The Effects of a Centralized College Admission Mechanism on Migration and College Enrollment: Evidence from Brazil*

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Abstract

As part of education reforms, decentralized assignment mechanisms have been increasingly replaced by centralized systems. However, empirical evidences of these transitions are scarce. We investigate the effects of introducing a centralized admission system that allocates students to Higher Education Institutions on migration and college enrollment. Using restricted access data, we exploit time variation in adoption of a centralized system across institutions. We find that the adoption increases intermunicipality and interstate mobility of first-year students by 2.6 percentage points (p.p.) and 3.9 p.p., respectively. The system is also associated with an increase by 4.4 p.p. in dropout rate of first-year students. Overall, our findings suggest that migration and strategic behaviors during the application process play a crucial role for an increase in dropout.

JEL classification: I23, I28.

Keywords: College admissions, Higher Education, migration, dropout.

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1 Introduction

Each year, million of students apply for college through a wide variety of mechanisms. Japan, for example, adopts a decentralized admission process and students are allowed to apply to one public university (Che and Koh (2014)). In other countries (as Chile), the process is highly centralized (Hastings et al. (2013)). Despite the lack of consensus on which mechanism is the most efficient way to select students, decentralized assignment mechanisms have been increasingly replaced by centralized systems in recent years. However, changes in assigment mechanisms are controversial, since empirical evidences of these transitions are scarce.

In this paper, we exploit a Brazilian large-scale policy change to investigate the effects of switching from a decentralized to a partially centralized college admission system on migration and enrollment of students. Partially because there are institutions that still admit students via decentralized mechanisms. Prior to 2010, students could directly apply to an institution and choose a major before taking entrance exams known as *Vestibular*. Only top-scoring students could be accepted. As students faced an uncertainty about their performance on admission exams, they often applied to several institutions. Institutions did not coordinate admission offers with each other, thus one student could receive multiple offers and not enroll. To fill the remaining spots, institutions moved to sequential rounds, offering seats to ranked students on wait lists. This is a typical case of a decentralized mechanism.

In 2010, after the reformulation of the National Exam of Secondary Education (ENEM), the Brazilian Ministry of Education created the Unified Selection System (SISU), an online computerized and centralized platform that allows students to apply to public higher education institutions based on a unique exam. After taking ENEM exam and receiving their scores, students subscribe to SISU and submit a list of up to two ranked programs, which are defined as a combination of major and institution. While the system is open to receive applications, admission cutoff scores are updated, partial classifications are disclosed once a day, and subscribers are allowed to change their choices as many times as they wish. Only the final list submitted to the system is valid. Students are then allocated to programs based on a deferred acceptance algorithm and could receive up to one offer. Qualified applicants may (or not) enroll in their assigned options. As the placement of students is determined via a centralized clearinghouse based on a common admission exam, we refer to this admission system as centralized. Students who did not qualify for their options should inform if they wish to be included on a wait list. Afterwards, the remaining spots are filled based on these wait lists, similarly to the decentralized system.

This policy change in Brazil provides a unique context to examine the consequences of introducing a partially centralized assignment. After the implementation of SISU, several application costs to students could be reduced. Instead of bearing several fees to apply to different institutions, students – when not free-exempt – now are only required to pay a relatively low registration fee for ENEM and there is no application fee to subscribe to SISU[1]. Students also save time by taking a unique exam, rather than various entrance exams, that serves the purpose of several applications. Geographical barriers are mitigated because ENEM exam can be easily taken near to the place of residence, instead of having to travel to take several *Vestibular* exams. Search costs for applicants are lowered due to the availability of an online platform that gathers information on majors, institutions and campus. We take advantage of the broad geographic scope of Brazilian institutions to understand how a centralized system affects students' mobility by reducing application costs.

Our empirical strategy exploits a gradual adoption of SISU across public institutions[2], comparing those that switched to a centralized admission with those that maintained their own admission exams before and after the implementation of the system. The centralized admission is not randomly assigned across institutions. Indeed, the adoption of a centralized system is optional because institutions have autonomy to decide how to select students. To validate our identification strategy, we show that the variation in the timing of adoption is not driven by institution-specific characteristics. Using four years of two restricted access data, we find that switching from a decentralized to a partially centralized assignment system led to an increase by 2.6 and 3.9 percentage points in intermunicipality and interstate mobility of first-year students, respectively. These estimates are robust to alternative specifications.

In the second part of the paper, we turn to the effect on enrollment. Moving to a partially centralized admission may affect enrollment for several reasons. First, students are constrained on the number of programs they can apply to because they are allowed to submit a short list with up two choices. In the old decentralized admission, there were no formal restrictions on the number of institutions to apply to. The limited number of options may induce students to report less preferred choices. Students, for example, might be more careful by submitting "safety" programs to avoid wasting alternatives. Second, to the best of our knowledge, SISU is the only system to provide updated cutoff scores daily and partial classification to subscribers, allowing them to switch their options

[1]Pallais (2015) shows that when students were allowed to send an extra free application, they applied to more colleges and low-income students attended more-selective colleges.

[2]In this paper, "public institutions" and "federal and state public institutions" are used interchangeably.

as many times as they wish while the system is open. Anecdotal evidences suggest that students are not truthfully reporting their preferences by choosing programs in which their scores seem to be enough for admission, instead of submitting their most preferred options. The direction of the effect on enrollment is unclear. On the one hand, allocation may be improved with a higher occupancy rates and a better pool of admitted students. On the other hand, the system encourages strategic behaviors, thus students may drop out after enrolling.

Also exploiting a temporal variation in adoption of SISU, we find strong evidences that the system is associated with an increase by 4.4 percentage points in dropout rate of first-year students. We show that the main results are robust to several potential threats. First, we address concerns about sample selection bias by showing that the results do not change when considering an alternative measure of migration or other sub-samples. Second, we do not find evidences that the estimates are driven by pre-existing trends. Third, we exclude the possibility that our results are affected by other educational policies. Fourth, we show that the composition of treatment groups do not have changed after the implementation of SISU, thus the estimated coefficients are unlikely to be driven by student selection.

Finally, to shed some light on the mechanisms behind the increase in dropout, we check for heterogeneous effects. We show that students who have migrated are more likely to drop out. This suggests that students may not afford to support themselves or face personal difficulties when they are far from home, thus reducing barriers to access to college may not be enough to effectively attract students from other locations. In addition, we find that students enrolled in less-selective programs, proxied by the average ENEM scores, are slightly more likely to drop out, suggesting evidences on strategic behaviors from applicants.

Related Literature:

Our results contribute to various literatures. In the context of educational markets, there is a large theoretical research on the optimal choice mechanism to select students (Gale and Shapley (1962), Abdulkadiroglu and Sönmez (2003)). In recent years, several countries underwent reforms (Abdulkadiroglu et al. (2005), Abdulkadiroglu et al. (2005)), replacing decentralized systems by centralized ones. Despite a growing spread of centralized mechanisms, some college admission processes remain decentralized[3]. We con-

[3]For example, Japan, Korea, and U.S. still admit students via decentralized mechanisms. Che and Koh (2014) suggest that, although centralized matching can be relatively fair and efficient, some institutions may be worse off in comparison to decentralized mechanism. Hafalir et al. (2014) compare the effects of decentralized and centralized college admission on efforts of students and student welfare. While higher ability students prefer centralized mechanisms, lower ability students prefer the decentralized ones.

tribute to a scarce empirical research on changes in admission mechanisms. In a school context, Abdulkadiroglu et al. (2015) study the effects of changing from an uncoordinated to a coordinated centralized assignment on allocation of students to high schools in NYC. After this policy change, each student is now constrained to receive up to one offer, instead of multiple offers. The authors focus on allocative efficiency and welfare gains and estimate student preferences to evaluate their willingness to travel for school. In a closely related paper, Horstschräer (2012) examines the impact of moving from a centralized to a decentralized admission system in German law schools, using regional variation over time. She finds no effects on dropout rates. Our contribution is to analyze the effects of switching from a nationwide decentralized to a centralized system in college institutions, rather than a specific field of study. We find strong effects on dropout and extend our analysis to geographical mobility.

Our work also builds on the literature studying the determinants of migration. Several states and countries are recently implementing policies to attract college educated workers (Groen (2004), OECD (2002)). To justify policies to attract students from other locations, one argument is that student migration during college affects labor mobility by acting as a "stepping stone" (Parey and Waldinger (2011)). Our findings suggest that a centralized mechanism can promote student migration by reducing college application costs.

This work is related to the growing literature that emphasizes the role of information constraints on school choice (Hastings and Weinstein (2008), Lai et al. (2009), Ajayi (2011), Bettinger et al. (2012), Lucas and Mbiti (2012)). Less educated parents and students from low-quality primary schools are more likely to make mistakes during school choice process or less likely to apply to high-quality schools. Providing more information to applicants can reduce this disparity. We take advantage of a unified admission system to investigate how revealing updated cutoff scores induces strategic choices in a college context. On the one hand, providing cutoff scores might lead to a selection of students with the highest scores. On the other hand, students can behave strategically by applying to options in which their scores are enough for admission, instead of choosing their most preferred programs. Thus, students might drop out after admission. Our results suggest that both disclosure of admission cutoffs and college migration play a key role in increasing dropout rates.

More broadly, this paper also contributes to the literature on college dropout (Belley and Lochner (2007), Bowen et al. (2009), Cohodes and Goodman (2014)). In the U.S., the fraction of students finishing higher education does not accompany the fraction of high school graduates attending college (Bound et al. (2010)). Supply-side factors, as quality of

institutions and academic resources, explain why students drop out of college (Bound and Turner (2007)). Credit constraints (Stinebrickner and Stinebrickner (2008)) and learning about academic ability (Stinebrickner and Stinebrickner (2012, 2014)) are also important factors in determining the dropout decision. The results presented in this paper indicate that geographical mobility and strategic choices before matriculation are also potential reasons to college dropout.

Finally, to the best of our knowledge, this work is the first empirical study about SISU in a nationwide scale. Our findings also contribute to the public policy debate on the implications of introducing a centralized college admission, especially in Brazil.

This paper proceeds as follows. We start by giving background information on the implementation of SISU in Section 2. We discuss how the system provides an ideal context to investigate the effects of switching from a decentralized to a partially decentralized admission mechanism in Section 3. We also describe the data, outline the baseline estimation strategy and discuss the validity of the empirical strategy. Section 4 presents the main results, followed by a battery of robustness checks. Section 5 discusses the heterogeneous effects. Finally, Section 6 concludes.

2 Institutional Context

2.1 Brazilian Higher Education System

In Brazil, admission to Higher Education is quite different from many countries. Brazilian institutions[4] – private or public ones – have autonomy to decide how to select their students. Unlike the US, but like many countries, students commit to a specific field of study before undergraduate matriculation. In addition, there are no subjective assessments because admissions are solely based on entrance test scores and only top-scoring applicants are offered a place. Prior to 2010, the admission process used to be exclusively decentralized. Students applied directly to institutions and had to take an entrance examination, known as *Vestibular*, for their specific chosen degree program (in this paper, program is defined as an institution-career combination). Additionally, institutions are free to design their own exams[5] in order to screen students for admission.

In public institutions, the competition in *Vestibular* exams is intense because they do

[4]In this paper, the terms "higher education institutions" and "institutions" are used interchangeably.

[5]For example, some institutions (that still maintain *Vestibular* as admission requirement) follow a pattern with two phases: the first stage consists of multiple-choice questions and the second stage consists of written questions and an essay. Others have a single-stage exam, in which the scores are weighting by student's choice of major.

not charge any tuition fee, offer few spots and are relatively high quality and more appealing. There is typically only one chance to take *Vestibular* each year for each institution[6]. There are no constraints on the number of *Vestibular* exams to be taken, thus a student often applies to more than one institution. Only top-scoring applicants to each program are offered a place, while the remaining ones are put on a wait list. Some of admitted students often do not enroll because they are also accepted to other institutions or programs. Thus, institutions proceed to accept students from wait lists, following the ranking of applicants.

In order to broaden access to tertiary education, the Brazilian Ministry of Education (henceforth, MEC) announced some sizable changes in recent years[7]. The main modification was the reformulation of the National Exam of Secondary Education (hereafter, ENEM) to boost its use a college admission exam, instead of *Vestibular* exams[8]. In contrast to *Vestibular* exams, the old ENEM exam was a problem-solving and critical analysis assessment, rather than a rigorous curriculum-based exam. Due to a general perception that ENEM was less selective than *Vestibular*, few institutions – but mostly private – used ENEM scores in their admission process[9]. Nonetheless, ENEM is a requirement to obtain scholarship and loan support from federal government, thereby the majority of graduating students used to take the old exam before 2009.

In 2008, MEC announced that 2009 ENEM would be reformulated, becoming more content-based and difficult[10]. Although ENEM is optional for students, its extent is remarkable. In 2014, the number of applicants reached a record high of about 8.7 million, in comparison to only 157.221 students registered to ENEM in 1998. Graph 1 indicates two key factors behind an increasing number of applicants. First, in 2004, the creation

[6]Some institutions have two *Vestibular* exams *per* year.

[7]For instance, in November of 2009, the enactment of Law 12.089, which prohibits a same student to occupy two or more vacancies in public institutions at the same time, increased the relative supply of spots in these institutions. Until then, the student was allowed to enroll in more than one public institution and there are anecdotal evidences of many students enrolling, but never attending classes.

[8]Created in 1998, ENEM was formerly conceived to be a non-mandatory one-day exam to evaluate the quality of secondary schooling. Indeed, despite of the non-mandatory nature of ENEM since its inception, the exam has been widely employed as a source for schools' league table to inform the quality of secondary schools. The old ENEM exam consisted of 63 multiple-choice questions from a range of subjects – Biology, Chemistry, Geography, History, Math, Physics, and Portuguese – and an optional written composition.

[9]For example, the State University of Campinas (UNICAMP), since 2000, and the University of São Paulo (USP), since 2003, use ENEM scores in first phase. From 2007 to 2009, the Federal University of the State of Rio de Janeiro (UNIRIO) allocated half of spots to ENEM scores.

[10]The new ENEM exam consists of a written essay and 180 multiple-choice questions, divided into four knowledge areas: Math, Natural Science, Human Science, and Languages and Codes. In comparison to the older version of the exam, those four subject areas comprise an even wider range of subjects: Human Sciences (Geography, History, Philosophy, and Sociology), Languages and Codes (Foreign Language, Literature, and Portuguese, among others subjects), Math (Geometry and Math), and Natural Science (Biology, Chemistry, and Physics).

of PROUNI ("University for All" Program), a federal government program that provides scholarships in private institutions. Among other eligibility criteria[11], applicants are required to take ENEM. Second, from 2009 onwards, the reformulation of ENEM and the implementation of SISU.

[FIGURE 1 HERE – "EVOLUTION OF ENEM"]

Since its reformulation, ENEM has been widely adopted as a sole or a partial assessment basis for admissions to higher education, replacing *Vestibular* exams. Increasingly, many public institutions reserve a fraction (or all) of their spots for admission through ENEM or uses ENEM scores as a partial requirement for their admission processes[12][13]. For example, since 2012, one of the most prestigious universities – UFRJ (the Federal University of Rio de Janeiro) – incorporates ENEM grade as the unique criteria to admit students.

Also as part of an effort to transform ENEM into a nationwide examination, MEC created, in January of 2010, a computerized and unified application platform: the Unified Selection System (SISU, or *Sistema de Seleção Unificada*). Run by MEC, SISU is a centralized mechanism that allocates students to spots in public institutions, using ENEM scores as a sole admission requirement. Like many countries, as Chile (Hastings et al. (2013)), Sweden (Ockërt (2010)) and China (Chen and Onur (2013)), SISU is a centralized admission mechanism that allocates students to programs based on a deferred acceptance (DA) algorithm, as we explain in the next section.

Figure 2 summarizes the dates of relevant events.

2.2 The Unified System

The SISU platform opens twice a year, at the beginning of the academic semester[14]. Only public institutions are allowed to participate in the system. After taking ENEM and re-

[11] In order to be eligible for Prouni, one of the following requisites is indispensable: a complete High School in public schools; a complete High School in private schools with full scholarship; attending High School in public schools and in private schools with full scholarship; having a disability; being a teacher in public schools. Furthermore, full and partial scholarships are awarded to applicants whose *per capita* monthly household income is less than 1.5 and 3 minimum wages, respectively. After the registering process, applicants are ranked by major-institution choices and ENEM scores, respecting the number of available scholarships. Only top-scoring applicants are awarded.

[12] By replacing the first phase of *Vestibular* or by constituting a part of the overall grade in the *Vestibular*

[13] It is worth mentioning that not all of HEIs opted out of ENEM as the only entrance requirement, preserving their own entry exams. For instance, two of the most important research universities – USP and UNICAMP – decided to maintain their own *Vestibular* exams, which are considered more rigorous than ENEM.

[14] In Brazil, academic terms are defined as semesters. The SISU system typically opens in January and July.

ceiving their scores, students subscribe to SISU. There is a single registration step and only the applicants who had taken ENEM in a previous year are able to access to the system in a current year. During the registration period, which usually lasts four or five days, the applicant opts for up to two options[15] from spots offered by the SISU system and defines whether he competes for a spot reserved for quota system or other affirmative policies[16].

During the registration period, cutoff scores for each program are calculated at the end of each day, and these information are provided to all subscribers. Students are free to change their choices over that period, as many times as they wish. Only the last confirmed choice is valid. This feature is probably the greatest attribute that makes the system unique. Anecdotal evidences suggest that providing the updated cutoff scores are inducing strategic behavior from the applicants. Appendix I provides further details of the system.

After registration period, the system closes and SISU assigns qualified applicants to programs through a deferred acceptance algorithm[17]. Students are accepted to their most preferred program for which they are qualified. If a student is admitted to his first option, he is not considered for admission at his second choice. The result of the assignment mechanism and the list of admitted applicants are published online, and applicants are informed about their classification on the list.

At least one call is announced[18]. During the call period, applicants who ranked and qualified for an assigned option can enroll in the program. Regardless of having enrolled in his first option, if the applicant is qualified to his top choice, he cannot participate in the next call. Also, regardless of having enrolled in his second alternative, the applicant still runs to his first option in the next call when he qualifies for his second choice, but not for his first choice. After regular calls, students who did not qualify for their options should inform to the system if they wish to be included on a wait list. Thereafter, SISU provides to institutions a wait list for each program and the process is similar to *Vestibular*. Any

[15] Again, each option consists of an institution-career combination.

[16] In fact, the Law 12.711, which embraces poor and black, mulattos or Indian students who have attended public schools, regulates the quota system. A minimum of 50% of spots for each program are reserved to those students. Enacted in August of 2012, the law is mandatory for all federal institutions, whilst optional for private institutions.

[17] The algorithm works in the following way: each student proposes to his first choice. After ranking the applicants by composite score, each program rejects the lowest-ranking students in excess of the pre-specified number of available spots and remaining applicants are tentatively admitted. The applicants rejected in the first alternative apply to the next most preferred program from the list. Thus, each program considers these new applicants and the tentatively admitted applicants and assigns its spots to these students, following a priority order. The lowest-ranking students in excess of the number of vacancies available are rejected.

[18] The number of calls is previously set up for each edition; for instance, in January of 2015, SISU had a single call.

remaining spot is filled based on wait list, following the ranking of applicants.

2.3 New System, New Admission Procedures: 2010 to Present

As institutions have an autonomy guaranteed by law, the adoption of SISU is not mandatory. In the first edition, for example, the system offered relatively few spots due to uncertainty about the new ENEM selectivity and the proper functioning of the system. However, over time, the adoption of the centralized mechanism rapidly evolved, both in number of institutions and spots, as the following graphs illustrate[19].

[FIGURE 3 HERE – "EVOLUTION OF SISU (IN NUMBER OF INSTITUTIONS)"]

[FIGURE 4 HERE – "EVOLUTION OF SISU (IN NUMBER OF SPOTS)"]

After the implementation of SISU, ENEM rapidly became a crucial admission exam to embark on the Higher Education route in the country. Since then, public institutions have a wider range of admission possibilities to choose. Initially, they decide whether ENEM exam will constitute an assessment basis for admission process. If so, they decide between three alternatives: using ENEM score as an overall grade in *Vestibular* without SISU, or using ENEM score as first phase or bonus in *Vestibular*, or adopting SISU. The adoption of the system can be partial or full, and institutions are free to choose the fraction of spots to be allocated.

3 Estimation Strategy

Brazilian Higher Education is an ideal laboratory to investigate the effects of switching from a decentralized to a partially centralized admission system. Partially because institutions can choose to admit students through both criteria. Adopting the SISU system is a large-scale policy that affects, every year, millions of Brazilian students.

We refer to *Vestibular* as a decentralized college admission procedure. Students apply directly to institutions and it is not possible to apply to more than one major for each institution. Students face an uncertainty about their admission chances, once they choose the major **before** the entrance exam. However, they can observe the performance distribution of students admitted in previous years, which is a publicly disclosed information. Anedoctal evidences suggest that several students decide to apply to a specific institution and/or major after observing this distribution. Meanwhile, the applicants also face

[19] In January of 2015, SISU offered more than 205.000 spots from 5.631 programs and 128 institutions.

several application costs. For instance, they may need to travel to take *Vestibular* exam (geographic cost), he might have to pay registration fees for the exam (monetary cost), and/or when more than one *Vestibular* exam are scheduled on the same day, they must choose one to attend (choice cost). Given uncertainty about their admission prospects, they often apply to more than one institution.

In 2010, with the creation of SISU, a new and centralized college admission mechanism is implemented. There is no application fee to subscribe to SISU. Students are allowed to submit an online application to the system with up to two ranked program choices[20] **after** taking ENEM exam and receiving their scores. SISU spans a wide range of public institutions with different selectivity levels and a vast catalog of programs. During the registration period, students' admission chances are daily and publicly available, since admission cutoffs for each program and students' partial classification are revealed. Also, applicants are free to change their choices as many times as they wish while the system is open. Only the last assigned choice is valid. Appendix III discusses in more details the differences between *Vestibular* and SISU settings in a simple non-formal framework.

Switching from a decentralized to a partially centralized admission system can lead to potential benefits for applicants and institutions. From the demand side, several costs are lowered for applicants: search costs (they can apply online to any program available in the system), monetary costs (instead of bearing registration fees of several exams[21], students are required to pay, when not free-exempt, a unique and low application fee[22] for ENEM; there is no application fee for SISU), time costs (a unique exam, rather than various exams), and geographical barriers (since ENEM exam can be easily taken in place of residence). Likewise, there may be some advantages to institutions, as the possibility to attract better students from further away and mitigate admission costs.

In addition to smoothing several costs associated with a decentralized admission system, SISU mechanism is also a unique opportunity to study to what extent students behave strategically when choosing their programs. To the best of our knowledge, there is no other centralized system in which cutoff scores are daily updated and revealed, and subscribers are allowed to change their options until the deadline. As students choose up to two program options and face an uncertainty about admission chances from the last update of cutoff scores until the deadline, they are constrained on the number of choices to be submitted to the system and have incomplete information about their admission prospects. According to Ajayi (2011), this is a case involving imperfect information with

[20] As program choices, notice that each student can submit either a same major in two institutions, or different majors in the same institution, or different majors in different institutions.

[21] Each of them costs at least 100 *reais* (USD 32).

[22] It costs 35 *reais* (USD 12).

constrained choices. The optimal strategy is such that the student does not necessarily apply to his most preferred program. Instead, he chooses programs based on his expected utility, taking into account the subjective probability of being admitted to a specific program (see Appendix III for further details). It implies that any chosen program is preferred to all other programs that he believes having equal admission probability.

In this paper, we focus on two main implications. First, we investigate the impact of moving from a decentralized to a centralized assignment system on students' migration. Since its inception, SISU offered spots from programs located in 757 municipalities widespread in all Brazilian states and regions[23]. The system, for example, allows an applicant who lives in Roraima (the northernmost of Brazilian states) to list options in Rio Grande do Sul (the southernmost of Brazilian states), without having to travel. On the one hand, institutions may be attracting more applicants from other locations or losing applicants to their counterparts located in other locations. On the other hand, there may be moving costs, so that individuals simply do not migrate. In this sense, introducing a centralized system that eliminates information and geographical obstacles does not affect students' mobility. Our first goal is to evaluate whether there is a higher mobility of first-year students.

Second, we also examine the effects on dropout rates. The SISU system encourages strategic behaviors, though it does not mean that students do not behave strategically in *Vestibular*. However, unlike SISU, in which a student chooses a program **after** reveiving his ENEM score, the registration for *Vestibular* requires that applicants choose a program **before** the examination. Another relevant difference is that, in a decentralized setting, the choice may be based on the performance distribution of students previously admitted and cannot be changed after registration for exam, whereas, in a centralized setting, the applicants often modify their choices after observing the cutoff scores.

Another source of dropout may also stem from a higher students' mobility. Despite public institutions do not charge tuition fees, moving is costly and students may not afford to support themselves. In addition to financial struggle, personal reasons may lead to drop out of college. This paper aims at assessing whether and to what extent SISU affects dropout rates of first-year students, as well as disentangling the mechanisms underlying the estimates.

[23] Brazil is administratively divided into over 5500 municipalities, 27 states and 5 regions.

3.1 Data

In this paper, we exploit two main administrative datasets: the Brazilian Higher Education Census and ENEM databases. The Census, carried out annually by INEP (National Institute for Educational Studies and Research), gathers detailed information on public and private higher education institutions, graduation courses, students, technical-administrative staff, and instructors. Every year, institutions are mandated to report every student enrolled in their programs during the previous year[24]. Only federal and state public institutions participate in SISU, thus we exclude students from private institutions to build our final sample. We also delete municipal institutions from the sample for two main reasons. First, they can charge tuition fees, while federal and state public institutions do not charge any fee. Second, none of them adopts SISU as an entrance requirement. Detailed information on students include their admission date and enrollment status. We also observe students' demographic characteristics and location. In our analysis, we focus on first-year students. ENEM databases, also gleaned from INEP, contain socio-demographic and academic information on test takers.

As our measure of migration, we ideally need information on the last location where the student has been before entering to college. Unfortunately, the Census does not provide this information. Also, both publicly student-level data are de-identified for reasons of confidentiality. Using restricted access data, we merge the Census data with ENEM microdata (henceforth, "the matched data") to recover the students' place of residence when they took the ENEM exam. To the best of our knowledge, we are the first researchers to be granted access to students' identification numbers to link both datasets. These identifiers are unique and do not change over time. Our analysis on migration is limited to yearly data from 2010 to 2013 because reliable individual information on students are only reported since the 2010 Census[25] and the 2013 Census data is the last available one. We are able to link approximately 69.68% of first-year college students from the Census to ENEM data sets. We then build a measure of mobility, which is defined as an indicator variable for whether the location where the student resided before entering college is different from his current location. This is our preferred measure of migration. Notice that

[24]If institutions do not participate, their students are not allowed to take the ENADE exam (National Exam of Undergraduate Course). This exam is a requisite to issue an academic record, without which it is not possible to obtain an undergraduate certificate of completion.

[25]Individual information on students actually are reported since 2009 in the Census data. However, the Brazilian Taxpayer Registry (*Cadastro de Pessoa Fisica*, or *CPF*), which is the individual identification number, is only included from 2010 onwards. Conversations with the INEP staff indicate that the inclusion of the Taxpayer Registry in the Census has substantially helped to build a reliable student-level data. Additionally, CPF is only mandatory to register for ENEM since 2009. Thus, using CPF to flawlessly link 2008 ENEM to 2009 Census is impractical.

the final sample is restricted to four cohorts of first-year students admitted between 2010 and 2013 from federal and state public institutions[26].

As expected in matched datasets, the limitation is a lack of past information on students who did not take the ENEM exams. For example, our estimates would be biased upwards if students who take ENEM are more likely to move out. To address with concerns about sample selection in our analysis, we create an alternative measure of migration. The Census reports birthplace for nearly 70% of students. We construct an indicator variable of migration for whether the student's birthplace is different from his current location. When possible, we corroborate results from our preferred measure of migration using this alternative variable, finding very similar estimates. It is worth mentioning that student's birthplace does not appear in 2009 Census. Because we do not want to lose observations from the year immediately before the implementation of SISU to test for pre-existing trends, we recover this information from past Census. More precisely, from 2010 Census, we maintain observations of 2009 cohort, which is easily identified by admission year. We show evidences that the attrition problem is not a concern in our analysis.

In the Census data, institutions are also required to update students' enrollment status: currently studying, on leave, cancellation, transferred to a new degree in same institution, graduating, or deceased. We use this information to construct a measure of dropout, which is defined as an indicator variable for whether student's enrollment status is on leave or cancellation in the current year[27]. To investigate the effects on dropout, we mainly use yearly data from 2010 to 2013. In some robustness checks, we also include the 2009 cohort.

Our empirical strategy requires us to identify institutions and programs that adopted SISU between 2010 and 2013. A minor data source, provided by MEC, assembles this information. A full list of institutions is found in Appendix V. When necessary, we also use ENADE (the National Exam of Undergraduate Course) microdata and measures of institutions' quality, both collected from INEP.

Table 1 shows annual descriptive statistics for a sample of first-year students from public institutions. From 2010 to 2013, the fraction of students admitted through *Vestibular* fell from 77% to 51%, while the share of students admitted through ENEM rapidly increased from 22% to 38%. Over time, more students are benefited from quota systems

[26] We use the terms "federal and state public institutions" and "public institutions" interchangeably.

[27] On leave(*"matrícula trancada"*) and cancellation (*"desvinculado do curso"*) are quite different. If a student requests to be on leave, he can return to the institution, subject to institutional rules, without having to take admission exams. If a student requests cancellation, he can no longer be enrolled, unless he is admitted through a new entrance examination.

and policies that provide social support[28].

3.2 Empirical Strategy

To examine how introducing a centralized admission mechanism affects migration and dropout of first-year students, we exploit temporal variation in the adoption of SISU. We estimate the following model:

$$Y_{ist} = c + \beta SISU_{st} + \delta X_{ist} + \alpha_s + \alpha_t + \varepsilon_{ist} \quad (1)$$

where the dependent variable Y_{ist} refers to the migration and dropout variables; the subscript i indexes student, s refers to each federal and state public institutions, and t identifies the year. $SISU_{st}$ captures the timing of SISU adoption, and is an indicator variable for whether the institution s (partial or fully) adopted SISU as an admission criterion in the year t. We also introduce time and institution fixed effects. Year fixed effects control for common shocks that each year affect all students in the same way. Institution fixed effects control for characteristics of each institution that do not vary across time and might be correlated both with the dependent variable and with the decision of an institution to adopt the centralized mechanism. Further, we include a set of covariates for student characteristics, X_{ist}: gender, disability, race and dummy variable equal to one if the student is benefited from quota system, which is a proxy for his socioeconomic status. The set of covariates also comprises age dummies for students[29]. As student-level data are combined with institution-level regressors, we cluster standard errors at the institution level to allow for potential serial correlation within institutions (Bertrand et al. (2004)).

We define Y_{ist} as an indicator variable for whether the place where a student resided in the year before entering college is different from institution's location. We test for mobility at two levels: municipality and state. The intermunicipality migration (variable *municipality*), which we define as an indicator for whether the municipality of residence during the ENEM exam is different from the municipality where the student i attends college, is the preferred specification because it reports the lowest geographic level. We also show results for interstate mobility (variable *state*), which is defined as moving from one state to another. Finally, to evaluate the impact on first-year student dropout rate, we define Y_{ist} as an indicator variable for whether student's enrollment status is on leave or cancellation in the first year.

[28] For example, food support, housing support, material support, etc.

[29] Due to computational limitations, we were not able for now to include institution linear time trends α_s*t to capture unobserved institution characteristics that evolve over time. We are aware of this issue and plan to address it as soon as possible.

In most cases, the decision to move to a new admission mechanism is a matter of institutions. However, some programs are not offered by SISU, even when an institution adopts the system. For example, there are programs that require specific skills[30], still admitting students through *Vestibular* exams. We run the following specification to explore the sensitivity of our results when considering the possibility that some programs are not offered by the system:

$$Y_{ipt} = c + \beta SISU_{pt} + \delta X_{ipt} + \gamma_s + \gamma_t + \varepsilon_{ipt} \tag{2}$$

where the subscript i refers to student, p refers to program (a career-institution combination), and s and t identify the institution and year, respectively. The indicator variable SISU_{pt} is equal to one whether the program p is offered by SISU in the year t. We also include institution[31] and time fixed effects to capture within institution changes in our outcomes due to adoption of SISU over time. The set of controls X and the dependent variable Y are the same as in Equation (1) and standard errors are clustered at the institution level[32].

3.3 Validating the Empirical Strategy

The empirical strategy relies on the assumption that the introduction of SISU is exogenous with respect to the outcomes of interest. As institutions have autonomy to decide how to select their students, the adoption of SISU is not exogenous. It is important to our analysis that the timing of adoption of SISU not be correlated with initial institution characteristics or time-varying shocks to migration or dropout. For example, if the only institutions that adopt SISU are those low-quality ones, the estimates would be biased.

However, the historical context indicates that the expansion of the centralized system does not seem to be driven by institution-specific characteristics, except for the fact that federal institutions are more likely to join the system. In 2008, when MEC stated his effort to reformulate ENEM to build a national standardized admission exam to Higher Education, most public institutions were reticent about the content of the new exam and the proper functioning of SISU. This reticence worsened considerably due to the leaking of the exam in 2009, followed by a rescheduling. In subsequent years, both ENEM and SISU gradually built a solid reputation though. More institutions increasingly joined SISU or

[30] For example, Music, Performing Arts and Visual Arts

[31] Current computational limitations did not allow us to include program fixed effects. We plan to solve it soon.

[32] Standard errors are clustered at the institution level, not at the program level, because conservative specifications are our preferred option.

used the ENEM score as a partial requirement for their *Vestibular* exams. For example, in 2014, all Brazilian federal universities used ENEM score to select their students[33]. In January of 2015, only five out of sixty-three federal universities did not use SISU to select their students. Although MEC offers a monetary compensation to institutions that replaced their *Vestibular* exams by ENEM[34], some of public institutions are still not ready to consent a replacement. In short, from the institutional and historical context, we argue that there are evidences that the determinants of adoption of SISU are predominantly related to its reliability and security, as well as to new ENEM selectivity, but not to dropout or migration of first-year students.

To ensure that dropout and migration are not some of the determinants of adhesion to SISU, we check for systematic differences across institutions that adopted SISU in some point between 2010 and 2013 (i.e., treated institutions) and those that did not join the system (i.e., untreated institutions) in the year immediately before the beginning of SISU, in 2009[35]. Table 2 shows the average value of a set of students' characteristics. We further include institutions' characteristics related to location, size and quality[36].

Overall, Table 2 yields no evidence of the timing of adoption of SISU to be correlated with institution characteristics, except for the fact that federal institutions are more likely to adopt the system as an entrance mechanism[37]. This result is not surprising because federal institutions receive transfer payments directly from the Ministry of Education, in contrast to state institutions, whose transfer payments are under supervision of the state government. Due to the financial dependency on MEC, federal institutions are arguably more likely to adopt SISU as an admission requirement. In robustness checks section, we show that our results remain the same after restricting the sample to federal institutions.

[33]By adopting SISU, by using ENEM score as an overall grade in *Vestibular* without SISU, or by using ENEM score as first phase or bonus in *Vestibular*.

[34]Monetary compensations are offered because one of the most important revenues comes from registration fees of *Vestibular* exams.

[35]Alternatively, we also check for differences across institutions that adopted SISU in 2010 and untreated institutions (Panel A, Appendix IV). Analogously, we replicate this exercise with two other samples of treated institutions – those that joined the system in 2010 and 2011 (Panel B, Appendix IV) and between 2010 and 2012 (Panel C, Appendix IV) – to test whether (and what) institution-specific characteristic seem to be a possible determinant for SISU.

[36]See Black and Smith (2004), Black and Smith (2006) for references of quality measures.

[37]Later, in robustness checks section, we show that our estimates are not driven by institutions' administrative categories (i.e., federal or state).

4 Results

In this section, we report estimation results, followed by a battery of alternative robustness tests to ensure that the effects are qualitatively similar across different specifications.

4.1 Effects on Migration

We first investigate whether introducing a centralized admission affects migration. We begin by presenting results for Equation (1). Our sample is restricted to students found in both ENEM and Census datasets. Table 3 presents the results. Columns (1) and (5) report estimates for a model with a set of students' characteristics and age dummies. In Columns (2) and (6), we include institution and year fixed effects. Notice that the estimated coefficients on migration are strongly significant. The coefficient in Column (2) indicates that the estimated average effect of adopting SISU is an increase by 2.6 percentage points (p.p) in intermunicipality mobility rate of first-year students. Similarly, Column (6) shows that institutions with a centralized admission experienced an increase by 3.9 p.p. in interstate migration rate.

As mentioned before, switching from a decentralized to a partially centralized admission system implies lower geographic costs for applicants. A potential concern is that the effects can be overestimated if there are cases of students enrolling in programs, but never attending, because they do not effectively move out. In order to reduce the likelihood of those "ghost students" biasing our estimates, we exclude individuals whose enrollment status is on leave or cancellation. Columns (3) and (7) indicate that our results are not driven by the inclusion of inactive students.

Next, we analyze whether the previous results are inaccurate because our identification strategy exploits time variation in the implementation of SISU across institutions, while there may be several programs that maintain decentralized admissions. In Columns (4) and (8), we report results related to Equation (2) to capture changes at program level over the period. The estimated coefficients are quite similar to those in Columns (2) and (6) for both intermunicipality and interstate mobility rates, suggesting an increase by 2.3 p.p. and 4.2 p.p., respectively. Overall, the results presented in this section suggest that switching from a decentralized to a partially centralized admission induces students' mobility.

Results presented in Tables 3 suggest sizable effects of SISU on student migration. The next step is to examine the intensity of treatment. Our baseline specification constrains the effect to be the same for all institutions within treatment group, which may not be a

reasonable assumption because institutions allocate different fractions of spots to SISU[38]. In order to investigate how estimated effects vary with treatment intensity, we consider an alternative specification. We construct a continuous treatment variable, $fraction_{st}$, and estimate the equation below:

$$Y_{ist} = c + \beta SISU_{st} * fraction_{st} + \delta X_{ist} + \gamma_s + \gamma_t + \varepsilon_{ist}, \quad (3)$$

where the subscript i identifies student, t refers to year, and s indexes public institutions s. The variable $fraction_{st}$ is the fraction of first-year students admitted through ENEM for each combination of institution s and year t. Time and institution fixed effects are included. The set of controls X and the dependent variable Y are the same as in Equation (1) and standard errors are clustered at the institution level.

Note that $SISU_{jt}$*$fraction_{jt}$ is the interaction between the timing of SISU adoption and the fraction of first-year students admitted through ENEM. We define $SISU_{jt}$*$fraction_{jt}$ as the fraction of first-year students admitted through SISU. We do not find any case of institutions using ENEM scores as admission requirement with and without SISU at the same time. Thus, when a student is admitted through ENEM in an institution that adopts SISU, it is equivalent to say that he is admitted through SISU.

The coefficient of interest β can interpreted as the effect of a full adoption of a centralized mechanism. Table 5 reports results from Equation (3). Interestingly, Columns (1) and (2) indicate that a full adoption of SISU corresponds to an increase by 3.4 p.p and 4.6 p.p. in intermunicipality and interstate mobility of first-year students, after controlling for students' chracteristics and fixed effects. These estimates are slightly stronger than those presented in Tables 3 and 4, suggesting that the effects are heterogeneous across different levels of spots allocated to the centralized platform. Institutions with a higher fraction of spots reserved to SISU are likely to receive more students from other locations[39].

4.2 Effects on Dropout

So far, we have showed that the adoption of a centralized admission is associated with a higher migration of students. In this section, we turn to the question of whether SISU could also impact on dropout. Table 4 reports the main results. Our baseline estimation

[38] As mentioned, the system can be adopted partial (e.g. UFRJ, in 2011, and UnB, in 2014) or fully (e.g. UFRJ, from 2012 onwards).

[39] Moreover, we test for heterogeneous effects across locations to capture to what extent the results are driven by location-specific features. For brevity, these results are omitted. We find a stronger effect on migration for institutions located in non-capital municipalities. Also, institutions located in North and Southeast regions are on average those that received relatively more students from other municipalities and/or states.

sample includes all first-year students from the Census over the 2010-2013 period. Column (1) displays the estimated coefficient after controlling for students' characteristics. Column (2) shows results from estimating Equation (1). The estimated coefficient falls from 6.8 p.p. to 4.4 p.p., suggesting sizable effects on dropout. In Column (3), we test if the point estimate changes when only observations from the matched data are considered. Notice that the estimated coefficient do not largely change in size or precision. Column (4) indicates that the estimates are robust to the inclusion of 2009 cohort. We estimate Equation (2) to capture changes at program level. As shown in Column (5), we find stronger effects.

To address concerns that the main specifications do not consider different levels of SISU adoption, we assess the intensity of treatment on dropout rate in the same vein as Equation (3). Column (3) of Table 5 indicates that introducing a centralized mechanism leads to a 4.2 p.p. increase in dropout rate. In Column (4) of Table (5), we show that we obtain a similar result by restricting the sample to be the same as in Columns (1) and (2).

4.3 Robustness Checks

In this section, we undertake several robustness checks to support the validity of the identifying assumptions.

4.3.1 Sample Selection

A natural concern about our matched data is a lack of past information on students who did not take ENEM. For example, if students who did not take ENEM are less likely to migrate, then our estimates would be biased upwards. We attempt to address concerns about selection bias that can potentially threaten the internal validity of our results by using a new variable of migration. We replicate our baseline specifications using the indicator variable for whether the student's birthplace is different from his current location. Although this alternative variable also suffers from the missing data problem, note that the *source* of the bias is arguably different. ENEM takers should subscribe to the exam by filling out a questionnaire and reporting where they live[40], thus all information collected in ENEM databases are from test takers' reports. On the other hand, the Census data is directly collected from institutions, not from students. As indicated in Columns (1) and (2) of Table 6, our results are robust to the use of this alternative measure. Additional results for migration using information on students' birthplace are reported in Appendix

[40]INEP attempts to allocate students to take ENEM at the nearest location to the place of residence.

VI.

A possible threat to our results could stem from the definition of the final sample. As stated in Section 3, federal institutions are more likely to join SISU because they are under pressure from the Ministry of Education, in contrast to state institutions. Indeed, in 2013, nearly 80% of federal institutions and only 20% of state institutions adopted the centralized admission. It still may be the case that federal institutions are somehow different from state ones, thus state institutions may not be a proper comparison group. To be sure that our estimates are not sensitive to including state institutions, we restrict our sample to federal institutions and estimate the baseline model. Columns (3) to (5) of Table 6 indicate that the coefficients are quite similar to those previously estimated.

4.3.2 Pre-Existing Trends

Another potential concern is that our results may be confounded by pre-existing trends on migration or enrollment. For example, our coefficients might reflect an anticipation before the effective implementation of SISU. Discussions with MEC, however, indicate that SISU was surprisingly announced to the public in January of 2010. In 2008, when MEC stated the reformulation of 2009 ENEM, nothing was mentioned about the creation of a centralized platform. Over 2009, when several institutions decide to reserve spots for admission through ENEM, there were no official announcements (or even rumors) on the creation of SISU.

Unfortunately, the Census data matched to ENEM microdata do not have observations for migration in the year immediately before the creation of SISU. Alternatively, we can investigate if there is an anticipatory effect on migration using an alternative measure of mobility. We use an indicator variable for whether the place of birth is different from current location. Although students' birthplace does not appear in 2009 Census, we can recover information on birthplace of 2009 cohort from 2010 Census[41]. We consider a new definition for $SISU_{st}$: an indicator variable equal to one in the year *t-1* if the institution *s* adopted SISU in the year *t*, pretending that SISU adoption took place in the year before. If there is an anticipatory effect, the coefficient associated with $SISU_{st}$ should be significantly different from zero. We extend this falsification test to dropout. As shown in Columns (6) to (8) of Table 6, the estimated coefficients are slightly small in magnitude and not significantly different from zero.

[41] Admission cohorts are easily identified by admission year. In Appendix VI, we show that the estimated coefficients are not driven the inclusion of the 2009 cohort.

4.3.3 Other Educational Policies

Another threat is that SISU might have been concomitantly implemented with other educational policies. In this case, the estimated coefficient could be also capturing these policies even after the inclusion of time-varying controls for students' characteristics. We did not find any relevant policies in public institutions in the last recent years, except the enactment of Quota Law in August of 2012. The quota system is an affirmative action policy that requires a minimum of 50% of spots in federal institutions to be reserved to poor and black, mulattos or Indian students who have attended public schools.

There is a concern that Quota Law might lead to a selection of students with a worse socioeconomic background and more likely to drop out. We attempt to rebut this claim by including an indicator variable quota_{st} for whether system of quotas is implemented in institution s and year t[42]. Columns (9) to (11) of Table 6 suggest that the coefficients are virtually unchanged after controlling for implementation of quota systems.

4.3.4 Selection on Observables

Finally, another potential caveat in our analysis relies on the possibility that the composition of treatment groups have changed after the implementation of SISU. For example, if institutions that adopted SISU are attracting students with a worse social background, those who are more likely to drop out or less likely to migrate, then the estimated coefficient would be capturing the worsening of the pool of students. To address this concern on student selection, we check whether there is any change on students' observable characteristics. We run regressions related to Equation (1) with several students' characteristics as the dependent variables[43].

Table 7 presents results. Overall, we find no significant changes in the composition of treatment groups, except for admission criteria and female students. Changes in admission criteria are expected because the SISU expansion is correlated with an increase in a pool of students admitted through ENEM and, consequently, a decrease in a pool of students admitted through *Vestibular*. Further, recent evidences in the literature suggest that female are more risk-averse than males and have lower performance under competition

[42]The Census reports if a student is benefited from quota system. Thus, it is straightforward to create the variable quota_{st}, which is equal to one if an institution s has at least one first-year student benefited from the quota system in the year t.

[43]Unfortunately, we do not include a proxy for student quality. ENEM scores are not a suitable measure for quality because students who are admitted through SISU are arguably more likely to have higher ENEM scores. It does not mean, however, that those are *better* students. We support this view by considering an alternative measure of student quality (ENADE scores). We do not find evidence that institutions that adopted SISU experienced an increase in the number of high-quality students.

(Gneezy et al. (2003), Niederle and Vesterlund (2007)). Thus, a decrease in a pool of female students may be a result of a higher risk aversion environment induced by the SISU system. In addition, note that any change in migration or dropout due to change in the composition of students by gender is captured by the inclusion of an indicator variable for female students.

5 Heterogeneous Effects

Thus far, we have documented the estimates of a reduced-form relationship between the adoption of a centralized mechanism and dropout of first-year students. As discussed in Section 3, SISU may affect dropout through different channels. In practice, distinguishing and identifying these different pathways is a hard task. We attempt to overcome this challenge by showing some evidences on the potential mechanisms.

The first question with relevant implications for policymakers is whether students that migrate are driving our dropout results. To sidestep this issue, we estimate Equation (1) separately for two sub-samples of individuals: those that remain in their municipality of residence and those that attend college in municipalities different from places of residence shortly before entering college. A similar approach is replicated at a state level. The estimates in Table 8 suggest that students from other locations are indeed more likely to drop out, especially those that have moved to another state.

If students who have migrated are less likely to stay for college, thus introducing a centralized admission process may not be enough to effectively boost enrollment. Even with reduced application costs. Although Brazilian public institutions do not charge any tuition fee, moving is costly and students may not afford to support themselves. In addition to financial struggle, some personal reasons - for instance, taking care of a family member, needing to spend more time with family, working to support the family, or problems of adaptation to new life - are more strenuous for those students. However, dropout is also costly to public institutions because the vacancy previously occupied by a student who drops out is hardly filled by another one. One possible cost-effective way to minimize this problem is providing financial or housing support to students from other locations.

Moreover, it is important to relate our findings to evidences on strategic behaviors. If the final list of programs submitted to SISU by students is largely based on the observed cutoff scores, one may argue that programs with a smaller demand could be those to experience higher migration or dropout rates. As a proxy for quality of programs, we consider the average ENEM scores. After combining 2012 ENEM microdata with 2013

Higher Education Census, we create the average ENEM scores of first-year students for all programs available in the 2013 Census. We divide these scores into quartiles to obtain a proxy for programs' selectivity. Finally, we estimate Equation (2) separately for quartile, with first quartile facing the smallest and fourth quartile facing the largest average ENEM scores, using a complete set of dependent variables: intermunicipality and interstate mobility, and dropout rate.

Table 9 presents the results. From Columns (3), (6), (9) and (12), we find a very large and monotonically decreasing effects on dropout rates, suggesting that students whose programs with higher measures of quality are those less likely to drop out of college. Yet, we do not find a similar pattern for migration. These findings can be interpreted as follows: the applicants near the smallest cutoff scores for admission are probably more likely to apply to options in which their scores are enough for admission. After matriculating, they may drop out.

6 Concluding Remarks

In this paper, we take advantage of a large-scale policy change to empirically investigate the effects of switching from a decentralized to a centralized admission system on migration and enrollment. We find that that institutions that have adopted SISU as an admission mechanism received relatively more first-year students from other municipalities and states. A plausible explanation is that application costs could be reduced after the implementation of a centralized system.

In addition to evaluating the effect on mobility, this paper assesses the effects on dropout rates of first-year students. We find evidences that SISU institutions underwent a larger increase in dropout rates of first-year students. Our findings have relevant policy implications. First, they suggest that a centralized admission process may not be enough to broaden the migration of college students. Second, our results also suggest that providing cutoff scores during the registration period may encourage strategic behavior from the applicants.

This paper also contributes to the policy debate on the system. In Brazil, the increasing popularity of SISU in recent years raised a debate about whether a centralized mechanism is the best way to select students. In particular, several public institutions remain reluctant to abolish a decentralized system due to the lack of a rigorous evaluation of SISU. On the other hand, advocates of SISU argue that the centralized system expands the access to Higher Education by mitigating several costs related to *Vestibular* and attracting students with distinct background from different locations.

Future research will investigate the long-term effects of introducing a centralized mechanism. More broadly, we also intend to exploit discontinuous admission rules – generated by cutoff scores – to reinforce the results presented here.

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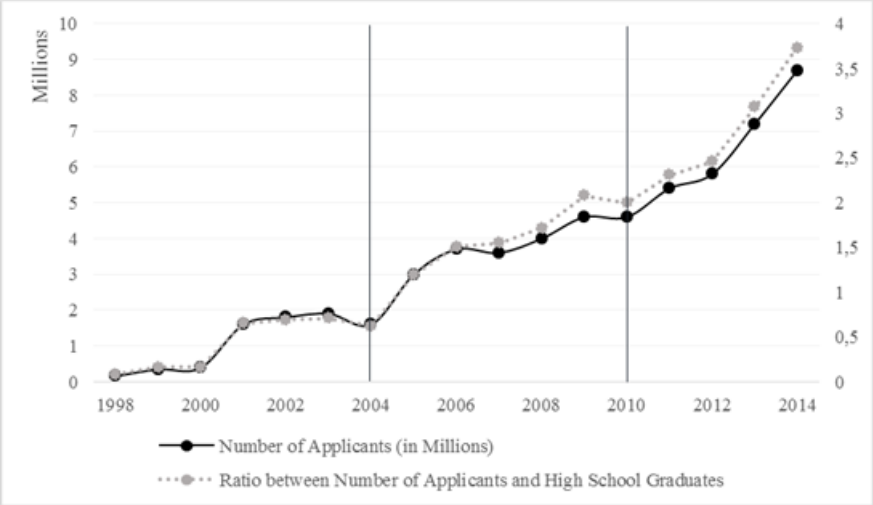
Figure 1: Evolution of ENEM

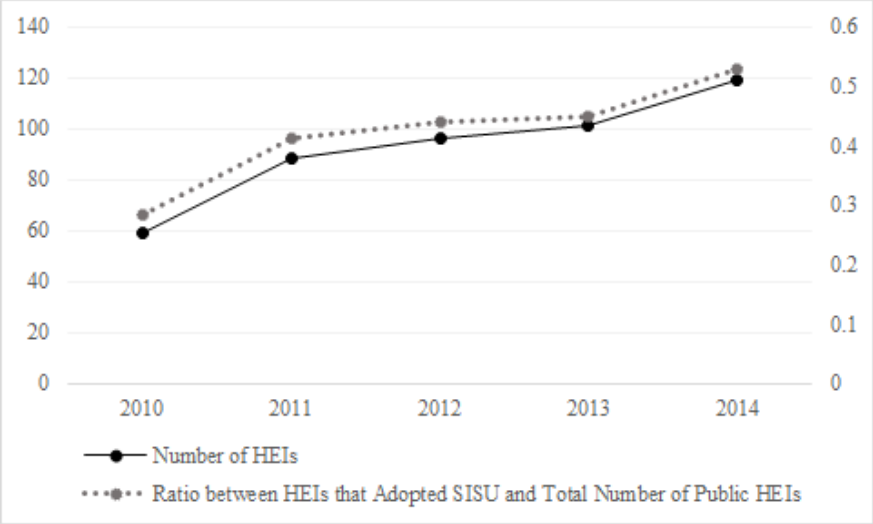


Note: Graph shows, on the left axis, how the number of ENEM applicants rapidly increased, since its first edition. On the right axis, graph shows the ratio of total number of applicants divided by the number of high school graduates. Information on applicants are obtained from ENEM microdata (1998 - 2012), provided by INEP (National Institute for Educational Studies and Research). Information on high school graduates are obtained from the annual School Census. Information on 2013 and 2014 editions are obtained from official announcements about the exam. The first edition, in 1998, received 157.221 registrations (approximately 0.1% of the Brazilian population), while the last edition received 8.721.946 registrations (roughly 4.3% of the Brazilian population), in 2014.

Figure 2: Timeline of New Policies to Higher Education

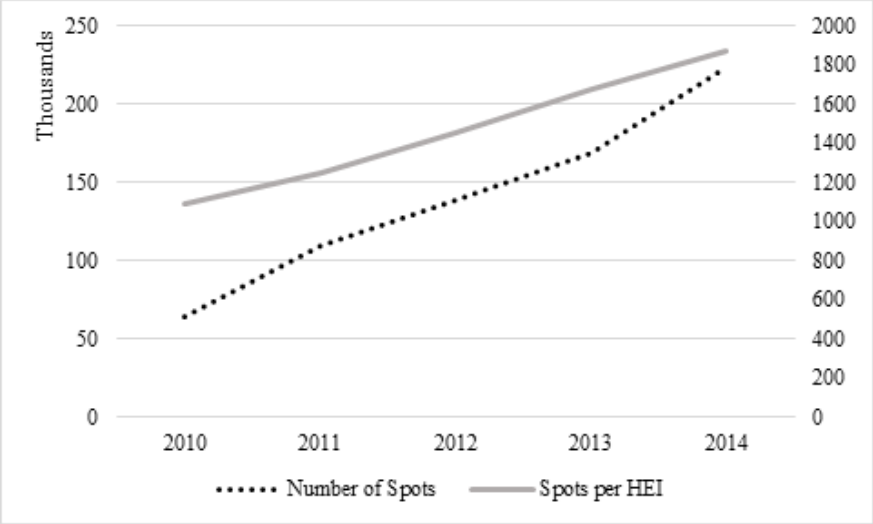
- In **1998**, MEC created the National Exam of Secondary Education (ENEM);
- In **September of 2008**, MEC stated his plan to transform ENEM into a national standardized entrance examination, instead of *Vestibular*, by reformulating 2009 ENEM;
- **Over 2009**, the rules of admission procedures were announced by institutions, several of whom (roughly 59 institutions) decided to reserve some spots for admission through ENEM as a single phase;
- In **June of 2009**, students registered online for 2009 ENEM;
- In **November of 2009**, the Law 12.089, which prohibits a same student to occupy two or more vacancies in public HEIs at the same time, was enacted;
- In **December of 2009**, the students took ENEM;
- In **January of 2010**, MEC announced the creation of SISU to assigns students who take ENEM to slots offered by public institutions that adopt ENEM score as a single-stage entrance examination;
- In **January of 2010**, SISU was officially established.

Figure 3: Evolution of SISU (In Number of Institutions)



Note: the graph illustrates how SISU expanded over time, by showing the annual evolution of the number of institutions that adopted SISU (on the left) and the ratio between the number of institutions that adopted SISU and the total number of federal and state public institutions (on the right). Data on institutions that adopted SISU comes from Ministry of Education (MEC). Number of public institutions between 2010 and 2013 comes from Higher Education Census, which is at yearly level, and information on 2014 comes from INEP's announcements. In absolute values, only 59 institutions participated in SISU in the first year, in 2010. In the following years, the number increased to 88 (in 2011), 96 (in 2012), 101 (in 2013) and 119 (in 2014) Higher Education Institutions (HEIs.)

Figure 4: Evolution of SISU (In Number of Spots)



Note: the graph refers to the number of spots offered by SISU. Data is from MEC's announcements. The axis on the left refers to the number of available spots for each year, while the axis on the right refers to the ration between the number of spots offered by SISU and the number of institutions that adopt the system. In all, 64.486, 109.461, 139.100, 169.043, and 223.168 spots were offered in 2010, 2011, 2012, 2013, and 2014, respectively.

Table 1: Descriptive Statistics

VARIABLES	2010	2011	2012	2013
% dropout	0.12	0.11	0.13	0.13
	(0.32)	(0.31)	(0.34)	(0.33)
% vestibular	0.77	0.68	0.56	0.51
	(0.42)	(0.46)	(0.47)	(0.50)
% ENEM	0.22	0.27	0.35	0.38
	(0.47)	(0.48)	(0.50)	(0.48)
female	0.54	0.52	0.53	0.52
	(0.50)	(0.50)	(0.50)	(0.50)
age	21.05	21.51	21.64	21.74
	(5.05)	(5.60)	(5.79)	(6.00)
% white	0.20	0.22	0.23	0.23
	(0.40)	(0.41)	(0.42)	(0.42)
disabled	0.00	0.00	0.00	0.01
	(0.05)	(0.06)	(0.07)	(0.07)
% receive social support	0.14	0.12	0.13	0.18
	(0.34)	(0.33)	(0.34)	(0.38)
% benefited from quota system	0.12	0.12	0.15	0.20
	(0.33)	(0.33)	(0.35)	(0.40)
standardized ENEM scores	0.02	0.02	0.03	0.02
	(1.00)	(1.00)	(1.00)	(1.00)
% migration (municipality)	0.52	0.50	0.50	0.50
	(0.50)	(0.50)	(0.50)	(0.50)
% migration (state)	0.11	0.09	0.09	0.10
	(0.31)	(0.29)	(0.29)	(0.29)
Observations	237.737	296.381	321.310	335.881

Note: this table reports descriptive statistics for first-year students from federal and state public institutions over the 2010-2013 period. Table displays means and standard deviations in parenthesis. Source: Higher Education Census and ENEM microdata.

Table 2: 2009 Characteristics of Treated and Untreated Institutions

	Untreated	Treated	p-Value
Observations	81	97	–
A. Students' Characteristics			
ENADE Scores	0.471	0.508	0.7294
Dropout	0.062	0.082	0.0894
Female	0.516	0.511	0.7989
White	0.223	0.215	0.8413
Disabled	0.008	0.006	0.7625
Admitted through ENEM	0.046	0.049	0.9214
Admitted through Vestibular	0.963	0.949	0.4345
Migration (State)	0.165	0.158	0.7738
Migration (Municipality)	0.537	0.519	0.6090
Receive Social Support	0.041	0.061	0.4244
Benefited from Quota System	0.095	0.067	0.2596
Age	24.432	23.923	0.2548
B. Institutions' Characteristics			
University Institutions	0.456	0.577	0.1093
Federal Institutions	0.165	0.835	0.0000
Bachelor's Degree Programs	0.319	0.378	0.1872
Located in State Capital Cities	0.277	0.307	0.5954
Located in Central-West Region	0.047	0.081	0.3470
Located in North Region	0.079	0.114	0.4361
Located in Northeast Region	0.176	0.280	0.1028
Located in Southeast Region	0.510	0.371	0.0629
Located in South Region	0.186	0.152	0.5339
Number of Employees	858.938	850.320	0.9727
Number of Students	1954	2362	0.2713
Number of Programs	74.938	59.680	0.5457
Number of Teachers	659.061	721.454	0.6431
Institutions Have a Lab	0.775	0.782	0.8633
General Index of Programs	3.435	3.581	0.2059
Institutional Concept	3.555	3.674	0.6394

This table reports comparison of 2009 students' and institutions' characteristics of treated and untreated institutions. Treated institutions are those that adopted SISU in some point between 2010 and 2013. The p-value comes from the t-test of equality across the two groups. The joint test fails to reject the null hypothesis of no relationship between both groups at 5% levels, except for federal institutions. As student's characteristics, we include ENADE scores of first-year students, the share of inactive, female, white and disabled students, fraction of students admitted through ENEM and *Vestibular*, fraction of students that have migrated, share of students that receive some type of social support and is benefited from quota system, and average student age. Variables for migration are defined as indicator variables for whether student's birthplace is different from his current location. General Index of Programs and Institution Concept are a measure of quality of institutions, provided by INEP. Source: Higher Education Census, ENADE microdata, and INEP.

Table 3: Effect of SISU on Migration

	(1) munic.	(2) munic.	(3) munic.	(4) munic.	(5) state	(6) state	(7) state	(8) state
SISU	0.015	0.026***	0.020***	0.023**	0.053***	0.039***	0.031***	0.042***
	(0.036)	(0.009)	(0.007)	(0.009)	(0.015)	(0.009)	(0.007)	(0.006)
Constant	0.33	0.447***	0.529***	0.447***	0.294	0.284	0.456	0.283
	(0.303)	(0.151)	(0.173)	(0.151)	(0.309)	(0.321)	(0.360)	(0.320)
Observations	1,191,309	1,191,309	1,046,414	1,191,309	1,191,309	1,191,309	1,046,414	1,191,309
R^2	0.018	0.146	0.148	0.146	0.014	0.086	0.088	0.087
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Institution FE		✓	✓	✓		✓	✓	✓
Year FE		✓	✓	✓		✓	✓	✓
Sample	All	All	Enrolled	All	All	All	Enrolled	All
Regressor Level	Institution	Institution	Institution	Program	Institution	Institution	Institution	Program

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. This table reports the effects of adopting SISU on migration of first-year students. The dependent variable *munic.* (*state*) is an indicator for whether the municipality (state) where a student resided before attending college is different from the municipality (state) where a student attends college. The sample consists of 1.191.309 first-year students from public institutions over the 2010-2013 period. Columns (1) and (4) present result for an OLS regression with observable student covariates (e.g. race, gender, disability, and benefited from quota system) and age dummies. Columns (2) and (5) display estimates with a full set of controls and institution and year fixed effects. Columns (3) and (6) exclude individuals whose enrollment status is on leave or cancellation from the sample. Columns (4) and (8) refers to Equation (2). Robust standard errors clustered at institution level are reported in parenthesis.

Table 4: Effect of SISU on Dropout Rates

	(1)	(2)	(3)	(4)	(5)
SISU	0.068***	0.044***	0.051***	0.045***	0.053***
	(0.010)	(0.012)	(0.015)	(0.011)	(0.010)
Constant	-0.048***	0.099	0.223***	-0.080***	0.222
	(0.009)	(0.012)	(0.153)	(0.008)	(0.153)
Observations	1,709,713	1,709,713	1,191,309	2,054,031	1,709,713
R^2	0.016	0.048	0.053	0.047	0.099
Controls	✓	✓	✓	✓	✓
Institution FE		✓	✓	✓	✓
Year FE		✓	✓	✓	✓
Sample	All	All	Restricted	2009-2013	All
Regressor Level	Institution	Institution	Institution	Institution	Program

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. This table reports the effects of adopting SISU on dropout of first-year students. The dependent variable *dropout* is an indicator variable for whether student's enrollment status is on leave or cancellation. The sample consists of 1.709.713 first-year students from public institutions over the 2010-2013 period. Column (1) displays estimates of an OLS with a set of observable student covariates (e.g. race, gender, disability, and benefited from quota system) and age dummies. Institution and year fixed effects are included in Column (2). In Column (3), we hold observations from Table 3. Column (4) refers to a sample over the 2009-2013 period. Column (5) refers to Equation (2). Robust standard errors clustered at institution level are reported in parenthesis.

Table 5: Treatment Intensity

VARIABLES	(1) munic.	(2) state	(3) dropout	(4) dropout
SISU*fraction	0.034**	0.046***	0.042**	0.043**
	(0.014)	(0.013)	(0.022)	(0.022)
Constant	0.444***	0.280	0.101***	0.221***
	(0.147)	(0.314)	(0.159)	(0.159)
Observations	1,191,309	1,191,309	1,709,713	1,191,309
R^2	0.144	0.086	0.048	0.052
Controls	✓	✓	✓	✓
Institution FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Sample	All	All	All	Restricted

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. This table reports the effects of adopting a centralized mechanism on migration and dropout by considering treatment intensity. Each column reports the results of an OLS regression. The dependent variables *municipality*, *state* and *dropout*, sample and period are the same as in Tables 3 and 4. Students' characteristics, age dummies, and year and institution fixed effects are included. In Column (4), we hold observations from Columns (1) and (2). Robust standard errors clustered at institution level are reported in parenthesis.

Table 6: Robustness Checks

VARIABLES	(1) munic.	(2) state	(3) munic.	(4) state	(5) dropout	(6) munic.	(7) state	(8) dropout	(9) munic.	(10) state	(11) dropout
SISU	0.038**	0.016	0.027**	0.039***	0.055***	0.008	0.006	-0.002	0.026***	0.039***	0.051***
	(0.019)	(0.010)	(0.011)	(0.011)	(0.020)	(0.010)	(0.008)	(0.007)	(0.009)	(0.008)	(0.015)
System of Quotas									0.001	0.001	0.007
									(0.006)	(0.006)	(0.011)
Constant	0.290***	0.112***	0.527***	0.391	0.313**	0.304***	0.116	-0.056***	0.467***	0.281	0.210
	(0.020)	(0.014)	(0.151)	(0.322)	(0.151)	(0.019)	(0.014)	(0.007)	(0.321)	(0.154)	(0.151)
Observations	1,461,829	1,461,829	884,474	884,474	884,474	1,461,829	1,461,829	1,461,829	1,191,309	1,191,309	1,191,309
R^2	0.137	0.082	0.152	0.086	0.050	0.137	0.082	0.046	0.145	0.086	0.053
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Institution FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Robustness	Sample Selection	Sample Selection	Only Federal	Only Federal	Only Federal	Falsification Test	Falsification Test	Falsification Test	Quota Law	Quota Law	Quota Law

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. This table reports robustness checks. Except for Columns (1), (2), (6), (7) and (8) the dependent variables *municipality*, *state* and *dropout*, sample and period are the same as in Tables 3 and 4. Students' characteristics, age dummies and year and institution fixed effects are included. Columns (1) and (2) test for sample selection by considering a new dependent variable: *munic.* (*state*) is equal to one if the municipality (state) of birth is different from municipality (state) where a student attends college. Columns (3) to (5) restrict the sample to federal institutions. Columns (6) to (8) report falsification tests. Columns (9) to (11) check whether there is an effect of quota systems on the outcomes of interest. The independent variable *System of Quotas* is equal to one if the system of quotas was implemented in institution s and year t. Robust standard errors clustered at institution level are reported in parenthesis.

Table 7: Effects on Observable Characteristics of Students

VARIABLES	(1) female	(2) white	(3) vestibular	(4) ENEM	(5) age	(6) social support	(7) quota system	(8) disabled
SISU	-0.016***	-0.011	-0.264***	0.209***	0.026	-0.003	0.009	0.000
	(0.004)	(0.043)	(0.077)	(0.083)	(0.241)	(0.015)	(0.034)	(0.001)
Constant	0.329	0.243***	0.953***	0.221*	23.621***	-0.053*	0.433***	-0.010***
	(0.335)	(0.013)	(0.077)	(0.119)	(0.327)	(0.032)	(0.024)	(0.003)
Observations	1,191,309	1,191,309	1,191,309	1,191,309	1,191,309	1,191,309	1,191,309	1,191,309
R^2	0.027	0.248	0.618	0.652	0.800	0.442	0.187	0.011
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Institution FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. This table presents the results for Equation (1). The sample consists of 1.191.309 students from public institutions over the 2010-2013 period. The dependent variables are dummy variables to famale students, white students, students admitted through ENEM and *Vestibular*, student age, indicator variables whether the student receives social support, is benefited from quota system and is disabled, respectively. Robust standard errors clustered at institution level are reported in parenthesis.

Table 8: Heterogeneity by Migration - Does Migration Lead to Dropout?

VARIABLES	(1) dropout	(2) dropout	(3) dropout	(4) dropout
SISU	0.045**	0.054***	0.044***	0.090**
	(0.014)	(0.016)	(0.119)	(0.037)
Constant	0.381***	-0.099***	0.389***	-0.015
	(0.011)	(0.009)	(0.009)	(0.022)
Observations	588,494	602,815	1,077,043	114,266
R^2	0.049	0.062	0.050	0.093
Controls	✓	✓	✓	✓
Institution FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Sample	Not Migrated (munic.)	Migrated (munic.)	Not Migrated (state)	Migrated (state)

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. We test whether students that have migrated are more likely to drop out. Controlling for students' characteristics and institution and year fixed effects, we estimate Equation (1) separately for two sub-samples of individuals: those that remain in places where they resided during the ENEM exam (Columns (1) and (3)) and those that have migrated (Columns (2) and (4)). Columns (1) and (2) refer to changes at municipality level, while Columns (3) and (4) are related to mobility at state level. Robust standard errors clustered at institution level are reported in parenthesis.

Table 9: Heterogeneity by ENEM Scores

VARIABLES	(1) munic.	(2) state	(3) dropout	(4) munic.	(5) state	(6) dropout	(7) munic.	(8) state	(9) dropout	(10) munic.	(11) state	(12) dropout
SISU	0.022	0.042***	0.068***	0.030***	0.038***	0.066***	0.028***	0.036***	0.060***	0.032***	0.045***	0.053***
	(0.016)	(0.007)	(0.019)	(0.011)	(0.006)	(0.014)	(0.009)	(0.006)	(0.011)	(0.010)	(0.010)	(0.010)
Constant	0.588***	0.975***	0.047***	0.129***	-0.150***	0.805***	0.051***	0.031***	0.968***	0.519***	0.072***	0.403***
	(0.005)	(0.003)	(0.008)	(0.008)	(0.005)	(0.010)	(0.007)	(0.006)	(0.011)	(0.013)	(0.010)	(0.017)
Observations	188,406	188,406	188,406	255,727	255,727	255,727	313,340	313,340	313,340	389,712	389,712	389,712
R^2	0.121	0.079	0.081	0.147	0.086	0.059	0.172	0.095	0.054	0.188	0.104	0.056
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Institution FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sample	1st quartile	1st quartile	1st quartile	2nd quartile	2nd quartile	2nd quartile	3rd quartile	3rd quartile	3rd quartile	4th quartile	4th quartile	4th quartile

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. We test whether the effects are heterogeneous across different levels of ENEM scores. Controlling for students' characteristics and institution and year fixed effects, we run regressions separately for four sub-samples of individuals. By year, the sample is broken into quartiles based on the average ENEM score of students enrolled in all programs listed in the 2013 Census, with quartile 1 facing the smallest average scores and quartile 4 facing the largest avarege scores. In Columns (1), (4), (7) and (10), the dependent variable is *municipality*. In Columns (2), (5), (8) and (11), the dependent variable is *state*. In Columns (3), (6), (9) and (12), the dependent variable is *dropout*. Robust standard errors clustered at institution level are reported in parenthesis.

7 APPENDIX

7.1 Appendix I
SISU APPLICATION AND ADMISSION

Applicants are required to take a national standardized exam – ENEM exam– to register in SISU system. Online registration for ENEM typically occurs in May. The registration fee, which is not refundable, costs 35 *reais* (USD 12). Students from public schools and low-income families are free-exempt.

Everyone take ENEM – a two-day exam, which is composed of an essay and 180 multiple-choice questions – on the same weekend, typically in October or November. Students receive their ENEM scores in January. Few days later, SISU system opens. Students subscribe to SISU informing their ENEM subscription number. There is no cost to subscribe. Applicants have four (or five, to be previously announced by MEC) days to submit a list of up to two options of career-institution combination, and to decide whether they compete for slots reserved for quota system or other affirmative policies.

Students' scores are calculated according to different weights given to each of five knowledge areas (Math, Natural Science, Human Science, Languages and Codes, and Writing Essay). Each institution determines a combination of weights for each major. Thus, students' scores may widely vary across those combinations of career and institution.

Also during the registration period, the cutoff scores for each program are calculated at the end of each day, at 2 a.m., and this information is provided to all subscribers. The partial classification for each subscriber is also privately disclosed. Students can change their options over the registration period as many times as they wish, but only the last confirmed choice is valid.

Figure 5 shows that an applicant indicates up to two options of career and institution combinations and assigns whether he applies for vacancies reserved for affirmative policies. Notice that different composite scores for the same applicant, once he is applying to different careers from the same institution. Additionally, Figure 6 presents the partial classification and the cutoff score for each option. Figure 7 shows that an applicant can modify his assigned choices as many times as he wishes until the deadline. Figure 10 shows that an applicant can search for other majors and institutions and also check the last calculated cutoff.

After the registration period, students are assigned to programs through a deferred acceptance algorithm. Section 2.2 of this paper describes the mechanism in details. The

result of the assignment and the list of admitted applicants are published online. Applicants are informed about their relative classification on the list. At least one call is announced. During the call period, applicants who ranked and qualified for an option can enroll in that program. If the applicant is qualified to his top choice, he cannot participate in the next call, regardless of having enrolled in his first option. If he qualifies for his second assigned choice, but not for his first choice, he stills runs to his first option in the next call, regardless of having enrolled in his second alternative.

After regular calls, students who did not qualify for their options should inform to the system if they wish to be included on a wait list. In this case, only the first option is considered. After that, SISU provides to institutions a wait list for each program and the process is similar to *Vestibular*: any remaining spot is filled based on wait list, respecting the ranking of applicants.

Figure 5: An Example of Choices from the SISU System

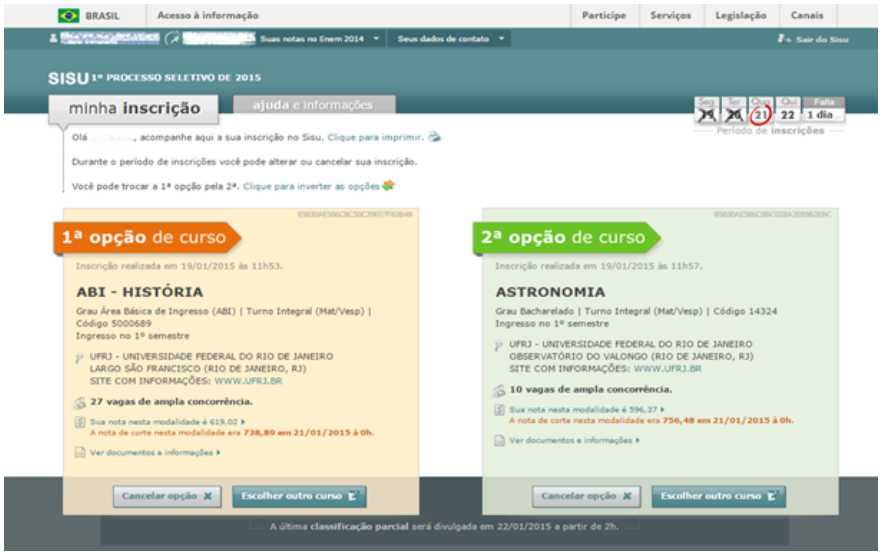


Figure 6: An Example of Partial Classification and Cutoff Scores

Figure 7: An Example of an Applicant Modifying his Options

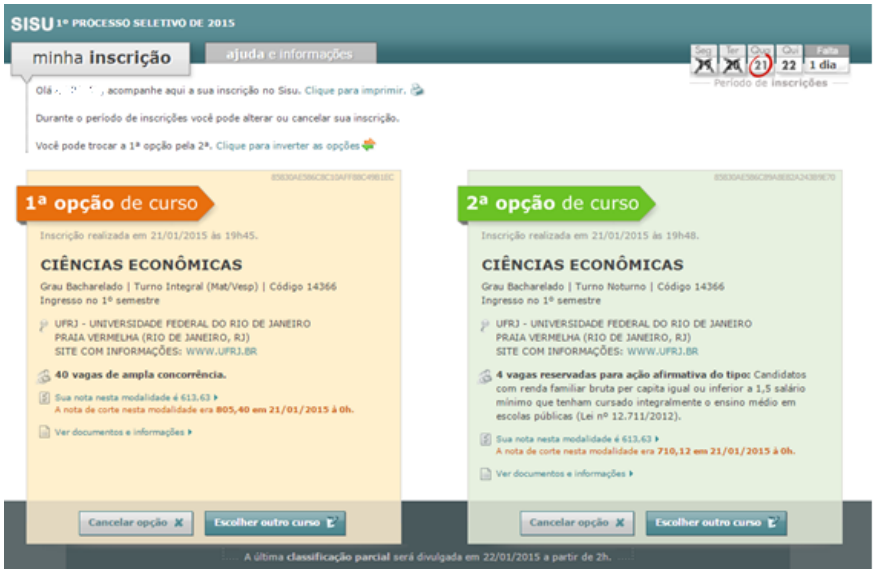


Figure 8: An Example of an Applicant Searching for Other Options and Checking the Last Updated Cutoff

7.2 Appendix II
DATA APPENDIX

This appendix contains a detailed description of the data used in the paper.

1. HIGHER EDUCATION CENSUS:

The Higher Education Census is annually carried out by the National Institute for Educational Studies and Research (INEP) since 1995. Before 2009, information on students and academic staff used to be collected at an aggregate level. These aggregated data at institution level are tricky to handle. Thus, due to unavailability of data at individual level, we exclude the pre-2009 period from the analysis.

From 2009 onwards, the Census is available at different levels. Student-level data contains demographic characteristics and educational attainment. Institution-level (program-level) data encompasses institutions' (programs') characteristics. Detailed information on libraries, staff and campus are also available.

We mainly focus on student- and institution-level data. We exclude observations related to municipal public, non-profit private and for-profit private institutions. Our sample is restricted to state public and federal public institutions. Using student-level data, we restrict the sample to first-year students. We drop individuals from distance education programs. We then construct the following variables (in **bold**):

- Gender, Age and Disability. These variables are directly constructed from the Census (described in the original dataset as IN_SEXO_ALUNO, NU_IDADE_ALUNO, and IN_ALUNO_DEFICIENCIA) to report whether the student is female (**female**), student's age (**age**) and whether the student has a disability (**disabled**), respectively. **Age dummies** are straightforwardly created for all ages reported in the Census;

- Socioeconomic Status. Students benefited from affirmative actions are identified. To comply with quota systems, spots are commonly reserved to poor (the original variable to point out these students is IN_RESERVA_RENDA_FAMILIAR), black, mulattos, or Indian students (IN_RESERVA_ETNICO), disabled students (IN_RESERVA_DEFICIENCIA) and/or individuals who have attended public schools (IN_RESERVA_ENSINO_PUBLICO). As a proxy for socioeconomic status, we generate an indicator variable (**quota**) for whether the student is benefited from quota system, regardless of the requirements. Another measure of socioeconomic condition is an indicator variable (**social support**) for whether the student receives any type of social support (e.g. housing support, food support, etc.) from the institution (IN_APOIO_SOCIAL). Information on race is summarized by an indicator variable (**white**) for whether the student is white (CO_COR_RACA_ALUNO);

- Enrollment Status. Each year, institutions report information on student's enrollment status in a current year (summarized by original variable CO_SITUACAO_ALUNO). There are six possible status: currently studying (*cursando*), on leave (*matrícula trancada*), cancellation (*desvinculado do curso*), transferred to a new degree in the same institution (*transferido para outro curso da mesma IES*), graduated (*formado*), or deceased (*falecido*). We define **dropout** as an indicator for whether student's enrollment status is on leave or cancellation;

- Admission Procedure. The Census provides detailed description on distinct entrance procedures: admission through ENEM (original variable: IN_ING_ENEM), admission through Vestibular (IN_ING_VESTIBULAR) or other admission systems. The fraction of first-year students admitted through ENEM (**enem**) is defined as the number of first-year students admitted through ENEM divided by the total number of first-year students for each combination of institution and year. Similarly, we construct the fraction of first-year students admitted through Vestibular (**vestibular**) as the number of students admitted through Vestibular divided by the total number of first-year students;

- Location. The institution-level data report information on where the institution is located (for example, whether the institution is located in a state capital city, the region, state and municipality in which a specific institution is rooted, etc.). We create an indicator variable (**located in state capital cities**) for whether an institution is based on a state capital city (original variable: IN_CAPITAL). We also build indicator variables for each region where an institution is located. As Brazil is divided into five regions (Central-West, North, Northeast, South, and Southeast), five indicator variables are constructed (textbflocated in Central-West region, **located in North region**, **located in Northeast region**, **located in Southeast region** and **located in South region**, respectively);

- Size. We include some measures for institutions' size. The total number of technical-administrative employees (**number of employees**) is directly provided by the Census (original variable: QT_TEC_TOTAL). The number of programs (**number of programs**) is calculated from the program-level data. Analogously, we can compute the total number of students (**number of students**) and teachers (**number of teachers**) from the student- and teacher-level data, respectively;

- Other characteristics. As we restrict our sample to state public and federal public institutions, it is straightforward to create an indicator variable (**federal institutions**) for federal institutions (original variable: CO_CATEGORIA_ADMINISTRATIVA). We also create an indicator variable (**university institutions**) for whether an institution is a university (CO_ORGANIZACAO_ACADEMICA) and an indicator variable (**institutions have a lab**) for whether an institution is equipped with a lab (IN_UTILIZA_LABORATORIO).

In this paper, we use two alternative measures for migration. The main measure – an indicator for whether the place where a student resided in the year before entering college is different from institution's location – is described in the next section. We employ alternative information for migration to check the robustness of our results: an indicator variable for whether the student's birthplace is different from his current location. To construct this second measure, we recover student's current location from the program-level data while information on student's birthplace comes from the student-level data. We then define the intermunicipality (or interstate) mobility as an indicator variable for whether the municipality (or state) of birth is different from the municipality (or state) where the student attends college (namely, **municipality** (or **state**)). Approximately 30% of students from the original sample do not have information on birthplace. However, there is another caveat to be aware of: unfortunately, students' birthplace does not appear in the 2009 Census. Because we want to keep observations from the year immediately before the implementation of SISU to test for pre-existing trends, we recover this information from the 2010 Census by holding observations of the 2009 cohort (these observations are easily tracked by admission year). When necessary, we exclude 2009 from our sample to show that the results remain virtually unchanged.

2. ENEM MICRODATA:

As aforementioned, our preferred measure for migration indicates whether the place where a student resided in the year before entering college is different from institution's location. The Census does not provide the last location where the student has been shortly before college. Alternatively, ENEM microdata are the best available source to recover this information because the majority of students aiming for college take the ENEM exam.

Using first-year students who attend non-distance programs from federal and state public institutions, we merge the 2010 Census with 2009 ENEM, the 2011 Census with 2010 ENEM, the 2012 Census with 2011 ENEM, and the 2013 Census with 2012 ENEM. This matching is feasible because the individual identification numbers – the Brazilian Taxpayer Registry (*Cadastro de Pessoa Física*, or CPF) – are included in the restricted access data sets. To ensure that these identifiers are unique, we drop individuals with missing identification numbers. We also exclude individuals with the same identification number in ENEM microdata for a specific year, as well as individuals who did not take the ENEM exam. Thus, nearly 30% of the original sample is removed.

Overall, we consider four cohorts of first-year students from 2010 to 2013 to construct the main measure for migration. We delete the 2009 Census from the analysis because the individual identification numbers are available from the 2010 Census onwards. Thus, it is not possible to merge the 2009 Census with 2008 ENEM without flaws. After merg-

ing the Census with ENEM, we define the intermunicipality (or interstate) migration as an indicator variable for whether the municipality (or state) where the student resided in the year of examination is different from his current location due to college (namely, **municipality** (or **state**)).

In addition, we standardize the ENEM scores of test takers (**standardized ENEM scores**). Average ENEM scores for each program listed in the 2013 Census is calculated as the weighted average of the 2012 ENEM scores of all first-year students enrolled in such program in 2013.

3. ADDITIONAL (AND MINOR) SOURCES:

a. List of Institutions and Programs:

The Brazilian Ministry of Education provided us a list of programs and institutions offered by SISU since its inception. Years of adoption are also included in this list. We coded these programs and institutions to properly combine this list with the Higher Education Census.

b. National Exam of Undergraduate Course (ENADE):

The National Exam of Undergraduate Course (ENADE) is an assessment of undergraduate programs offered by higher education institutions. Programs are classified into three areas and only one area is evaluated each year. Thus, each program is evaluated every three years. Currently, only students who are finishing an undergraduate program in a current year are required to take ENADE when that program is under evaluation in that year.

However, until 2011, both freshman and senior students were required to take the ENADE exam. We take advantage of this requisite to construct an alternative measure of first-year students' ability: the **standardized ENADE scores**.

c. Other Measures for Institutions' Quality:

INEP provides other measures of institutions' quality. We select two of them: the **General Index of Programs** (*Índice Geral de Cursos*) and the **Institutional Concept** (*Conceito Institucional*). Both measures consider ENADE scores, the available infrastructure, educational and pedagogical issues, and faculty qualification.

7.3 Appendix III
A SIMPLE FRAMEWORK

In order to provide a better understanding of changes in Brazilian Higher Education system, this section outlines a simple and non-formal framework, based on a portfolio choice problem from Chade and Smith (2006) and Ajayi (2011), that captures the differences between *Vestibular* and SISU.

For each semester, let define a finite set of students I = {1,...,K}, where K is the total number of applicants to Higher Education. Students select the programs (i.e., institution-course combination) to which apply to. Also, consider a finite set of available programs B = {1,...,N}. Students decide whether to apply to each of b programs, such that b $\subseteq$ B, subject to a cost. The empirical analysis considers two settings: *Vestibular* and SISU.

1. Vestibular:

Each applicant *i*, with an unknown ability, receives a utility V_{ib} from being admitted to program b. Although there is an uncertainty about the admission chances, the performance distribution of students admitted in previous years is a publicly disclosed information, which is a proxy for the expected selectivity level for each program, given by w_b. Thus, the applicant forms a belief about his performance on the exam, expressed by H_i, and his subjective probability of admission to a specific program, given by $Pr(H_i > w_b) = q_{ib} \in [0,1)$.

Meanwhile, the applicant *i* also faces a cost (e.g. geographic, monetary, and or choice cost). Define an application cost C_{ib} as an increasing function on distance, registration fee and choices, among others variables. Likewise, there is also an idiosyncratic component ε_{ib} associated with the cost.

Obviously, the student never register for *Vestibular* of a given program b when his expected utility of applying is strictly smaller than the cost. There are no constraints on the number of *Vestibular* exams that can be taken, but the application set A is finite, by definition.

Thus, the student i chooses an application set $A_i = 1,...,N$ that maximizes his net expected utility, expressed by:

$$\max_{A \subseteq B} \quad \sum_{b=1}^{N} q_b V_b - \sum_{b=1}^{N} C_b(distance, registrationfee, choices, others, \varepsilon), \tag{4}$$

In this case, the optimal strategy is to apply to all *Vestibular* exams that yield a positive net expected utility.

2. SISU:

In this setting, it is possible to outline the application (or career) choices as a portfolio choice problem, following Chade and Smith (2006) and Ajayi (2013). The student *i* who applies to SISU institutions necessarily takes ENEM. He has has ability T_i, proxied by his ENEM score e_i, which is known to the student before the beginning of SISU process. The student *i*'s cardinal utility (ex post payoff) from attending program b is given by u_{ib}. Each program has a known selectivity level s_b, proxied by a cutoff score, which is updated daily until the application deadline. However, from the last update of the cutoff score until SISU deadline, there is an uncertainty about the admission chances. Let s_b^* be the last updated cutoff score.

Once the student actually knows ENEM and cutoff scores, he forms a belief about his subjective probability of being admitted to a specific program. The probability is expressed by $\Pr(T_i > s_b^*) = \Pr(e_i > s_b^*) = p_{ib} \in [0,1)$. Then, each student has an expected payoff from applying to program b, given by $p_{ib}u_{ib}$.

There is no registration fee for entering in the system. However, each student can only submit up to two programs. Thus, each student *i* chooses an application set A_i that maximizes his net utility:

$$\max_{A \subseteq B} \quad p_1 u_1 + \pi_2 p_2 u_2, \tag{5}$$

where the subscript is the dth-ranked choice from the application set and $d \leq 2$. Moreover, p_1 is the overall probability of being admitted to his first choice, whereas $\pi_2 p_2$ is the conditional probability of being admitted to the second choice given that the student is rejected to his most preferred option.

This case involves imperfect information and constrained choices. Ajayi (2013) argues that the optimal strategy is such that the student behaves strategically, not necessarily applying to the most preferred program. Instead, he chooses programs based on his expected utility, $p_{ib}u_{ib}$. It implies that any program in the application set is preferred to all other programs that the student believes having equal admission probability.

7.4 Appendix IV
PREDICTORS OF ADOPTION (PART II)

In this appendix, we check for differences across institutions that adopted SISU in 2010 and untreated institutions (Panel A). This exercise is replicated in Panel B, with institutions that adopted SISU in 2010 and 2011 as treated group and the remaining ones as control group. Analogously, Panel C considers institutions that joined the system between 2010 and 2012 as the treated ones. The goal is to test what institution-specific characteristics may be a determinant for SISU.

Table 10: 2009 Characteristics of Treated and Untreated Institutions (Part II)

	Panel A			Panel B			Panel C		
	Untreated	Treated	p-Value	Untreated	Treated	p-Value	Untreated	Treated	p-Value
Count	121	57	–	96	82	–	86	92	–
A. Students' Characteristics									
ENADE Scores	0.499	0.481	0.8685	0.474	0.5111	0.7236	0.463	0.517	0.6059
Dropout	0.062	0.097	0.0063	0.060	0.088	0.0212	0.061	0.084	0.0545
Female	0.525	0.490	0.1377	0.531	0.492	0.0753	0.524	0.503	0.3517
White	0.221	0.214	0.8738	0.220	0.218	0.9513	0.219	0.219	0.9959
Disabled	0.006	0.008	0.7827	0.007	0.007	0.9794	0.007	0.006	0.8539
Admitted through ENEM	0.039	0.066	0.3825	0.039	0.058	0.5092	0.044	0.052	0.7805
Admitted through Vestibular	0.965	0.936	0.1112	0.966	0.943	0.1963	0.964	0.948	0.3673
Migration (State)	0.161	0.161	0.9904	0.154	0.168	0.5603	0.163	0.159	0.8753
Migration (Municipality)	0.520	0.541	0.5887	0.524	0.530	0.8775	0.529	0.524	0.8935
Receive Social Support	0.046	0.064	0.5065	0.037	0.069	0.1768	0.039	0.064	0.2974
Benefited from Quota System	0.093	0.050	0.1048	0.092	0.066	0.2938	0.091	0.689	0.3715
Age	24.54	23.33	0.0104	24.64	23.59	0.0185	24.46	23.87	0.1850
B. Institutions' Characteristics									
Federal Institutions	0.336	0.947	0.0000	0.191	0.927	0.0000	0.167	0.870	0.0000
Bachelor's Degree Programs	0.330	0.398	0.1531	0.316	0.393	0.0858	0.319	0.382	0.1627
Located in State Capital Cities	0.292	0.297	0.9372	0.271	0.320	0.3846	0.273	0.313	0.4746
Located in Central-West Region	0.064	0.069	0.8994	0.060	0.072	0.7339	0.056	0.075	0.5998
Located in North Region	0.095	0.107	0.7991	0.077	0.123	0.3066	0.075	0.121	0.3045
Located in Northeast Region	0.218	0.264	0.4957	0.201	0.270	0.2755	0.178	0.284	0.0920
Located in Southeast Region	0.456	0.388	0.3895	0.503	0.354	0.0436	0.515	0.359	0.0351
Located in South Region	0.166	0.171	0.9410	0.158	0.180	0.6939	0.176	0.160	0.7778
Number of Employees	977.66	592.25	0.1505	803.56	913.57	0.6619	848.06	860.02	0.9620
Number of Students	2345.3	1900.4	0.2623	2015.3	2414.3	0.2839	2069.7	2321.2	0.4992
Number of Programs	76.77	45.09	0.2392	71.88	60.48	0.6515	76.35	57.53	0.4545
Number of Teachers	768.98	531.89	0.0978	659.04	732.89	0.5829	678.36	706.80	0.8321
Institutions Have a Lab	0.754	0.832	0.0987	0.770	0.789	0.6656	0.760	0.796	0.4258
General Index of Programs	3.449	3.655	0.0866	3.402	3.638	0.0385	3.425	3.596	0.1357
Institutional Concept	3.679	3.625	0.7810	3.500	3.700	0.3787	3.600	3.667	0.7844

This table reports comparison of 2009 students' and institutions' characteristics of treated and untreated institutions. Panel A chekcs for differences across institutions that adopted SISU in 2010 and untreated institutions. This exercise is replicated for two other samples of treated institutions – those that adopted the system in 2010 and 2011 (Panel B) and between 2010 and 2012 (Panel C) – and p-values come from the t-test of equality across the two groups.

7.5 Appendix V
LIST OF INSTITUTIONS

In this appendix, we include a list of which institutions have adopted SISU between 2010 and 2013, and when the adoption has taken place. This list is obtained from SISU data. A list of programs is available upon request.

Table 11: List of Institutions

Institution	2010	2011	2012	2013
Universidade Federal do Mato Grosso (UFMT)	Yes	Yes	Yes	Yes
Universidade Federal do Amazonas (UFAM)	Yes	Yes	Yes	Yes
Universidade Federal do Piauí (UFPI)	Yes	Yes	Yes	Yes
Universidade Federal de Ouro Preto (UFOP)	No	Yes	Yes	Yes
Universidade Federal de São Carlos (UFSCAR)	No	Yes	Yes	Yes
Universidade Federal de Viçosa (UFV)	Yes	Yes	Yes	Yes
Universidade Federal do Rio Grande (FURG)	No	Yes	Yes	Yes
Universidade Estadual de Santa Cruz (UESC)	No	No	Yes	Yes
Escola Nacional de Ciências Estatísticas (ENCE)	Yes	Yes	Yes	Yes
Universidade Estadual de Ciências da Saúde de Alagoas (UNCISAL)	Yes	Yes	No	No
Universidade do Estado da Bahia (UNEB)	No	Yes	Yes	Yes
Universidade Federal de São João Del Rei (UFSJ)	Yes	Yes	Yes	Yes
Universidade Federal do Maranhão (UFMA)	Yes	Yes	Yes	Yes
Universidade Federal do Acre (UFAC)	No	Yes	No	Yes
Universidade Estadual da Paraíba (UEPB)	No	No	Yes	Yes
Universidade Federal do Rio Grande Do Norte (UFRN)	No	Yes	Yes	Yes
Universidade Federal do Paraná (UFPR)	No	Yes	Yes	Yes
Universidade Federal Fluminense (UFF)	No	Yes	Yes	Yes
Universidade Federal do Espírito Santo (UFES)	No	No	No	Yes
Universidade Federal Rural do Rio De Janeiro (UFRRJ)	Yes	Yes	Yes	Yes
Universidade Federal de Juiz De Fora (UFJF)	No	Yes	Yes	Yes
Universidade Federal de Alagoas (UFAL)	No	No	Yes	Yes
Universidade Federal da Paraíba (UFPB)	No	Yes	Yes	Yes
Universidade Federal de Pernambuco (UFPE)	No	Yes	Yes	Yes
Universidade Federal de Santa Maria (UFSM)	No	Yes	Yes	Yes
Universidade Federal do Ceará (UFC)	No	Yes	Yes	Yes
Universidade Federal de Goiás (UFG)	No	Yes	Yes	Yes
Universidade Federal do Rio de Janeiro (UFRJ)	No	Yes	Yes	Yes
Universidade Federal Rural de Pernambuco (UFRPE)	Yes	Yes	Yes	Yes
Universidade Tecnoógica Federal do Paraná (UTFPR)	Yes	Yes	Yes	Yes
Universidade Federal Rural do Semi-Árido (UFERSA)	Yes	Yes	Yes	Yes
Universidade Federal Rural da Amazônia (UFRA)	No	No	Yes	Yes
Universidade Federal de São Paulo (UNIFESP)	Yes	Yes	Yes	Yes
Universidade Federal de Lavras (UFLA)	Yes	Yes	Yes	Yes
Centro Federal de Educação Tecnológica Celso Suckow da Fonseca (CEFET/RJ)	Yes	Yes	Yes	Yes
Centro Federal de Educação Tecnológica de Minas Gerais (CEFET/MG)	No	Yes	Yes	Yes
Universidade Federal de Alfenas (UNIFAL-MG)	Yes	Yes	Yes	Yes
Universidade Federal dos Vales do Jequitinhonha e Mucuri (UFVJM)	Yes	Yes	Yes	Yes
Universidade Federal de Itajubá (UNIFEI)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia da Bahia (IFBA)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Maranhão (IFMA)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Sul (IFRS)	Yes	Yes	Yes	Yes
Universidade Federal de Pelotas (UFPEL)	Yes	Yes	Yes	Yes
Universidade Estadual do Sudoeste da Bahia (UESB)	No	No	Yes	Yes
Universidade Federal do Estado do Rio De Janeiro (UNIRIO)	Yes	Yes	Yes	Yes

Institution	2010	2011	2012	2013
Universidade Federal de Mato Grosso Do Sul (UFMS)	Yes	Yes	Yes	Yes
Fundação Universidade Federal de Rondônia (UNIR)	Yes	No	No	No
Fundação Universidade Federal de Ciências da Saúde de Porto Alegre (UFCSPA)	Yes	Yes	Yes	Yes
Universidade do Estado de Mato Grosso (UNEMAT)	No	No	No	Yes
Universidade Estadual do Piauí (UESPI)	No	No	No	Yes
Universidade Federal de Roraima (UFRR)	No	Yes	No	Yes
Universidade Estadual do Norte Fluminense Darcy Ribeiro (UENF)	Yes	Yes	Yes	Yes
Universidade Estadual de Mato Grosso Do Sul (UEMS)	No	Yes	Yes	Yes
Universidade do Estado de Minas Gerais (UEMG)	No	No	No	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande Do Norte (IFRN)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia Fluminense (IF FLUMINENSE)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia da Paraíba (IFPB)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia Goiano (IF GOIANO)	Yes	Yes	Yes	Yes
Instituto Superior de Educação do Rio De Janeiro (ISERJ)	No	No	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia Sul-Rio-Grandense (IF Sul)	No	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Ceará (IFCE)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Espírito Santo (IFES)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Pernambuco (IFPE)	No	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de São Paulo (IFSP)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Goiás (IFG)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Amazonas (IFAM)	No	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Pará (IFPA)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Piauí (IFPI)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Alagoas (IFAL)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Sertão Pernambucano (IF SERTÃO)	No	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Santa Catarina (IFSC)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Rio De Janeiro (IFRJ)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Mato Grosso (IFMT)	No	No	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Triângulo Mineiro (IFTM)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Sergipe (IFS)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Roraima (IFRR)	Yes	Yes	Yes	Yes

Institution	2010	2011	2012	2013
Instituto Federal de Educação, Ciência e Tecnologia do Norte de Minas Gerais (IFNMG)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Minas Gerais (IFMG)	No	No	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Sudeste de Minas Gerais (IFSEMG)	Yes	Yes	Yes	Yes
Universidade Estadual do Rio Grande do Sul (UERGS)	Yes	Yes	Yes	Yes
Universidade do Tocantins (UFT)	Yes	Yes	Yes	Yes
Fundação Universidade Federal do Vale do São Francisco (UNIVASF)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia Farroupilha (IF Farroupilha)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Sul de Minas Gerais (IF SUL DE MINAS)	Yes	Yes	Yes	Yes
Universidade Federal do Recôncavo da Bahia (UFRB)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Rondônia (IFRO)	No	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Tocantins (IFTO)	Yes	Yes	Yes	Yes
Fundação Universidade Federal do ABC (UFABC)	Yes	Yes	Yes	Yes
Centro Universitário Estadual da Zona Oeste (UEZO)	No	Yes	Yes	Yes
Instituto Superior de Educação Professor Aldo Muylaert (ISEPAM)	No	No	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia Catarinense (IF Catarinense)	Yes	Yes	Yes	Yes
Faculdade de Educçãao Tecnológica do Estado do Rio de Janeiro (FAETERJ)	No	No	No	Yes
Instituto Superior de Tecnologia de Paracambi (IST PARACAMBI)	No	No	Yes	No
Fundação Universidade Federal do Pampa (UNIPAMPA)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia de Brasília (IFB)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia Baiano (IFBAIANO)	Yes	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Paraná (IFPR)	No	Yes	Yes	Yes
Universidade da Integração Internacional da Lusofonia Afro-Brasileira (UNILAB)	No	No	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Acre (IFAC)	No	Yes	Yes	Yes
Instituto Federal de Mato Grosso do Sul (IFMS)	No	Yes	Yes	Yes
Instituto Federal de Educação, Ciência e Tecnologia do Amapá (IFAP)	No	Yes	Yes	Yes

7.6 Appendix VI
RESULTS USING AN ALTERNATIVE MEASURE OF MIGRATION

In this appendix, we replicate our baseline specifications to test if the coefficients are robust to an alternative measure of migration: an indicator variable for whether the place of birth is different from the current location.

Table 12: Effect of SISU on Migration (Alternative Measure)

VARIABLES	(1) munic.	(2) munic.	(3) munic.	(4) munic.	(5) munic.	(6) state	(7) state	(8) state	(9) state	(10) state
SISU	0.045	0.038**	0.035*	0.039	0.026	0.041***	0.016	0.015	0.013	0.023**
	(0.031)	(0.019)	(0.019)	(0.025)	(0.017)	(0.015)	(0.010)	(0.010)	(0.013)	(0.009)
Constant	0.504	0.519	0.521	0.554	0.517	0.135	0.124	0.158	0.173	0.120***
	(144.100)	(17.228)	(28.903)	(43.870)	(77.123)	(88.688)	(50.523)	(15.423)	(52.399)	(8.975)
Observations	1,461,829	1,461,829	1,277,915	1,193,967	1,461,829	1,461,829	1,461,829	1,277,915	1,193,967	1,461,829
R^2	0.006	0.137	0.139	0.136	0.137	0.008	0.082	0.083	0.082	0.082
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Institution FE		✓	✓	✓	✓		✓	✓	✓	✓
Year FE		✓	✓	✓	✓		✓	✓	✓	✓
Sample	2009-2013	2009-2013	Enrolled	2010-2013	2009-2013	2009-2013	2009-2013	Enrolled	2010-2013	2009-2013
Regressor Level	Institution	Institution	Institution	Institution	Program	Institution	Institution	Institution	Institution	Program

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. This table reports the effects of adopting SISU on migration of first-year students. The dependent variable *munic.* (*state*) is an indicator for whether the municipality (state) of birth is different from the municipality (state) where a student attends college. The sample consists of 1.461.829 first-year students from public institutions over the 2009-2013 period. Columns (1) and (6) present results for an OLS regression with observable student covariates (e.g. race, gender, disability, and benefited from quota system) and age dummies. Columns (2) and (7) display estimates with a full set of controls and institution and year fixed effects. Columns (3) and (8) exclude individuals whose enrollment status is on leave or cancellation from the sample. Columns (4) and (9) exclude students admitted in 2009. Columns (5) and (10) refer to Equation (2). Robust standard errors clustered at institution level are reported in parenthesis.

Table 13: Treatment Intensity on Migration (Alternative Measure)

VARIABLES	(1) munic.	(2) munic.	(3) state	(4) state
SISU*fraction	0.066**	0.076*	0.042**	0.044**
	(0.031)	(0.040)	(0.017)	(0.022)
Constant	0.516	0.558	0.124	0.175
	(52.668)	(39.272)	(49.184)	(35.992)
Observations	1,461,829	1,193,967	1,461,829	1,193,967
R^2	0.137	0.137	0.082	0.082
Controls	✓	✓	✓	✓
Institution FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Sample	2009-2013	2010-2013	2009-2013	2010-2013

Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level. This table reports the effects of adopting a centralized mechanism on migration by considering treatment intensity. We estimate Equation (3). We use an alternative measure of migration: the dependent variable *munic.* (*state*) is an indicator for whether the municipality (state) of birth is different from the municipality (state) where a student attends college. Students' characteristics, age dummies, and year and institution fixed effects are included. Columns (1) and (3) consist of sample of 1.461.829 first-year students from public institutions over the 2009-2013 period. Columns (2) and (4) refer to a sample of 1.193.967 first-year students from public institutions over the 2010-2013 period. Robust standard errors clustered at institution level are reported in parenthesis.