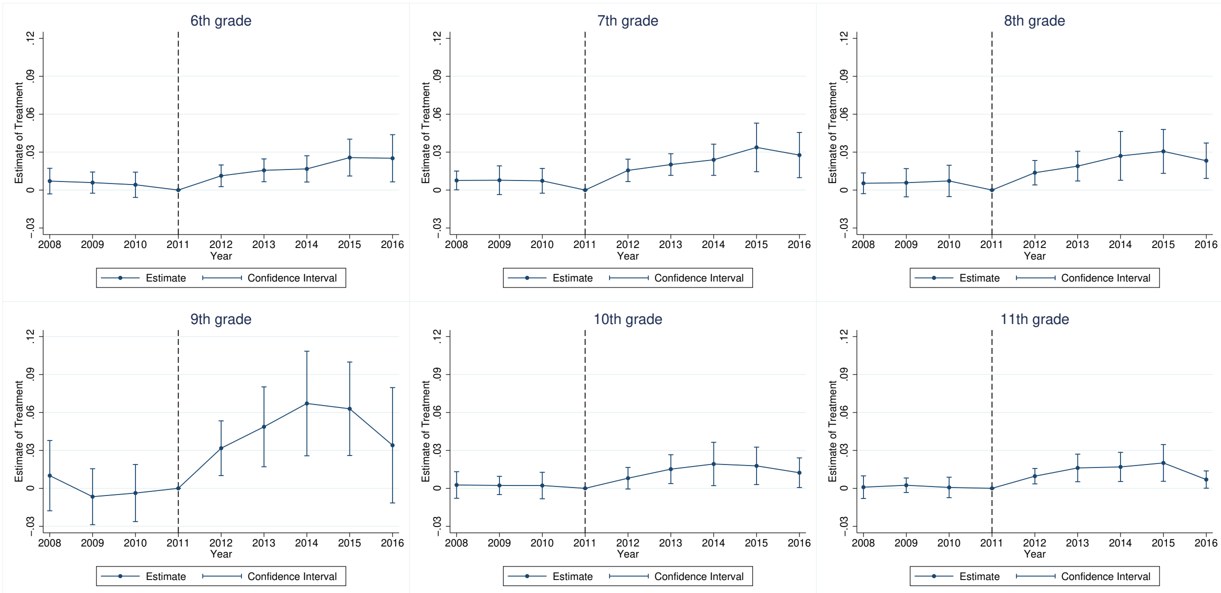
A Additional Figures and Tables

Figure A.1: Effect of QL on School Movements by Ethnicity and Gender



Notes: This Figure plots the estimates of the treatment effects of QL on movements of 9th graders to secondary school. Year 2011 is the baseline, 2008 to 2010 are pre-periods and 2012 to 2016 are treated periods. CI are 95% confidence intervals. Specifications include cohort and school FE, individual and microregion time-varying controls, as defined in Section 4.

Figure A.2: Effect of QL on School Movements by Grade



Notes: This Figure plots the estimates of the treatment effects of QL on movements from private to public schools of students from different grades. Year 2011 is the baseline, 2008 to 2010 are pre-periods and 2012 to 2016 are treated periods. CI are 95% confidence intervals. Specifications include cohort and school FE, individual and microregion time-varying controls, as defined in Section 4.

Table A.1: Robustness - Dropout and Repetition

	(1)	(2)	(3)	(4)
	Private School		Public School	
	Dropout	Repetition	Dropout	Repetition
$Treat_m.Before_t$	0.008	-0.005	0.013	0.015
	(0.011)	(0.004)	(0.014)	(0.011)
$Treat_m.Post_t$	0.007	-0.012***	0.013	-0.004
	(0.009)	(0.004)	(0.012)	(0.010)
N	2237493	2039035	9501866	8029024

Notes: This Table plots the estimates of the treatment effects of QL on persistence, dropout and repetition rates of students from 9th grade. Year 2011 is the baseline, 2008 to 2010 are pre-periods (Before) and 2012 to 2016 are treated periods (Post). Standard errors are shown in parenthesis and are clustered at the microregion level. Individual controls include gender, age, ethnicity and urban status. Time-varying microregion controls include local population, GDP per capita, value added of agriculture, industry, service and public administration, total public spending and public spending in education (at the microregion and the state levels), and different moments of labor income of the formal sector of the locality (mean and percentiles 5, 10, 25, 50, 75 and 90). * p<0.1, ** p<0.05, *** p<0.01.

B Robustness

B.1 Alternative Definitions of Treatment

In this section, I investigate whether results are robust to alternative definitions of variable $Treat_m$. As described in Section 7.1, Table B.1 Column (1) shows the baseline results, in which the treatment variable equals $Treat^2_m$ in equation (2), i.e., individuals are considered to be exposed to treatment happening in any of the 50 microregions of the country where there is a federal university. Column (2) shows the results in which treatment equals $Treat^1_m$ in equation (1), in which students are only exposed to treatment in their microregion of residence. Column (3) shows results in which students are exposed to treatment in all microregions, but that the treatment of each institution is weighted not only by size, as in baseline, but also by an index of quality.[17] The intuition is that higher-quality institutions attract more applications and, therefore, may have a higher effect on students' choices. Finally, Column (4) considers the baseline treatment definition (2), but uses θ as the pre-reform flows between microregions to all institutions of higher education, and not only to public institutions (as in baseline). In any case, results are extremely similar in all three definitions of treatment.

Note that in columns (1) to (4), treatment at the university level is defined based on the difference between the quotas defined by the national law (50%) and the level of quotas determined by institutional policy before QL: $Treat_{u,m} = 2(0.5 - Q_{u,2012})$. This means that, if the institution had no quotas in 2012 ($Q_{u,2012} = 0$), $Treat_{u,m} = 1$. On the other hand, if it already had 50% of reserved vacancies before the implementation of the law, then $Treat_{u,m} = 0$. If $0 < Q_{u,2012} < 0.5$, $Treat_{u,m}$ assumes a value between zero and one.

An alternative way to define treatment by institution takes into account the actual share of public-school students enrolled in each major p of university u, $PS_{pu,2012}$. In this case, I construct variable $Treat^5_{u,m} = \frac{\sum_p Size_{pu,m} x max(0;0.5-PS_{pu,2012})}{\sum_p Size_{pu,m}}$. The term $max(0; 0.5 - PS_{pu,2012})$ measures the gap between the level of quotas implemented through the reform and the actual share of public-school students in program p right before adoption. In this case, if $PS_{pu,2012}$ is equal or higher than 50%, the variable assumes the value zero. I then, aggregate the measure by each institution, weighting each program by the number of new enrollments in 2012. Constructed as such, variable $Treat^5_{u,m}$ ranges from zero to 0.29, since no institution in the country had no public-school students enrolled in the baseline year. Therefore, I normalize $Treat^5_{u,m}$ so it ranges from zero to one.

Note that the baseline treatment definition $Treat_{u,m}$ considers that students in 9th grade are mostly affected by the *message* sent by institutions in the admission documents publicized during the selection procedure. In this case case, it is possible that an institution that had no quota policy defined in 2012 is treated according to the baseline definition ($Q_{u,2012} = 0$ and $Treat_{u,m} = 1$), but is

[17] *Índice Geral de Cursos*, a linear index from 1 to 5 computed by INEP.

Table B.1: Robustness - Different Treatment Definitions

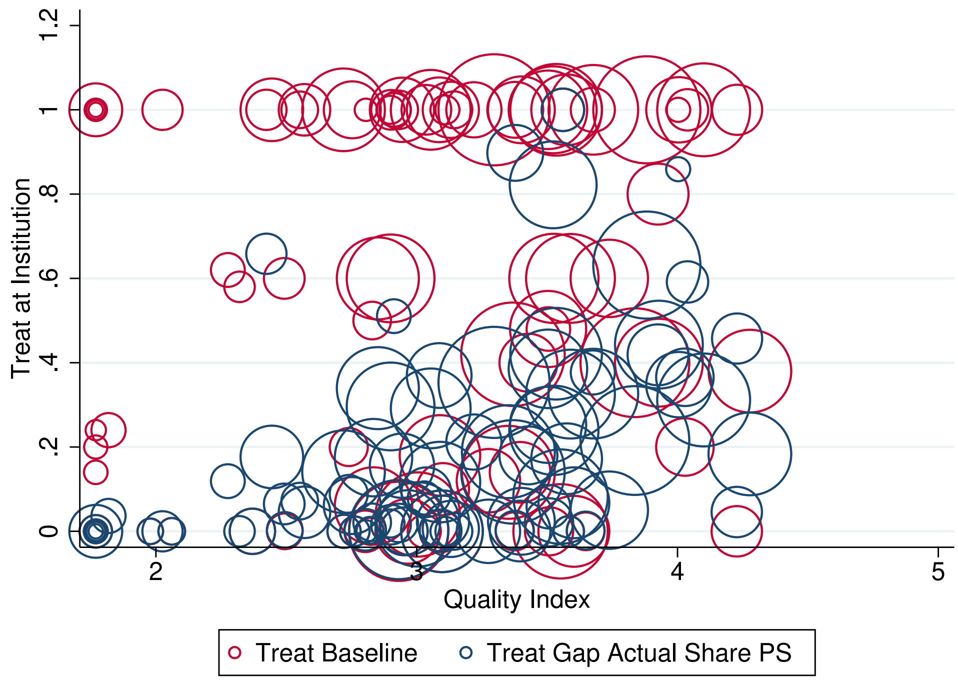
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	Microregion Only	Weighted by size and quality	Flows with all institutions	Treatment as Gap	Baseline + Treatment as Gap
$Treat_m.Before_t$	-0.000					0.002
	(0.009)					(0.012)
$Treat_m.Post_t$	0.047***					0.031**
	(0.014)					(0.014)
$Treat^1_m.Before_t$		-0.000				
		(0.009)				
$Treat^1_m.Post_t$		0.046***				
		(0.014)				
$Treat^3_m.Before_t$			-0.001			
			(0.009)			
$Treat^3_m.Post_t$			0.047***			
			(0.015)			
$Treat^4_m.Before_t$				-0.000		
				(0.009)		
$Treat^4_m.Post_t$				0.047***		
				(0.014)		
$Treat^5_m.Before_t$					-0.005	-0.009
					(0.019)	(0.024)
$Treat^5_m.Post_t$					0.096***	0.052
					(0.033)	(0.038)
N	1932498	1932498	1932498	1932498	1932498	1932498

Notes: In this Table, I plot the estimates of the treatment effects of QL on movements of 9th graders of a private to a public secondary school for different definitions of treatment at microregion m. In Column (1), I use the baseline definition of treatment as defined in equation (2). In Column (2), I assume students are only exposed to treatment in their microregion, as defined in (1). In Column (3), I assume students are exposed to treatment in any of the 50 microregions as in Column (1), but I weight each institution of the microregion by a linear index of quality/performance, in addition to size. In Column (4), I use the baseline treatment definition of equation equation (2), but use pre-reform θ considering all student's flows to higher education, not only to public institutions (as in baseline). Finally, Column (5) includes an alternative measure , in which treatment is defined as the gap between 50% and the baseline share of public school students by major within institution u. All columns include time, microregions and school fixed effects, in addition to individual and microregion controls, following equation (3). Standard errors are shown in parenthesis and are clustered at the microregion level. * p<0.1, ** p<0.05, *** p<0.01.

untreated following the alternative measure $Treat^5_{u,m}$ (if all programs of institution u had more than 50% of public-school students in that year ($Treat^5_{u,m} = 0$ because $max(0; 0.5 - PS_{pu,2012}) = 0$). On the other hand, we *could not* have an opposite scenario: an institution in which $Q_{u,2012} = 0.5$ and $Treat_{u,m} = 0$ would also have $PS_{pu,2012} = 0.5$ and $Treat^5_{u,m} = 0$.

Figure B.1 presents the distribution of $Treat_{u,m}$ (Baseline) and $Treat^5_{u,m}$ (Alternative Measure) by the quality index of each institution. The correlation between both variables is positive (0.46) and highly significant, but fairly different than one. This means that, although correlated, these two

Figure B.1: Treatment Variables by Institution



Notes: This figure presents the distribution of $Treat_{u,m}$ (Baseline) and $Treat^5_{u,m}$ (Alternative Measure) by the quality index of each institution. Each circle represents an institution weighted by its size.

treatment definitions also may capture different effects of the policy. Intuitively, $Treat_{u,m}$ implicitly assumes that students in 9th grade react based on the message sent by the admission policy of the institution, while $Treat^5_{u,m}$ assumes that families have extra information (not explicitly publicized by universities) on the actual distribution of public-school students by major, being able to infer the actual gap between the target policy and the baseline share.

Although I estimate the complete set of results using both variables, I use $Treat_{u,m}$ in my baseline results for three reasons. First, in previous work (Mello, 2021), I study how QL impacted the demographic composition of public higher education in Brazil and showed that it increases enrollments of public school students even in programs with more than 50% of this demographic group in baseline. This is only possible if individuals change some dimension of their application behavior, as a response to a change in the *message* sent by the admission committee. Similar evidence was found by Thibaud (2019), who analyzed spillover effects of an affirmative action policy introduced in an elite higher education institution in France. Second, I perform an empirical exercise in which I include $Treat_m$ and $Treat^5_m$ simultaneously in the empirical framework (Column 6 of Table B.1). In this case, both variables have similar point estimates, but only $Treat_m$ remains significant. Third, results using $Treat_m$ and $Treat^5_m$ follow exactly the same pattern. Yet, results from $Treat_m$ are smaller in magnitude, providing more conservative estimates for the treatment effect of QL, which can be considered a lower bound.

B.2 Alternative Samples of Microregions

The baseline identification strategy explores the exogenous pattern of variation produced by the differences between the level of quotas reserved for public-school students by institutional policy before the national law and the 50% determined by QL. In this Section, I test whether the results are robust to the exclusion of microregions where local universities experienced changes in their Affirmative Action (AA) policy in the years preceding the national law.

Table B.2: Robustness - Different Samples of Microregion

	(1)	(2)	(3)	(4)
	Baseline	Drop 2012	Drop 2012-2011	Drop 2012-2010
$Treat_m.Before_t$	-0.000	-0.001	-0.005	-0.004
	(0.009)	(0.010)	(0.008)	(0.008)
$Treat_m.Post_t$	0.047***	0.049***	0.048***	0.052***
	(0.014)	(0.015)	(0.014)	(0.014)
N	1932498	1911761	1548316	1491747
	(5)	(6)	(7)	(8)
	Drop 2012-2009	Drop 2012-2008	Drop 2012-2007	Drop 2012-2006
$Treat_m.Before_t$	-0.011	-0.015*	-0.019	-0.019
	(0.008)	(0.009)	(0.012)	(0.015)
$Treat_m.Post_t$	0.058***	0.059***	0.050**	0.059***
	(0.016)	(0.016)	(0.019)	(0.018)
N	1398379	1212269	692293	582566

Notes: This table plots the estimates of the treatment effects of QL on movements of 9th graders of a private to a public secondary school for different samples of microregions. In Column (1), I include all the 50 microregions with a federal university. In Column (2), I drop one microregion that experienced changes in its Quota Policy in 2012. In Column (3), I drop additionally 5 microregions with changes in 2011 and, in column (4), 6 microregions with changes in 2010. Similarly, column 5, 6, 7 and 8 drop, additionally and respectivelly, 4 microregions with changes in 2009, 6 with changes in 2008, 3 with changes in 2007 and, finally, 4 with changes in 2006. This means that, in column (8), effects are estimated from the variation of the 17 microregions that had no changes in their Quota Policies between 2006 and 2013, when they were affected by QL. Standard errors are shown in parenthesis and are clustered at the microregion level. * p<0.1, ** p<0.05, *** p<0.01.

For example, one year before the implementation of the national law (i.e., for the admission cohort of 2012), the Federal University of Mato Grosso, UFMT, located in Campo Grande, changed their institutional AA policy, reserving 50% of its vacancies to public school students. Therefore, to rule out that the results observed in the paper are driven entirely by the movements observed in this microregion, which could be influenced by a lagged response of pre-reform treatment of the local university, in Table B.2, Column (2), I estimate results dropping the microregion of Campo Grande. Results are virtually the same as the ones from baseline, shown in Column (1), considering all the 50 microregions where there is a federal university.

Similarly, in the remaining of the columns of Table B.2, I perform the same exercise, but in each column, I drop additional microregions that experienced changes in their AA policy in preceding years (sequentially). The microregions dropped in each column are shown in Table B.3, which portrays the year and the type of AA adopted in each of the 59 federal universities active in 2012. Thus, in Column (3), I drop, in addition to microregion of Campo Grande, the 5 microregions of Table B.3 with universities that experienced changes in the AA policy destined to public-school students in year 2011. As shown in column (3), results remain very similar to the baseline results. I proceed with this approach in the following columns of table B.2.

In column (8), I drop all 33 microregions in which local universities experienced changes in their AA policy between years 2006 and 2012. This means that the model of column (8) is estimated based on the variation of the 17 microregions that did not experience changes in these periods. The robustness of results of table B.2 assure that the effect of QL is not driven by specific changes observed in particular microregions in pre-periods. Instead, the unique pattern of variation driven by the differences between the 50% share determined by the national law and the local policies is what allows the identification of the causal effects of QL.

Table B.3: Adoption of AA Policy by Federal University

id	co_ies	University	Year	Type	Category/description
530001	2	UNB	2004	Quotas	PPI
270001	577	UFAL	2005	Quotas	PS + PPI
290001	578	UFBA	2005	Quotas	PS + PPI
520001	584	UFG	2005	Quotas	PS + PPI
260001	580	UFPE	2005	Bonus	PS
410001	571	UFPR	2005	Quotas	PS, PPI
260001	587	UFRPE	2005	Bonus	PS
350001	591	UNIFESP	2005	Quotas	PS PPI
170001	3849	UFT	2005	Quotas	Indigenous
150001	590	UFRA	2005	Quotas	PS + PPI
310027	576	UFJF	2006	Quotas	PS + PPI
150001	569	UFPA	2006	Quotas	PS + PPI
240001	570	UFRN	2006	Bonus	PS
290004	4503	UFRB	2006	Quotas	PS + PPI
350001	4925	UFABC	2007	Quotas	PS + PPI
210001	548	UFMA	2007	Quotas	PS + PPI
220001	5	UFPI	2007	Quotas	PS
320001	573	UFES	2008	Quotas	PS
330001	572	UFF	2008	Bonus	PS
430001	581	UFRGS	2008	Quotas	PS + PPI
420001	585	UFSC	2008	Quotas	PS + PPI
350037	7	UFSCar	2008	Quotas	PS + PPI
430011	582	UFSM	2008	Quotas	PS, PPI, Disability
410001	588	UFTPR	2008	Quotas	PS
310001	575	UFMG	2009	Bonus	PS + PPI
310003	6	UFOP	2009	Quotas	PS
310055	597	UFTM	2009	Bonus	PS
430010	5322	UNIPAMPA	2009	Quotas	PS + PPI, Disability
330001	574	UFRRJ	2010	Bonus	PS
280001	3	UFS	2010	Quotas	PS + PPI
310039	107	UFSJ	2010	Quotas	PS + PPI
260015	3984	UNIVASF	2010	Quotas	PS
430009	12	URG	2010	Bonus	PS + PPI
420007	15121	UFFS	2010	Bonus	PS
410007	15001	UNILA	2010	Bonus	PS

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310016	596	UFVJM	2011	Quotas	PS
250001	579	UFPB	2011	Quotas	PS + PPI
330001	586	UFRJ	2011	Quotas	PS
310059	17	UFU	2011	Quotas	PS
230003	15497	UNILAB	2011	Bonus	PS
150015	15059	UFOPA	2011	Quotas	Indigenous
510001	1	UFMT	2012	Quotas	PS + PPI
120001	549	UFAC	2013	Quotas	Law 12711/2012 - PS + PPI
130001	4	UFAM	2013	Quotas	Law 12711/2012 - PS + PPI
230001	583	UFC	2013	Quotas	Law 12711/2012 - PS + PPI
500005	4504	UFGD	2013	Quotas	Law 12711/2012 - PS + PPI
310043	592	UFLA	2013	Quotas	Law 12711/2012 - PS + PPI
500001	694	UFMS	2013	Quotas	Law 12711/2012 - PS + PPI
430009	634	UFPEL	2013	Quotas	Law 12711/2012 - PS + PPI
140001	789	UFRR	2013	Quotas	Law 12711/2012 - PS + PPI
310033	8	UFV	2013	Quotas	Law 12711/2012 - PS + PPI
310042	595	UNIFAL-MG	2013	Quotas	Law 12711/2012 - PS + PPI
160001	830	UNIFAP	2013	Quotas	Law 12711/2012 - PS + PPI
310052	598	UNIFEI	2013	Quotas	Law 12711/2012 - PS + PPI
110001	699	UNIR	2013	Quotas	Law 12711/2012 - PS + PPI
330001	693	UNIRIO	2013	Quotas	Law 12711/2012 - PS + PPI
240009	589	UFERSA	2013	Quotas	Law 12711/2012 - PS + PPI
250005	2564	UFCG	2013	Quotas	Law 12711/2012 - PS + PPI
430001	717	UFCSPA	2013	Quotas	Law 12711/2012 - PS + PPI

Notes: This table shows the year of adoption of affirmative action by each of the 59 Brazilian federal universities of 2012. The main source for this table is the paper by Schwambach Vieira and Arends-Kuenning (2019). Information on UFAL and UFPB was updated based on Resolução 9/2004 (UFAL) and Resolução 9/2010 (UFPB). Information on UFRA, UFRB, UNIPAMPA, UFFS, UNILA, UFVJM, UNILAB, UFOPA, UFERSA, UFCG and UFCSPA were added based on documentation from institutions. PS stands for public-school students, PPI for non-white (Pretos, pardos e indígenas). "PS+PPI" refers to quotas to PS and subquotas to PPI within the quotas for PS. "PS, PPI" refers to separate quotas for each group.