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PEDRO DE ARAGÃO FERNANDES

THE IMPACT OF STUDYING ABROAD ON ACADEMIC PERFORMANCE: EVIDENCE FROM THE BRAZILIAN "SCIENCE WITHOUT BORDERS" PROGRAM

Rio de Janeiro
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Orientador: Valéria Lúcia Pero

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Rio de Janeiro
2018

To my little brother Scooby,
who gave me nothing but love and happiness.

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ABSTRACT

Fernandes, Pedro de Aragão. **The Impact of Studying Abroad on Academic Performance: Evidence from the Brazilian "Science without Borders" Program**. 2018. 100 f. Dissertação (Mestrado em Economia) - PPGE, Instituto de Economia, Universidade Federal do Rio de Janeiro, Rio de Janeiro, 2018.

This dissertation investigates the effects of the Science without Borders (*Ciência sem Fronteiras*) scholarships on the academic performance of the Brazilian students. The *Ciência sem Fronteiras* (hereafter, CSF) existed from 2011 to 2017 and provided 100,000 scholarships for tertiary students at foreign universities of excellence, focusing in areas considered essential to increase productivity and competitiveness. Using a rich dataset covering more than 2,000,000 students from thousands of undergraduate courses in Brazil, I study the effects of receiving a scholarship of this program on the scores of the National Exam of Student Performance (Enade). I use a series of econometric strategies in order to account for possible self-selection bias into studying abroad. The ordinary least squares and propensity score matching results show that a temporary study-related visit abroad through a scholarship from the CSF program improves students' grades on average. However, the effects are very heterogeneous: students from STEM and Health sciences are positively affected, while students from social and humanities sciences have null and negative effects. Moreover, quantile regressions show that students at the bottom of grades distribution benefit much less from the scholarship than students at the top of the distribution. While interesting, the OLS and PSM results might be biased, since the program targets better students. In order to deal with this issue, I aggregate the data at the course/university level and use a differences-in-differences strategy that tests whether grades change differently in courses/universitities in which more students receive scholarships from the CSF program. Moreover, I instrument the share of students that receive CSF scholarships using the courses' priority status. The results from these strategies indicate that the Science without Borders has no effect on the general education grade and a negative effect on the specific knowledge grade.

Keywords: Social programs - Analysis - Brazil, *Ciência sem Fronteiras*, Student exchange program.

RESUMO

Fernandes, Pedro de Aragão. **The Impact of Studying Abroad on Academic Performance: Evidence from the Brazilian "Science without Borders" Program**. 2018. 100 f. Dissertação (Mestrado em Economia) - PPGE, Instituto de Economia, Universidade Federal do Rio de Janeiro, Rio de Janeiro, 2018.

Esta dissertação investiga os efeitos das bolsas do Ciência sem Fronteiras sobre o desempenho acadêmico dos estudantes brasileiros. O Ciência sem Fronteiras (CSF) existiu de 2011 a 2017 e forneceu 100.000 bolsas de estudo para estudantes de nível superior em universidades estrangeiras de excelência, com foco em áreas consideradas essenciais para aumentar as produtividade e competitividade. Utilizando um rico conjunto de dados abrangendo mais de 2.000.000 de estudantes de milhares de cursos de graduação no Brasil, estuda-se os efeitos de se receber uma bolsa desse programa nas notas do Exame Nacional de Desempenho dos Estudantes (Enade). Utiliza-se uma série de estratégias econométricas para superar o possível viés de auto-seleção para estudar no exterior. Os resultados de mínimos quadrados ordinários e *propensity score matching* mostram que uma visita temporária relacionada ao estudo no exterior através de uma bolsa de estudos do programa CSF melhora as notas dos alunos em média. No entanto, esses efeitos são muito heterogêneos: estudantes de ciências exatas e saúde são afetados positivamente, enquanto os alunos de ciências sociais e humanidades possuem efeitos nulos e negativos. Além disso, regressões quantílicas mostram que os estudantes na parte inferior da distribuição de notas são muito menos beneficiados pelas bolsas do que estudantes no topo da distribuição. Embora interessante, os resultados de MQO e PSM podem ser viesados, uma vez que o programa tem como alvo melhores alunos. Para lidar com esse problema, agrega-se os dados no nível de curso/universidade e utiliza-se uma estratégia de diferenças-em-diferenças que testa se as notas mudam de maneira diferente em cursos/universidades em que mais alunos recebem bolsas de estudo do programa CSF. Além disso, instrumenta-se a proporção de estudantes que recebem bolsas de estudo do CSF usando o status de prioridade dos cursos. Os resultados dessas estratégias indicam que o Ciência sem Fronteiras não tem efeito sobre a nota de educação geral e um efeito negativo sobre a nota de conhecimento específico.

Palavras-chave: Programas sociais - Análise - Brasil, Ciência sem Fronteiras, Programa de intercâmbio de estudantes.

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1 INTRODUCTION

Public policies focusing on the qualification of higher education students through international exchange programs have expanded throughout the world over the last years. According to the OECD (2014), the number of students attending at least part of higher education outside their country of origin increased by about 450% between 1975 and 2012, going from 800,000 to 4,500,000. The popularity of these programs raises the question of what are the gains from participating in exchange programs. However, despite the growing importance of exchange programs, the literature on the subject is still scarce.

This study contributes to the literature on the effects of exchange programs by evaluating the Science without Borders (*Ciência sem Fronteiras* - CSF) effect on academic performance. The CSF was a Brazilian federal program established in 2011 and ended in 2017 that aimed, among other objectives, to provide 100,000 scholarships for tertiary students and researchers at foreign universities of excellence. It focuses on areas of expertise considered essential by the federal government - STEM (science, technology, engineering and mathematics) and health sciences. While the CSF was not the only channel through which Brazilian students could temporarily study in another country, it is the largest that has ever been.

According to a report of the Brazilian senate (BRAZIL, 2015), each scholarship cost approximately R$ 100,000.00 on average and 78% were granted to undergraduate students. This is almost five times the annual expenditure per student at public universities (R$ 21,875.00) and seventeen times the annual expenditure at public high schools (INEP, 2016). Despite this enormous cost per student, no rigorous evaluation of the consequences of the CSF exists in the literature.

Drawing on a rich dataset from the National Student Performance Exam (*Exame Nacional de Desempenho dos Estudantes* - Enade) from 2007-2016, I analyse the program's impacts on students' academic performance, using the grades in the Enade as proxy of performance. The Enade is a national exam for undergraduate students that are about to finish their studies, and its main objective is to evaluate their academic performance. A socioeconomic questionnaire is filled out by the student and, since 2013, it identifies the students who have studied abroad through the Science without Borders. Thus, it is possible to create control and treatment groups in order to measure the impact of the Science without Borders on student performance.

Establishing a causal link between the Science without Borders and students' grades is a difficult task because the program is based on merit and focuses on better students, generating spurious correlation between the program and notes (reverse causality). In addition, studying abroad has both financial and opportunity costs, leading to mainly students from richer socioeconomic backgrounds being selected. As wealth correlates with note, this also generates a spurious correlation between program and notes (selection bias). Another causality problem is immediately apparent: students who opt for an exchange year are likely to generally differ from their non-mobile peers both in terms of motivation and ability. The unobserved heterogeneity may also affect students' academic achievements, which may introduce a self-selection bias in ordinary least squares estimates of the effect of studying abroad through the CSF program on students' grades.

To overcome these biases, I use different empirical strategies. Using ordinary least square (OLS) with numerous controls and fixed effects and propensity score matching (PSM) techniques, I find similar results: the CSF increases the general grade of students from 0.281 to 0.354 standard deviations.

Focusing on the possible heterogeneous effects of the program, I run OLS regression across different areas of knowledge and also quantile regressions. The STEM, health and biological students seem to be positively affected by the program, while the social and humanities sciences seem to be either unaffected or negatively affected by the program. Moreover, quantile regressions indicate much smaller effects of studying abroad at the bottom of the grade distribution and larger grade effects at the top distribution.

The OLS and PSM rest on the "unconfoundness"hypothesis. This hypothesis states that - conditional on the vector of covariates used either as control or to calculate the propensity scores - the treatment is not correlated with unobservable determinants of academic performance. To the extent that this hypothesis is not true, the OLS and PSM estimates will be biased. For that reason, I aggregated my dataset at the course x university x period level and implemented a differences-in-differences design comparing the evolution of grades in courses with different proportions of students receiving scholarships from the CSF program. The design enables me to eliminate all unobserved heterogeneity that jointly influences treatment status and academic performance at the course x university level that is constant through time. Additionally, I use a IV strategy that instruments the proportion of students who receive CSF scholarships with the course's priority status according to the federal government. The final results show that the proportion of students going abroad through the Science without Borders has has no effect on the general education grade and a negative effect on the specific knowledge grade.

The thesis is structured as follows: Section 2 provides information on the formulation and goals of CSF. Section 3 reviews the literature on the effects of studying abroad. Section 4 exposes the database and descriptive statistics. Section 5 presents the identification strategy. Section 6 presents and interprets the results. Finally, Section 7 presents the conclusions.

2 SCIENCE WITHOUT BORDERS PROGRAM

The sound performance of the Brazilian economy during the first decade of the 2000s was not accompanied by an increase in productivity (SQUEFF et al., 2012; SQUEFF; NOGUEIRA, 2013). In order to promote productivity growth, the Brazilian government launched, in 2011, the Greater Brazil Plan (*Plano Brasil Maior – PBM*), a set of policies focused in promoting knowledge-intensive economic activities as a mechanism to drive innovation and productivity. Through the Training and Professional Qualification arm of the PBM, the government invested in the human capital of the working age population and thus in the potential of knowledge. One of the main actions carried out was the Science without Borders.

Studying abroad programs for undergraduate students have existed for some time in Brazil. Private and public universities, through partnerships with foreign institutions, have been sending students to foreign institutions and receiving foreign students for some decades. As CASTRO et al. (2012) remarks, the Rockefeller Foundation, which came to Brazil in 1913, and later the Ford Foundation were responsible for sending a significant number of students to study overseas. The practice of meritocratic scholarship selection was later incorporated by the private and public Brazilian institutions.

Government-funded international exchange programs have also existed for some time. However, these programs have typically focused on granting scholarships for graduate students. The main public agencies responsible for the granting of international scholarships are the National Council for Scientific and Technological Development (*Conselho Nacional de Desenvolvimento Científico e Tecnológico* - CNPq) and the Coordination for the Improvement of Higher Education Personnel

(*Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* - Capes).

The Science without Borders program was instituted by Decree No. 7,642 of December 2011, being the result of a joint effort of the Ministry of Science, Technology and Innovation (*Ministério da Ciência, Tecnologia e Inovação* - MCTI) and the Ministry of Education (*Ministério da Educação* – MEC) through their respective funding agencies: CNPq and Capes. The objective of the program was "to train highly qualified human resources at the best foreign universities and research institutions, in order to promote the internationalization of national science and technology, stimulate research that generates innovation and, consequently, increase the competitiveness of Brazilian companies"(BRAZIL, 2011, p.2).

In order to meet its objectives, the SwB granted scholarships in “institutions of excellence abroad” through the following modalities (BRAZIL, 2011, 2015):

- **Visiting Undergraduate**: Focused in undergraduate students with excellent academic performance from the priority knowledge areas. A mandatory criterion for participation in the SwB was a score of at least 600 points in the National High School Exam (Exame Nacional do Ensino Médio - ENEM). The time spent abroad could last from 12 months to 18 months.
- **Professional Masters**: Focused in candidates who had already completed any undergraduate course from the priority knowledge areas with excellent academic performance.
- **Visiting PhD**: Focused in PhD students from the priority knowledge areas. Candidates had to be regularly enrolled in Brazilian PhD courses accredited by Capes. The time spent abroad could last from 3 months to 12 months.
- **Full PhD**: Focused in candidates that were not enrolled in a Brazilian PhD course. The time spent abroad could last from 36 months to 48 months.

- **Postdoc**: Focused in candidates with PhD's degree. The time spent abroad could last from 6 months to 24 months.
- **Foreign Researchers**: Focused in foreign visiting researchers.
- **Young talents**: Focused in candidates living abroad with PhD's degree. The objective was to attract talented young scientists, foreign or Brazilian, with outstanding scientific or technological production in the priority knowledge areas. Young researchers with differentiated scientific production would receive a scholarship and funding resources to fulfill two to three years of activities with a research group in Brazil.

Candidates would apply for universities abroad through "public calls" published by the federal government. Regardless of their socioeconomic background, students were awarded scholarships that included full tuition, airplane tickets, health insurance and settlement allowance.

The concession of scholarships were destined to specific fields of interest, defined by the Brazilian government, mostly STEM fields: Engineering; Physical Sciences; Mathematics; Physics; Chemistry; Biology; Geosciences; Clinical; Pre-clinical and Health Sciences; Computing and Information Technology; Aerospace Technology; Pharmaceuticals; Sustainable Agricultural Production; Oil, Gas and Coal; Renewable Energy; Minerals Technology; Biotechnology; Nanotechnology and New Materials; Technologies for Prevention and Mitigation of Natural Disasters; Bioprospecting and Biodiversity; Marine Sciences; Creative Industry; New Technologies Construction Engineering; Practical Technologists.[1].

An evaluation study of public policies of the Federal Senate (BRAZIL, 2015)

[1] This list can be found on the program's official website: *http://www.cienciasemfronteiras.gov.br/web/csf/areas-contempladas*

reports that the initial project goal was to provide 75,000 scholarships, with an estimated cost of R$ 3,200,000,000.00, financed by Capes and CNPq. Another 26,000 scholarships would be financed by the private initiative. 101,446 scholarships were awarded to students and researchers between 2011 and 2014, of which 78% were for undergraduate exchanges. The study estimates that the total expenditure of the program up to November 2015 was around R$ 10,500,000,000.00, representing a cost of R$ 103,000.00 per scholarship. As of August 2015, 69,042 undergraduate scholarships had been implemented.

CASTRO et al. (2012) show that the number of scholarships offered by the Science without Borders was four times the size of the previous pattern. The program was considered an innovation in the Brazilian education system, since most of the scholarships were destined to undergraduate students.

According to MCMANUS; NOBRE (2017), the CSF program sent 92,880 Brazilian students and higher education professionals to study abroad for periods varying from one (visiting undergraduate, visiting PhD, visiting scholar and post doctorate research) to four years (full doctorate). A total of 73,353 undergraduate students were sent for an academic year to 2,912 universities, including 182 of the top 200 universities in the world in "Shanghai Ranking - Academic Ranking of World Universities". Among these students, more than 40% had optional summer internships at university, government and industrial laboratories. The number of Brazilian students and researchers abroad increased from a pre-SwB average of around 5,000 per year to more than 40,000 in 2015. It is also verified that a significant percentage of 2011/2012 cohort SwB undergraduate students entered the Brazilian postgraduation system.

In order to be awarded scholarships, undergraduate students needed to apply and go through a selection process inside their universities, each one with its own rules, and then through another process from the CSF program. Students were mainly selected according to their grades.

The last public calls for scholarships within the program were in 2014. New public calls were not created in 2015. Due to the program's fiscal cost and the absence of studies evaluating the effectiveness of the program, the Brazilian government suspended the concession of scholarships in April 2016 and ended the program in April 2017.

3 LITERATURE REVIEW

Exchange programs are broadly aligned with the economic theory on the returns of education: qualify individuals, increase human capital, and generate positive externalities by increasing productivity, generating new ideas, and adopting new technologies. However, there are still few empirical studies on the returns exchanges programs.

3.1 Effects on Labor Market

Previous empirical analyses have focused on the effects of studying abroad on job opportunities in developed countries, especially European countries, because, since 1987, the ERASMUS program has been enabling student mobility.

MESSER; WOLTER (2007) sought to estimate the gains of Swiss students who expend one semester abroad. Starting salaries upon entry to the labor market and the probability of writing a dissertation were examined as possible expressions of the benefits deriving from exchange semesters. The empirical analysis indicated that student mobility correlate positively with both forms of potential benefits. The use of instrumental variables indicate, however, that these same correlations cannot be interpreted as causal. The analysis also show that exchange semesters lead to delayed graduations.

DI PIETRO (2015) paper used data on a large sample of Italian graduates in order to investigate the extent to which students' participation in study abroad programs impacts their subsequent employment likelihood. The estimated effect of study abroad program participation using the instrumental variable strategy indicates that graduates who studied abroad during university are about 22.9 percentage points more likely to be employed three years following graduation relative to their non-mobile peers. This effect is mainly driven by the impact that study abroad programs have on the employment prospects of graduates from disadvantaged (but not very disadvantaged) backgrounds.

Empirical evidence also indicates that international experience affects international job market mobility. PAREY; WALDINGER (2011) present evidence of the causal positive effect of studying abroad on the probability of Erasmus German students working in a foreign country later in life. Their instrumental variable results indicate that the group of students who studied abroad are about 15 percentage points more likely to work abroad later on. DI PIETRO (2012) uses a similar instrumental variable approach to that of PAREY; WALDINGER (2011) and DI PIETRO (2015) for Italian students. His findings suggest that studying abroad increases likelihood of working abroad by between 18 and 24 percentage points.

3.2 Effects on Academic Performance

Few empirical analysis have focused on the the effects of studying abroad on academic performance, more specifically, effects on undergraduate's grades.

Focusing on the effects of the ERASMUS program on academic performance, MEYA; SUNTHEIM (2014) used a dataset collected at a German university and analyzed, using a PSM strategy, whether studying one or two semesters in a foreign institution influences the university's final grade. Although the effect seems to be positive, it is verified that students selectively transfer degrees achieved abroad that are better than the average grade achieved at the home university. Moreover, the study shows the reduced probability of finishing studies within the standard time period.

Due to the Science without Borders being relatively recent, the existing literature on the program is still incipient. The only study paper found using an econometric approach is that of CONCEIÇÃO; FRANÇA; JACINTO (2016). Following MEYA; SUNTHEIM (2014) strategy, they analysed the Science without Borders program in Brazil. Using the National Student Performance Exam (Exame Nacional de Desempenho dos Estudantes - Enade) dataset from 2013, which evaluated mostly undergraduate health sciences students. The descriptive statistics show that individuals who studied abroad through an SwB scholarship indeed come from from richer socioeconomic backgrounds on average. Seeking to reduce the potential selection bias, they restrict the sample to contain only students who studied abroad either through the SwB or others exchange programs, as these groups are similar regarding socioeconomic characteristics. Using a propensity score matching technique, they find preliminary evidence that the CSF is superior to other exchange programs in Brazil on average, having a positive impact on undergraduate students' grades. The use of a database containing mostly health sciences is not and ideal evaluation of the program, since most of the scholarships went to engineering students.

4 DATA

The data comes from National Student Performance Exam (Enade) microdata. The exam is applied annually since 2004 and is organized by the National Institute of Educational Studies and Research Anísio Teixeira (*Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* - INEP), linked to the Ministry of Education.

The purpose of Enade is mainly to evaluate the academic performance of graduating students in relation to the contents provided in the curricular guidelines of the respective undergraduate courses. Each year, different areas of knowledge are evaluated, so that each area is evaluated at intervals of no more than three years. All students from the respective courses being evaluated in a given year, that are expected to graduate in two semesters or less, must take the exam. The exam is divided into two parts: a General Knowledge test and a Specific Knowledge test of the student's course. The General Grade is a weighted average of the previous two.

In addition to the exams results, INEP provides a socioeconomic questionnaire which is filled by the student. Since 2013, the questionnaire identifies the students who have studied abroad through the Science without Borders scholarship. My dataset is composed of six editions of Enade from before the creation of the CSF program (2007, 2008, 2009, 2010, 2011 and 2012) and four editions from after the creation of the CSF program (2013, 2014, 2015 and 2016).

Some of the courses evaluated in 2007 were: Agroindustry Technology, Agronomy, Biomedicine, Dentistry, Medicine, Nursing, Nutrition, Occupational Therapy, Pharmacy, Physical Education, Physiotherapy, Radiology, Social Work, Speech Therapy, Veterinary Medicine, Zootechnic. 215,419 students were evaluated in 2007.

Some of the courses evaluated in 2008 were: Agricultural Engineering, Analysis and Systems Development, Architecture and Urbanism, Biological Sciences, Biotechnoly Engineering, Building Technology, Cartographic Engineering, Chemical Engineering, Chemical Industry Engineering, Chemical Processes Technology, Chemistry, Civil Engineering, Computer Engineering, Computer Networks, Computer Science, Control and Automation Engineering, Electronics Engineering, Electrotechnical Engineering, Engineering, Environmental Engineering, Environmental Sanitation, Fishing Engineering, Food Engineering, Food Technology, Forest Engineering, Geography, History, Hydraulic Resources Engineering, Industrial Automation, Industrial Engineering, Industrial Maintenance, Industrial Production Management, Information system, Land Surveying Engineering, Languages, Materials Engineering, Mathematics, Mechanical Fabrication Technology, Mining Engineering, Naval Engineering, Pedagogy, Petroleum Engineering, Philosophy, Physics, Production Engineering, Social Sciences, Telecommunication Engineering, Sanitary Engineering. 461,776 students were evaluated in 2008.

Some of the courses evaluated in 2009 were: Accounting Sciences, Administration, Advertising and Design, Archivology, Cinema, Design, Economics, Editorial Process, Executive Secretariat, Fashion Design, Financial Management, Gastronomy, Human Resources Management, International Relations, Journalism, Law, Library Science, Management Processes, Marketing, Music, Psychology, Public Relations, Radiology, Statistics, Theatre, Tourism, Tourism Management. 994,270 students were evaluated in 2009.

Some of the courses evaluated in 2010 were: Agribusiness, Agroindustry Technology, Agronomy, Biomedicine, Dentistry, Environmental Management, Hospital Management, Medicine, Nursing, Nutrition, Occupational Therapy, Pharmacy, Physical Education, Physiotherapy, Radiology, Social Work, Speech Therapy, Veterinary Medicine, Zootechnic. 422,896 students were evaluated in 2010.

Some of the courses evaluated in 2011 were: Agricultural Engineering, Analysis and Systems Development, Architecture and Urbanism, Biological Sciences, Biotechnology Engineering, Building Technology, Cartographic Engineering, Chemical Engineering, Chemical Industry Engineering, Chemical Processes Technology, Chemistry, Civil Engineering, Computer Engineering, Computer Networks, Computer Science, Control and Automation Engineering, Electrical Engineering, Electronics Engineering, Electrotechnical Engineering, Engineering, Environmental Engineering, Environmental Sanitation, Food Engineering, Food Technology, Forest Engineering, Geography, Geological Engineering, History, Hydraulic Resources Engineering, Industrial Automation, Industrial Electric Engineering, Industrial Maintenance, Industrial Production Management, Information system, Land Surveying Engineering, Languages, Materials Engineering, Mathematics, Mechanical Engineering, Mechanical Fabrication Technology, Mechatronics Engineering, Metallurgical Engineering, Mining Engineering, Music, Naval Engineering, Network Engineering, Pedagogy, Petroleum Engineering, Philosophy, Physical Education, Physics, Production Engineering, Social Sciences, Telecommunication Engineering, Textile Engineering, Visual Arts, Sanitary Engineering. 376,180 students were evaluated in 2011.

Some of the courses evaluated in 2012 were: Accounting Sciences, Administration, Advertising and Design, Commercial Management, Design, Economics, Executive Secretariat, Financial Management, Human Resources Management, International Relations, Journalism, Law, Logistics, Management Processes, Marketing, Psychology, Tourism. 587,351 students were evaluated in 2012.

Some of the courses evaluated in 2013 were: Agribusiness, Agronomy, Biomedicine, Dentistry, Environmental Management, Hospital Management, Medicine, Nursing, Nutrition, Pharmacy, Physical Education, Physiotherapy, Radiology, Social Work, Speech Therapy, Veterinary Medicine, Zootechnic. 195,525 students were evaluated in 2013.

Some of the courses evaluated in 2014 were: Analysis and Systems Development, Architecture and Urbanism, Biological Sciences, Chemical Engineering, Chemistry, Civil Engineering, Computer Engineering, Computer Networks, Computer Science, Control and Automation Engineering, Electrical Engineering, Engineering, Environmental Engineering, Food Engineering, Forest Engineering, Geography, History, Industrial Automation, Industrial Production Management, Information system, Languages, Mathematics, Mechanical Engineering, Music, Pedagogy, Philosophy, Physical Education, Physics, Production Engineering, Social Sciences, Visual Arts. 481,720 students were evaluated in 2014.

Some of the courses evaluated in 2015 were: Accounting Sciences, Administration, Advertising and Design, Commercial Management, Design, Economics, Executive Secretariat, Fashion Design, Financial Management, Foreign Trade, Gastronomy, Graphic Design, Human Resources Management, Interior Design, International Relations, Journalism, Law, Logistics, Management Processes, Marketing, Psychology, Public Administration, Public Management, Quality Management, Theology, Tourism. 549,487 students were evaluated in 2015.

Some of the courses evaluated in 2016 were: Agribusiness, Agronomy, Biomedicine, Dentistry, Environmental Management, Medicine, Nursing, Nutrition, Pharmacy, Physical Education, Physiotherapy, Radiology, Social Work, Speech Therapy, Technology in Aesthetics and Cosmestics, Veterinary Medicine, Zootechnic. 216,044 students were evaluated in 2016.

Students who did not score in one of the tests were excluded from the sample. Students who did not report whether or not they studied abroad were also excluded. I also drop from the sample observations with missing control variables. Observations of students who have just begun their undergraduate studies are also excluded[1].

The reason I do not use previous Enade's editions is because the socioeconomic questionnaires have different response options. If I were to adapt the variables from recent Enade editions, too much information would be lost. However it is important to highlight that the Enade's editions of 2007 and 2008 do not have a socioeconomic questionnaire as complete as the more recent editions. For that reason, I have three main datasets: the first is the "2013-2016" sample, including the Enade's editions from 2013 to 2016 (the editions that contain Science without Borders students); the second is the "2009-2016" sample, including the Enade's editions from 2009 to 2016 and having the exact same control variables from the first sample; the third is the "2007-2016" sample, including the Enade's editions from 2007-2016 and some differences regarding the control variables in comparison to the previous samples.

On a total of 4,500,668 students, 2,464,347 were not excluded from the "2007 -2016" sample and 2,272,989 were not excluded from the "2009-2016" sample:

- **2007**: 55,345 students (2007-2016 sample), 0 students (2009-2016 sample).
- **2008**: 127,496 students (2007-2016 sample), 0 students (2009-2016 sample).
- **2009**: 241,238 students (2007-2016 sample), 237,835 students (2009-2016 sample).

[1]Earlier editions of the exam used to also evaluate students who had just begun their undergraduate studies. The editions of 2007, 2008, 2009 and 2010 contain these type of students.

- **2010**: 109,545 students (2007-2016 sample), 108,989 students (2009-2016 sample).
- **2011**: 285,201 students (2007-2016 sample), 283,516 students (2009-2016 sample).
- **2012**: 455,312 students (2007-2016 sample), 452,880 students (2009-2016 sample).
- **2013**: 159,149 students (2007-2016 sample), 158,709 students (2009-2016 sample).
- **2014**: 392,701 students (2007-2016 sample), 392,701 students (2009-2016 sample).
- **2015**: 444,872 students (2007-2016 sample), 444,871 students (2009-2016 sample).
- **2016**: 193,488 students (2007-2016 sample), 193.488 students (2009-2016 sample).

Dependent Variables: I analyse the effect of studying abroad through a CSF scholarship on Enade's grades. Therefore, there are three dependent variables: "Specific Knowledge Grade", "General Education Grade" and "General Grade". The first target is to measure the mastering of knowledge specifically related to the student area, while the second is common to all areas and aims to assess the general knowledge on the Brazilian and world realities and other areas of knowledge. The General Grade is a weighted average from the previous two grades: 75% of the Specific Knowledge grade and 25% of the General Education grade. The grades range from 0 to 100.

Grades were standardized at Course-Year levels for the regressions, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year.

Independent Variables: Since the sample contains students from different undergraduate courses and universities, I control for the two categorical variables by using: "Course" and "University". When combining both variables, each new category represents an undergraduate course from a specific university. I call this variable "Course X University".

Accounting for the students' socioeconomic background, I use a categorical variable of "Family Income" that contains 7 possible values measured in minimum wages (MW): "less than 1.5 MW", "1.5 MW - 3 MW", "3 MW - 4.5 MW", "4.5 MW - 6 MW", "6 MW - 10 MW", "10 MW - 30 MW" and "30 MW or more". For the "2007-2016" sample, the values are: "less than 3 MW", "3 MW - 10 MW", "10 MW - 30 MW" and "30 or more MW".

I also utilize categorical variables for both mother and father formal education, with both variables assuming the values: "No education", "Secondary Education (age 6 to 11)", "Secondary Education (age 12 to 14)", "High Schoo" "Graduation" and "Postgraduation". For the "2007-2016" sample, the values are: "No education", "Secondary Education (age 6 to 11)", "Secondary Education (age 12 to 14)", "High School", "Graduation".

A categorical variable identifying if the student was accepted at his home university through a quota criteria is also used. The quota criterion are "Race" criteria, "Income" criteria, "Public School" criteria for those who studied in public schools, "2 or more previous criteria" and "Other" criteria. The sample "2007-2016" does not have this variable.

Dummies of race are also used: “White”, “Black”, “Mixed Race”, “Indigenous” and “Yellow”. Other controls include the gender of the student (a dummy for “Female”) and the student’s “Age” and “Age-squared”, to verify if older students have better grades and if this effect is non-linear.

4.1 Summary Statistics: Student Level

This subsection is used in order to analyse the summary statistics of the Enade dataset. Firstly, a comparison of grades is done between CSF students and control students using the Enade’s editions of 2013, 2014, 2015 and 2016. Secondly, I compare the socioeconomic backgrounds of the treatment group and the control group.

I begin my summary statistics analysis with Table 4.1, where there are comparisons of the General Grades across courses from the 2013 Enade’s edition. The sample contains 158,709 observations, out of which 683, the “CSF” treatment group, were part of the Science without Borders program. The $Grade^{total}$ column shows the average grades for all students in each course. The $Grade^{tr}$ column shows the average grades for CSF students, while the $Grade^{nt}$ column shows the average grades for nontreated students. The *Difference* column contains the difference in average grades between treatment and control groups. The *p-value* column shows the p-value for null hypothesis testing. The $Obs.^{tr}$ column contains the number of observations for the treatment group while the $Grade^{nt}$ column contains the number of observations for the nontreated group. The CSF’s courses groups usually have higher average grades, except for the courses: Agribusiness, Physical Education and Social Work. However the p-values show that not all differences as statistically significant. The courses that reject the null hypothesis test are: Agronomy, Biomedicine, Nutrition, Pharmacy, Physiotherapy, Speech Therapy, Veterinary Medicine and Zootechnic (Table 4.1).

Table 4.1: Summary Statistics - General Grades Comparison (2013)

Course	Grade^{total}	Grade^{tr}	Grade^{nt}	Difference	p-value	Obs.^{tr}	Obs.^{nt}
Agribusiness	49.77	47.90	49.78	-1.88	0.80	3	1,396
Agronomy	53.62	62.66	53.52	9.15	0.00	82	7,330
Biomedicine	47.92	56.11	47.84	8.27	0.00	52	5,190
Dentistry	46.79	49.21	46.77	2.43	0.15	57	9,497
Environmental Management	37.70	37.74	37.70	0.04	0.99	15	6,762
Hospital Management	37.30	38.80	37.30	1.50	0.85	2	1,582
Medicine	48.09	48.58	48.09	0.49	0.77	59	15,104
Nursing	51.57	51.92	51.57	0.35	0.79	106	24,344
Nutrition	43.39	51.29	43.36	7.93	0.00	37	10,300
Pharmacy	42.14	52.43	42.04	10.39	0.00	111	12,054
Physical Education	49.97	49.32	49.97	-0.66	0.80	33	13,331
Physiotherapy	48.66	56.25	48.64	7.61	0.00	33	10,589
Radiology	40.50	43.88	40.49	3.39	0.48	6	2,432
Social Work	37.29	36.79	37.29	-0.50	0.86	24	27,772
Speech Therapy	53.10	67.44	53.04	14.40	0.01	5	1,363
Veterinary Medicine	45.59	50.79	45.56	5.23	0.00	47	6,963
Zootechnic	47.05	56.50	47.00	9.50	0.01	11	2,017

Data: National Examination of Student Performance (Enade) 2013. Microdata.

Table 4.2 contains comparisons of the General Grades across courses from the 2014 Enade's edition. The sample contains 392,701 observations, out of which 5,345 were part of the Science without Borders program. Most of the CSF's courses groups present higher average grades and also reject the null hypothesis test. The only course that shows a smaller average grade for the treatment group (in comparison to the control group) and also has a p-value smaller than 0.05 is "Pedagogy". Table 4.3 contains comparisons of the General Grades across courses from the 2015 Enade's edition. The sample contains 444,871 observations, out of which 1,064 were part of the Science without Borders program. This table contains a more equal division between negative and positive values in the column *Difference* than the previous tables. Many of these differences reject the null hypothesis test. Table 4.4 contains comparisons of the General Grades across courses from the 2016 Enade's edition, which evaluated almost the same courses as in 2013. The sample contains 193,488 observations, out of which 2900 were part of the Science without Borders program. The CSF's courses groups usually have higher average grades and all cases with higher grades reject the null hypothesis test. The only course that shows a smaller average grade for the treatment group (in comparison to the control group) and also has a p-value smaller than 0.05 is "Social Work".

Table 4.2: Summary Statistics - General Grades Comparison (2014)

Course	**Grade**^{total}	**Grade**^{tr}	**Grade**^{nt}	**Difference**	**p-value**	**Obs.**^{tr}	**Obs.**^{nt}
Analysis and Systems Development	40.58	51.09	40.54	10.55	0.00	38	11,022
Architecture and Urbanism	47.34	56.04	47.08	8.96	0.00	404	13,480
Biological Sciences	45.29	61.06	45.02	16.04	0.00	365	21,075
Chemical Engineering	46.01	55.80	44.96	10.84	0.00	408	3,810
Chemistry	41.44	55.60	41.14	14.46	0.00	170	8,206
Civil Engineering	45.91	59.45	45.61	13.84	0.00	468	21,030
Computer Engineering	47.78	58.68	46.70	11.98	0.00	215	2,191
Computer Networks	42.49	43.27	42.49	0.78	0.86	9	3,833
Computer Science	45.42	60.42	45.00	15.41	0.00	273	9,741
Control and Automation Eng.	43.83	59.48	42.79	16.69	0.00	222	3,328
Electrical Engineering	43.68	55.86	43.07	12.78	0.00	461	9,341
Engineering	49.10	61.35	48.06	13.29	0.00	372	4,346
Environmental Engineering	47.22	61.96	46.68	15.28	0.00	232	6,302
Food Engineering	51.59	62.29	50.94	11.35	0.00	89	1,467
Forest Engineering	49.75	59.24	49.38	9.87	0.00	68	1,751
Geography	41.30	51.65	41.25	10.39	0.00	51	12,069
History	41.24	41.22	41.24	-0.03	0.99	20	18,367
Industrial Automation	48.01	47.17	48.01	-0.85	0.92	3	1,673
Industrial Production Management	47.90	46.60	47.90	-1.30	0.89	2	2,198
Information system	43.70	54.73	43.62	11.11	0.00	98	13,099
Language-Portuguese	42.48	37.25	42.48	-5.23	0.09	18	13,429
Language-Portuguese and English	43.70	36.67	43.71	-7.04	0.10	11	9,810
Language-Portuguese and Spanish	38.92	33.46	38.92	-5.46	0.38	5	3,283
Mathematics	32.69	39.28	32.66	6.62	0.00	62	13,611
Mechanical Engineering	46.94	59.66	46.30	13.36	0.00	505	10,079
Music	46.48	59.90	46.44	13.46	0.01	6	2,267
Pedagogy	46.86	42.73	46.86	-4.14	0.00	121	110,821
Philosophy	42.57	47.85	42.56	5.29	0.62	2.	4,635
Physical Education	44.15	40.74	44.16	-3.42	0.07	53	24,153
Physics	40.06	47.86	39.90	7.96	0.00	65	3,161
Production Engineering	45.90	60.67	45.38	15.29	0.00	505	14,535
Social Sciences	45.30	45.37	45.30	0.08	0.99	11.	4,585
Visual Arts	43.02	53.98	42.99	11.00	0.01	13	4,658

Data: National Examination of Student Performance (Enade) 2014. Microdata.

Table 4.3: Summary Statistics - General Grades Comparison (2015)

Course	Grade^{total}	Grade^{tr}	Grade^{nt}	Difference	p-value	Obs.^{tr}	Obs.^{nt}
Accounting Sciences	40.71	36.37	40.71	-4.35	0.01	58	54,799
Administration	41.80	39.08	41.81	-2.72	0.01	153	122,267
Advertising and Design	51.64	62.73	51.60	11.13	0.00	50	14,553
Commercial Management	49.92	47.77	49.93	-2.16	0.67	7	4,844
Design	50.37	61.81	49.36	12.45	0.00	503	5,700
Economics	42.41	36.45	42.42	-5.97	0.37	4	7,771
Executive Secretariat	50.01	77.70	49.99	27.71		1	1,417
Fashion Design	51.48	59.70	51.47	8.23	0.34	2	1,328
Financial Management	38.98	38.83	38.98	-0.15	0.98	3	5,622
Foreign Trade	48.41	55.95	48.41	7.54	0.43	2	2,043
Gastronomy	51.58	35.74	51.61	-15.87	0.00	10	4,518
Graphic Design	52.28	64.44	52.15	12.29	0.00	22	2,025
Human Resources Management	40.75	31.88	40.76	-8.87	0.00	31	27,919
Interior Design	46.26	49.22	46.25	2.97	0.57	6	2,363
Journalism	47.68	55.75	47.65	8.10	0.00	30	8,920
Law	45.73	40.62	45.74	-5.12	0.00	98	106,818
Logistics	47.07	47.94	47.07	0.88	0.83	9	10,553
Management Processes	53.54	41.70	53.55	-11.85	0.01	9	10,007
Marketing	47.88	42.23	47.88	-5.65	0.48	3	5,635
Psychology	47.25	55.94	47.23	8.71	0.00	44	24,035
Public Administration	55.81	55.70	55.81	-0.11	0.99	3	3,258
Public Management	46.11	44.27	46.11	-1.84	0.83	3	4,289
Quality Management	46.99	49.95	46.99	2.96	0.73	2	1,887
Theology	57.46	55.60	57.47	-1.87	0.81	4	3,450
Tourism	53.66	48.83	53.67	-4.84	0.38	7	3,442

Data: National Examination of Student Performance (Enade) 2015. Microdata.

When looking at the previous tables, it is possible to see that students from different areas of knowledge were granted scholarships, although the priority areas of the program were made mostly of STEM fields and Health Sciences. Table 4.2 shows that engineering students were the most benefited by the program and have some of highest differences in “General Grades” compared to the control groups. I included the “Specific Knowledge” grades comparisons on Table A1, Table A2, Table A3 and Table A4 and the “General Education” grades comparisons on Table A5, Table A6, Table A7 and Table A8.

Table 4.4: Summary Statistics - General Grades Comparison (2016)

Course	Grade^{total}	Grade^{tr}	Grade^{nt}	Difference	p-value	Obs.^{tr}	Obs.^{nt}
Agribusiness	42.58	32.38	42.61	-10.23	0.10	4	1,401
Agronomy	57.37	65.37	57.12	8.25	0.00	334	10,785
Biomedicine	43.75	53.87	43.44	10.42	0.00	227	7,479
Dentistry	54.75	64.09	54.59	9.49	0.00	239	13,948
Environment Management	41.53	38.87	41.53	-2.66	0.71	3	4,771
Medicine	65.16	68.42	65.02	3.40	0.00	619	15,218
Nursing	41.47	48.79	41.42	7.38	0.00	229	32,390
Nutrition	48.75	62.89	48.56	14.33	0.00	163	12,481
Pharmacy	50.61	62.17	50.21	11.97	0.00	437	12,703
Physical Education	43.64	49.50	43.61	5.89	0.00	94	18,921
Physiotherapy	40.12	52.41	40.02	12.39	0.00	125	14,557
Radiology	41.26	56.42	41.15	15.27	0.00	17	2,347
Social Work	43.57	37.40	43.58	-6.18	0.02	35	26,983
Speech Therapy	51.87	57.40	51.81	5.59	0.03	20	1,812
Tech in Aest and Cosm	43.31	32.07	43.32	-11.26	0.11	3	4,130
Veterinary Medicine	49.70	58.36	49.39	8.98	0.00	300	8,434
Zootechnic	41.16	51.66	40.92	10.74	0.00	51	2,228

Data: National Examination of Student Performance (Enade) 2016. Microdata.

The grades comparisons across different courses show that on most of the cases, CSF students have on average higher grades than other students. This is specially true for courses that are known to be part of the priority areas of the program. However, it is also possible to find courses where CSF students had smaller (and statistically significant) grades than their control counterparts, for example: Law and Administration students (Table 4.3).

However, the simple comparison between grades may lead to biased conclusions. Socioeconomic background characteristics also influence students grades and even their desire to pursue an exchange year abroad. For that reason, I generate summary statistics on the socioeconomic characteristics of Science without Borders students and other students.

Table 4.5 contains data on students from Enade's editions of 2013, 2014, 2015 and 2016. The sample contains 1.189,769 observations, out of which 9,992, the "CSF" treatment group, were part of the Science without Borders program. Students who identify themselves as "White" represent 67% of the CSF group, while the control group is composed of 56%. The control group has a larger proportion of "Blacks", "Mixed Race" and "Indigenous" students but smaller proportion of "Yellow" students. All differences in percentages of "Race" reject the null hypothesis test. The variables "Father Education", "Mother Education" and "Family Income" demonstrate that students who study abroad through the Science without Borders come from richer socioeconomic background. It is clear that, proportionally, the CSF students usually have parents academically more qualified and are part of richer families. The p-values confirm that the differences are statistically significant.

Both groups appear to have small differences between the proportions of quota students but most of these differences are statistically significant. While "Racial" and "Public School" criterions are proportionally higher for the treatment group, the "Income" criteria is higher for the control group. The first two criterions, although correlated with income, do not necessarily represent students from worst economic backgrounds.

Furthermore, CSF students are younger, 51% are women and 76% of them were from public universities. While in the control group 63% are women and only 24% studied in a public university. The results are understandable, since STEM fields usually have fewer women and public universities, especially the federal ones, have usually better STEM fields undergraduate courses.

Table 4.5: Summary Statistics - CSF students vs. Other students (2013-2016)

	Total N = 1,189,769	**CSF = 1** N = 9,992	**CSF = 0** N = 1,179,777	**Difference**	**p-value**
Race					
White	0.56	0.67	0.56	0.11	0.00
Black	0.09	0.05	0.09	-0.04	0.00
Mixed Race	0.27	0.17	0.27	-0.10	0.00
Yellow	0.07	0.09	0.07	0.02	0.00
Indigenous	0.01	0.00	0.01	-0.00	0.03
Father Education					
none	0.07	0.02	0.07	-0.05	0.00
sec school (age 6 to 11)	0.30	0.10	0.30	-0.20	0.00
sec school (age 12 to 14)	0.15	0.09	0.15	-0.06	0.00
high school	0.29	0.30	0.29	0.01	0.13
graduation	0.14	0.32	0.14	0.18	0.00
postgraduation	0.05	0.17	0.05	0.12	0.00
Mother Education					
none	0.05	0.01	0.05	-0.04	0.00
sec school (age 6 to 11)	0.26	0.07	0.26	-0.19	0.00
sec school (age 12 to 14)	0.15	0.07	0.15	-0.07	0.00
high school	0.31	0.29	0.31	-0.02	0.00
graduation	0.15	0.34	0.15	0.19	0.00
postgraduation	0.08	0.21	0.08	0.13	0.00
Family Income					
1,5 MW	0.15	0.07	0.16	-0.08	0.00
1,5 - 3 MW	0.27	0.14	0.27	-0.13	0.00
3 - 4,5 MW	0.20	0.14	0.20	-0.06	0.00
4,5 - 6 MW	0.13	0.14	0.13	0.01	0.01
6 - 10 MW	0.13	0.21	0.13	0.08	0.00
10 - 30 MW	0.09	0.24	0.09	0.15	0.00
30 or more MW	0.02	0.05	0.02	0.03	0.00
Quotas					
No quota	0.82	0.83	0.82	0.01	0.00
Racial	0.01	0.02	0.01	0.01	0.00
Income	0.05	0.03	0.05	-0.03	0.00
Public School	0.06	0.09	0.06	0.03	0.00
2 or more previous criterions	0.03	0.03	0.03	-0.00	0.17
Other criterions	0.03	0.01	0.03	-0.02	0.00
Other Controls					
Age	28.73	24.86	28.76	-3.90	0.00
Female	0.63	0.51	0.63	-0.12	0.00
Public University	0.25	0.76	0.24	0.52	0.00

Data: National Examination of Student Performance (Enade) 2013, 2014, 2015 and 2016. Microdata.

4.2 Summary Statistics: Course/University Level

This subsection analyses the summary statistics of the Enade dataset aggregated at course/university level, focusing on the historical evolution of average Enade grades of each course from each university using all the exam's editions since 2007. In order for grades to be comparable across years and areas knowledge, grades presented here have already been standardized at Course-Year level before being aggregated. It is important to remember that each year, different areas of knowledge are evaluated using the Enade exam, so that each area is evaluated at intervals of no more than three years. In order to focus on the evolution of grades, I exclude from my ten years dataset any course/university that is present in less than three years. In other words, each course/university must appear three years (2007-2010-2013, 2008-2011-2014 and 2009-2012-2015).

I begin my aggregated summary statistics analysis with Table 4.6, where each course/university has been assigned to a group: the $Grade^{tr}$ and $Grade^{nt}$, indicating if in 2013 the respective course/universities had at least one student going abroad through the program (treated group) or not (nontreated group). Column "Year" indicates which year each line of statistics belongs to. Column $Grade^{tr}$ shows the average standardized grade for the treated group. Column $Grade^{nt}$ shows the average grade for the nontreated group. Column *Difference* shows the difference in average grades between treated and nontreated each year. Column $DID_{Year-2007}$ shows the *differences in differences* for each year in relation to 2007, in other words, it is the difference between the average grade of the treated and untreated groups in a given year (2010 or 2013) minus the difference in average grades between treated and nontreated average grades of 2007. Column $DID_{Year-2010}$ shows the *differences in differences* for each year in relation to 2010, in other words, it is the difference between the average grade of the treated and untreated groups in a given year (2013) minus the difference in average grades between treated and nontreated average grades of 2010. The table is also divided between panels: Panel A has statistics on the "General Grade", Panel B has the statistics on the "Specific Knowledge Grade" and Panel C has the statistics on the "General Education Grade".

Table 4.6: Agreggated Summary Statistics - Grades Evolution Comparison (2013)

Year	**Grade**^{tr} **N = 234**	**Grade**^{nt} **N = 1117**	**Difference**	**DID**$_{Year-2007}$	**DID**$_{Year-2010}$
		Panel A: General Grade			
2007	0.318	0.043	0.275	.	.
2010	0.282	0.068	0.214	-0.061	.
2013	0.232	0.084	0.148	-0.127	-0.066
		Panel B: Specific Knowledge Grade			
2007	0.288	0.044	0.244	.	.
2010	0.283	0.076	0.207	-0.036	.
2013	0.238	0.089	0.149	-0.095	-0.058
		Panel C: General Education Grade			
2007	0.271	0.022	0.249	.	.
2010	0.158	0.020	0.138	-0.111	.
2013	0.100	0.026	0.075	-0.174	-0.063

Data: National Examination of Student Performance (Enade) 2007, 2010, 2013. Microdata.
Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year

Table 4.6 shows that on average, treated courses/universities posses higher grades in all three years than nontreated ones. Column *Difference* shows that the General Grade (Panel A) differences between treated and nontreated groups varied between 0.275 standard deviation points (SDs) (2007) and 0.148 SDs (2013). The Specific Knowledge Grade (Panel B) differences between treated and nontreated groups varied between 0.244 standard deviation points (2007) and 0.149 SDs (2013). The General Education Grade (Panel C) differences between treated and nontreated groups varied between 0.29 standard deviation points (2007) and 0.075 SDs (2013). Columns $DID_{Year-2007}$ and $DID_{Year-2010}$ present negative values in all cases, meaning that there is no apparent evidence of the positive impact of the program, on the contrary, the impact seems to be negative.

Table 4.7, where each course/university has been assigned to a group: the

$Grade^{tr}$ and $Grade^{nt}$, indicating if in 2014 the respective course/universities had at least one student going abroad through the program (treated group) or not (non-treated group). Column $DID_{Year-2008}$ shows the *differences in differences* for each year in relation to 2008, in other words, it is the difference between the average grade of the treated and untreated groups in a given year (2011 or 2014) minus the difference in average grades between treated and nontreated average grades of 2008. Column $DID_{Year-2011}$ shows the *differences in differences* for each year in relation to 2011, in other words, it is the difference between the average grade of the treated and untreated groups in a given year (2014) minus the difference in average grades between treated and nontreated average grades of 2011.

Table 4.7: Agreggated Summary Statistics - Grades Evolution Comparison (2014)

Year	**Grade^{tr}** N = **612**	**Grade^{nt}** N = **1867**	**Difference**	**DID$_{Year-2008}$**	**DID$_{Year-2011}$**
		Panel A: General Grade			
2008	0.284	-0.010	0.295	.	.
2011	0.259	0.029	0.230	-0.065	.
2014	0.251	0.021	0.231	-0.064	0.001
		Panel B: Specific Knowledge Grade			
2008	0.284	-0.010	0.294	.	.
2011	0.284	0.026	0.258	-0.036	.
2014	0.255	0.026	0.229	-0.065	-0.029
		Panel C: General Education Grade			
2008	0.149	-0.004	0.153	.	.
2011	0.063	0.030	0.034	-0.120	.
2014	0.126	0.002	0.125	-0.028	0.091

Data: National Examination of Student Performance (Enade) 2008, 2011, 2014. Microdata.
Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year

Table 4.7 shows that on average, treated courses/universities posses higher grades in all three years than nontreated ones. Column $Difference$ shows that the General Grade (Panel A) differences between treated and nontreated groups varied between 0.295 standard deviation points (2008) and 0.23 SDs (2011). The Specific Knowledge Grade (Panel B) differences between treated and nontreated groups varied between 0.294 standard deviation points (2008) and 0.129 SDs (2014).

The General Education Grade (Panel C) differences between treated and nontreated groups varied between 0.153 standard deviation points (2008) and 0.034 SDs (2011). Columns $DID_{Year-2008}$ present negative values in all cases, which would mean a negative impact of the CSF on average grades. However, Column $DID_{Year-2011}$ shows a positive impact of the program when comparing grades from 2011 and 2014 for the General Education Grade of 0.091 SDs (Panel C).

Table 4.8, where each course/university has been assigned to a group: the $Grade^{tr}$ and $Grade^{nt}$, indicating if in 2015 the respective course/universities had at least one student going abroad through the program (treated group) or not (nontreated group). Column $DID_{Year-2009}$ shows the *differences in differences* for each year in relation to 2009, in other words, it is the difference between the average grade of the treated and untreated groups in a given year (2012 or 2015) minus the difference in average grades between treated and nontreated average grades of 2009. Column $DID_{Year-2012}$ shows the *differences in differences* for each year in relation to 2012, in other words, it is the difference between the average grade of the treated and untreated groups in a given year (2015) minus the difference in average grades between treated and nontreated average grades of 2012.

Table 4.8 shows that on average, treated courses/universities posses higher grades in all three years than nontreated ones. Column *Difference* shows that the General Grade (Panel A) differences between treated and nontreated groups varied between 0.127 standard deviation points (2009) and 0.56 SDs (2012). The Specific Knowledge Grade (Panel B) differences between treated and nontreated groups varied between 0.130 standard deviation points (2009) and 0.058 SDs (2015). The General Education Grade (Panel C) differences between treated and nontreated groups varied between 0.069 standard deviation points (2009) and 0.024 SDs (2012). Columns $DID_{Year-2009}$ present negative values in all cases, which would mean a negative impact of the CSF on average grades. However, Column $DID_{Year-2012}$ shows

Table 4.8: Agreggated Summary Statistics - Grades Evolution Comparison (2015)

Year	**Grade^{tr}** **N = 323**	**Grade^{nt}** **N = 2786**	**Difference**	**DID$_{Year-2009}$**	**DID$_{Year-2012}$**
		Panel A: General Grade			
2009	0.131	0.004	0.127	.	.
2012	0.083	0.027	0.056	-0.071	.
2015	0.080	0.019	0.061	-0.066	0.004
		Panel B: Specific Knowledge Grade			
2009	0.133	0.002	0.130	.	.
2012	0.087	0.027	0.060	-0.071	.
2015	0.080	0.022	0.058	-0.072	-0.002
		Panel C: General Education Grade			
2009	0.075	0.006	0.069	.	.
2012	0.037	0.013	0.024	-0.045	.
2015	0.046	0.000	0.047	-0.022	0.023

Data: National Examination of Student Performance (Enade) 2009, 2012, 2015. Microdata.
Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year

a positive impact of the program when comparing grades from 2011 and 2014 for the General Education Grade of 0.023 SDs (Panel C).

Results from Tables 4.7 and 4.8 indicate that the program there is a correlation between a course/university having Science without Borders students and an increase in the general education grade. However, this positive correlation only appears when comparing grades from the most recent year (2014 or 2015) and the previous year (2011 and 2012). The effect actually appears to be negative when comparing grades from the most recent years with the first years (2008 and 2009). The same positive correlation cannot be found for the specific knowledge grade in any case.

However, the treatment "CSF" cannot be considered binary when using aggregated data, since only a percentage of students from a course/university go abroad through the Science without Borders, in other words, the treatment is continuous, varying from 0 to 1.

In order to see if there is any correlation between the percentage of students of a course/university going abroad and the increase of grades, I generate Figure 4.1. The graph's horizontal axis contains the percentage of students of a given course/university in 2013, 2014 or 2015 and in its vertical axis contains the difference of general grade between the third year and the second year(2013-2010, 2014-2011 or 2015-2012). As can be seen, there seems to be a positive, yet small, correlation between the variables.

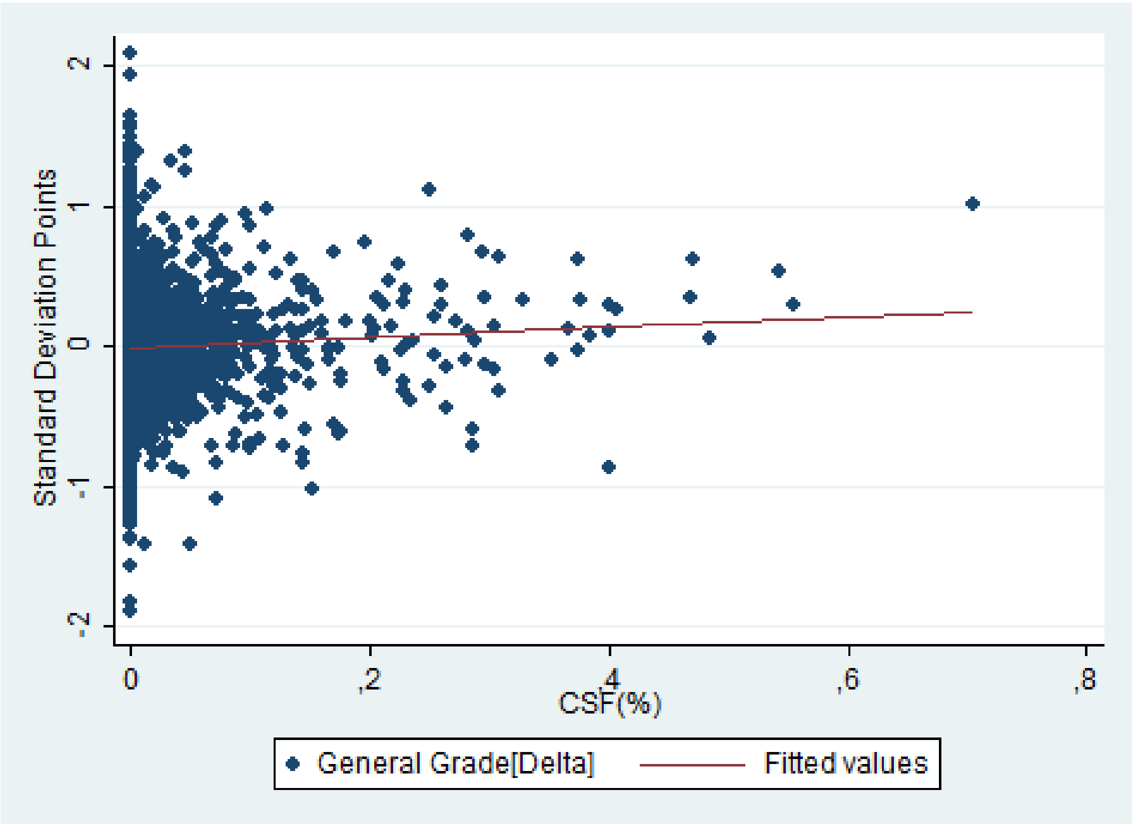

Figure 4.1: Percentage of CSF students x Difference of Average General Grades between Third and Second Year

Figure 4.2 contains in its horizontal axis the percentage of students of a given course/university in 2013, 2014 or 2015 and in its vertical axis contains the difference of the specific knowledge grade between the third year and the second year(2013-2010, 2014-2011 or 2015-2012). The correlation seems to be non-existent.

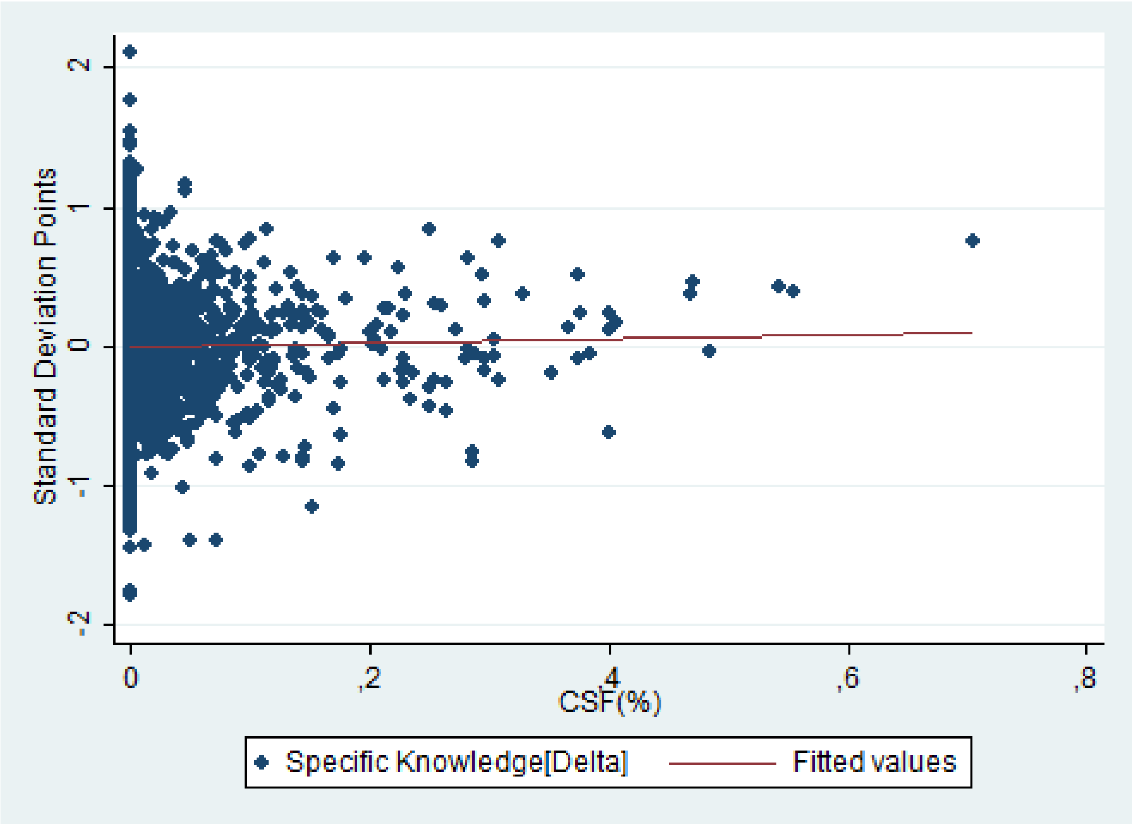

Figure 4.2: Percentage of CSF students x Difference of Average Specific Knowledge Grades between Third and Second Year

Figure 4.3 contains in its horizontal axis the percentage of students of a given course/university in 2013, 2014 or 2015 and in its vertical axis contains the difference of the general education grade between the third year and the second year(2013-2010, 2014-2011 or 2015-2012). The correlation seems to be positive and even larger than on Figure 4.1.

The aggregated summary statistics have shown that courses/universities that have had CSF students in 2013, 2014 or 2015 Enade edition have, historically, higher average grades than those that did not have CSF students. The *differences-in-differences* preliminary analysis shows first evidence that the program might have had a positive impact on average general education grades and negative impact on

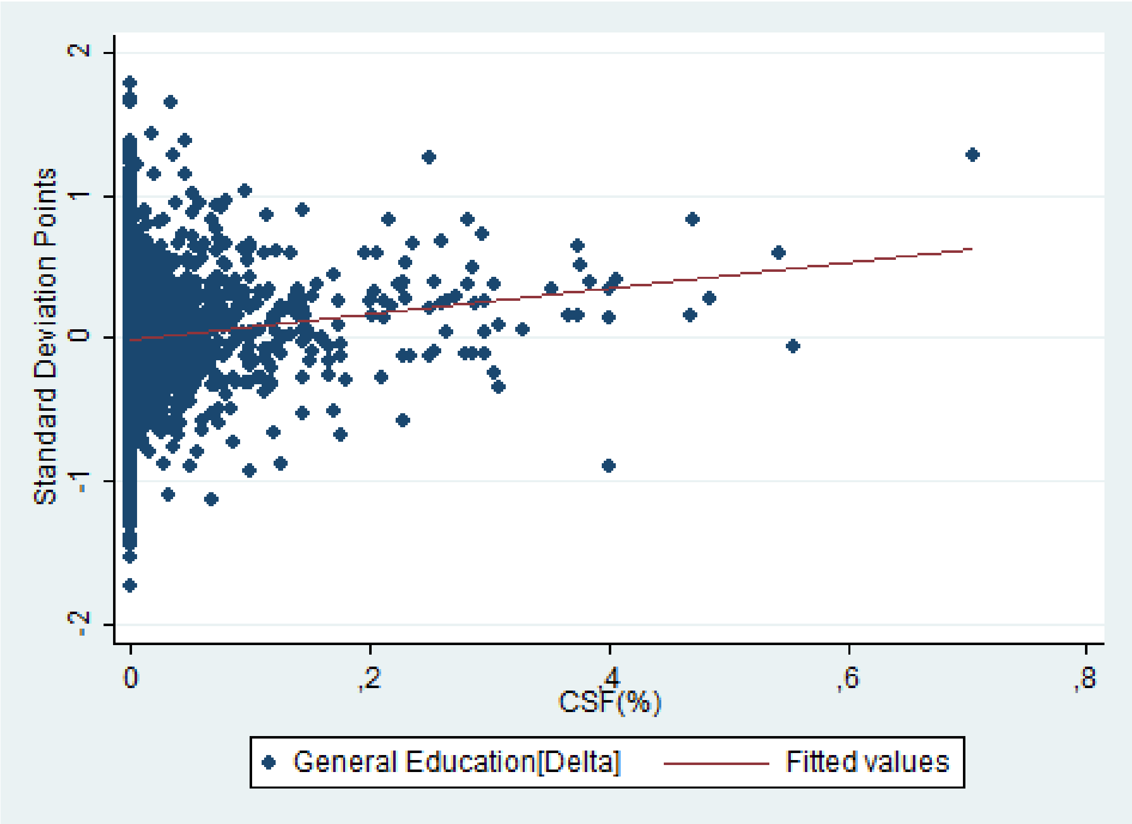

Figure 4.3: Percentage of CSF students x Difference of Average General Education Grades between Third and Second Year

specific knowledge grades. Finally, looking at the correlation on the percentage of students at each course/university and the difference of grades between two periods (post-treatment, pre-treatment) shows a positive correlation, specially for the general education grade.

The aggregated statistics may also lead to biased results, since it might correlated with the different percentage of students with different characteristics (qualification and motivation) at different points in time.

5 EMPIRICAL STRATEGY

This section discusses the different empirical strategies used to investigate the relationship between receiving a scholarship from the CSF and students' grades. The summary statistics in Section 4 suggest that undergraduate students who go abroad during their university studies through the CSF program might have systematically higher grades than other students. In addition, the socioeconomic characteristics of both groups are quite distinct. The aggregated statistics have also show that courses/universities that have Science without Border students usually have always had higher average grades. Also, having a larger percentage of students going abroad is positively correlated with increasing the average grade. Randomly selecting students to participate in the CSF program would be the best way to overcome the problem of self-selection bias into studying abroad (ANGRIST; PISCHKE, 2008). However, such a procedure cannot be performed since students are selected according to their home university grades.

5.1 Ordinary Least Squares

My analysis begin with an Ordinary Least Squares strategy, estimating the following equation:

$$\begin{aligned} Grade &= \beta_1 CSF + \beta_2 IndividualCharacteristics + \\ &\quad \beta_3 FamilyBackground + \beta_4 Quota + \\ &\quad \beta_5 CourseXUniversity + \beta_6 Year + \mu \end{aligned} \tag{5.1}$$

Where *Grade* is the grade of a student and *CSF* is a dummy variable indicating whether the individual studied abroad through the CSF. *Individual Characterisitcs* is a vector of individual's controls consisting of: "age", "age squared", "race"and "female". *Family Background* is a vector of individual's controls consisting of: "family income", "father education"and "mother education". The *Quota* control identifies whether the student was accepted at his home university by a quota criteria and what was the criteria. I include a set of dummies for each course from each university (*Course X University*) and *Year* controls. By controlling for this extensive set of covariates, it is expected that the omitted variable bias is being minimized.

However, a direct comparison of both groups and OLS regressions may lead to biased results. Students who apply for the Science without Borders program are mainly selected according to their previous academic performances. If better students are selected for the exchange program, it is possible that the correlation between better grades in the Enade and the CSF treatment is not causal, even after controlling for the previous described covariates. Furthermore, students who opt for an academic year abroad are likely to differ from non-mobile students in terms of not only ability but also motivation.

5.2 Propensity Score Matching

In order to take self-selection into studying abroad through the CSF into account, we apply a Propensity Score Matching strategy. The general idea of this approach, introduced by ROSENBAUM; RUBIN (1983), consists of comparing individuals that have received a certain treatment and individuals of a control group who have not, but who are very similar concerning their observable pre-treatment characteristics. The difference in the outcome can be assigned to the treatment, since the matched individuals differ only in the treatment (HECKMAN; ICHIMURA; TODD, 1998; BECKER; ICHINO, 2002; CALIENDO; KOPEINIG, 2008).

Finding counterparts that are equal with regard to observable covariates can be difficult, therefore a balancing score should be used in order to group treated and untreated individuals (ROSENBAUM; RUBIN, 1983). The PSM consists of measuring the conditional probability of being exposed to a treatment given a set of pre-treatment covariates (BECKER; ICHINO, 2002):

$$p(X) \equiv Pr\{T = 1|X\} = E\{T|X\} \tag{5.2}$$

T denotes the treatment, which is studying abroad through the CSF program, and X is a set of pre-treatment covariates. The individuals, both treated and untreated, are grouped by their propensity scores so that, within a respective group, the distribution of covariates is identical and independent of the assignment to the treatment.

The average treatment effect on the treated (ATET) is the difference between the expected outcome when being and not being exposed to the treatment for all individuals who actually received the treatment (BECKER; ICHINO, 2002):

$$\tau_{ATET} = E\{E[Y_{1i}|T_i = 1, p(X_i)] - E[Y_{0i}|T_i = 0, p(X_i)]|T_i = 1\} \tag{5.3}$$

with Y_{1i} and Y_{0i} representing the outcome for student i when he receives and does not receive the treatment, respectively.

Analyzing the summary statistics presented in Section 4 as well as the results of other studies presented in Section 3, I expect that gender, individual characteristics, family background, quotas, field of study and the Brazilian university have an impact on receiving a CSF scholarship.

The propensity score of being a CSF student is estimated for all students in the sample using a probit model with a normal cumulative distribution function (Φ) and $h(X_i)$ as a function of the same individuals' covariates from the OLS strategy:

$$Pr(T_i = 1|X_i) = \Phi\{h(X_i)\} \tag{5.4}$$

It is important to remember, however, that probit regressions do not work in cases of “perfect prediction or “perfect failure": conditions in which the outcome does not vary at some levels of the independent variables. Consequently, many of the students from my sample cannot have their propensity scores estimated because many of them come from courses and universities without Science without Border students.

In order to estimate the average treatment effect on the treated of equation (5.3) it is necessary to match treated and untreated individuals based on their propensity scores. I use the same matching algorithms used by MEYA; SUNTHEIM (2014), the first being the nearest neighbor matching (NN), within a calipher of 0.05 to reduce the risk of bad matching, followed by the kernel matching, with an Epanechnikov kernel function and bandwidth of 0.06, and radius matching, with a caliper of 0.05. The last two algorithms make use of more control group individuals, but these additional matches are not as close as the nearest neighbor.

5.2.1 Rosenbaum Bounds

A crucial assumption of PSM is conditional independence (CIA). This means that all covariates that affect treatment and outcome are observed. If there exist unobserved variables that affect both studying abroad through the CSF and success at Enade, propensity score matching would lead to biased results (BECKER; CALIENDO, 2007). There may other unobserved factors (such as motivation for studying abroad and students grades during undergraduation) correlating with participation in the program and with the outcome variables.

The bounding approach proposed by ROSENBAUM (2002) was developed as test that can be applied in order to evaluate the robustness of results in the presence of omitted variables. In other words, the Rosembaum bounds test is used in order to verify if the results are sensitive to such unobserved heterogeneity.

CALIENDO; KOPEINIG (2008) show that in the presence of a hidden bias γ, two individuals with the same observed covariates x have differing chances of receiving treatment. Assuming that the participation probability is given by $P(x_i) = F(\beta x_i + \gamma u_i)$ where x_i is the observed characteristics for individual i and u_i is the unobserved variable, if the study is free o hidden bias then γ equals zero. Assuming that there is a matched pair of individuals i and j and F is a logistics distribution, the odds ratio that either of the two matched individuals will receive treatment is given by:

$$\frac{\frac{P(x_i)}{1-P(x_i)}}{\frac{P(x_j)}{1-P(x_j)}} = \frac{P(x_i)(1-P(x_j))}{P(x_j)(1-P(x_i))} = \frac{exp(\beta x_j + \gamma u_j)}{exp(\beta x_i + \gamma u_i)} = exp[\gamma(u_i - u_j)] \tag{5.5}$$

If there are either no differences in unobserved variables ($u_i = u_j$) or if unobserved variables have no influence on the probability of participating ($\gamma = 0$), the odds ratio is one, implying the absence of hidden or unobserved selection bias. Assuming that motivation plays a role for the participation decision and the outcome variable, and a person is either motivated ($u = 1$) or not ($u = 0$), ROSENBAUM (2002) shows that (5.5) implies the following bounds on the odds-ratio that either of the two matched individuals will receive treatment:

$$e^{-\gamma} = \frac{P(x_i)(1-P(x_j))}{P(x_j)(1-P(x_i))} = e^{\gamma} \tag{5.6}$$

where $e^{\gamma} = \Gamma$. Individuals have the same probability of participating if $\Gamma = 1$. If $\Gamma = 2$, then individuals who appear to be similar (in terms of x) could differ in their odds of receiving the treatment by as much as a factor of 2. The larger Γ gets, as long p-value is smaller than 0.05 (significance level of 5%), the more robust are the estimates.

5.3 Quantile Regressions

Analysing the effectiveness of the Science without Borders on student performance using OLS and PSM estimate the mean effect of the program on student achievement. While estimating how “on average” the program affects educational outcomes yields straightforward interpretations, the standard methodologies may miss what is crucial for policy purposes, namely, how studying abroad affects achievement differently at different points of the test score distribution.

Quantile regressions analysis (KOENKER; BASSETT JR, 1978; KOENKER, 2005) are used when the variables of interest potentially have varying effects at different points in the conditional distribution of the dependent variable.

As explained by FIRPO; FORTIN; LEMIEUX (2009), conditional quantiles do not average up to their unconditional population counterparts, unlike conditional means (OLS). Conditional quantile methods cannot be used to answer a question as simple as “what is the impact on median grades of increasing of studying abroad by one year, holding everything else constant?”.

In order to analyse the program’s effects on the test score distribution, I use FIRPO; FORTIN; LEMIEUX (2009) ”unconditional quantile regression” (UQR) approach. This strategy allows for obtaining the effect of the CSF at different quantiles of the unconditional distribution of grades. Within this framework, the quantiles are defined pre-regression and therefore do not vary with the additional covariates included in the model. The method involves regressing the Recentered Influence Function (RIF) of the unconditional quantile of the dependent variable on the explanatory variables. The RIF is calculated as follows:

$$(Y; q_\tau F_y) = q_\tau + [(\tau - \mathbb{1}\{Y \leq q_\tau\})/f_y(q_\tau)] \tag{5.7}$$

where Y is the outcome variable (the grade), τ designates the specific quantile, q_τ is the value of the outcome variable at this quantile, $f_y(q_\tau)$ is the density at the point q_τ, and $\mathbb{1}\{Y \leq q_\tau\}$ is a dummy variable which indicates whether the outcome variable is below q_τ. After this transformation, it is possible to simply run a least squares regression with the RIF as the dependent variable.

5.4 Differences-in-Differences

The previous empirical strategies make use of repeated cross-section data. Because the sample design does not attempt to retain the same units in the sample, information regarding dynamic dependence in behaviour is lost (CAMERON; TRIVEDI, 2005).

A major attraction of panel data is the possibility of consistent estimation of the fixed effects model, which allows for the elimination of unobserved individual heterogeneity constant across time. The differences-in-differences (DID) estimator allows for measuring the effects of a treatment using standard panel data methods if panel data are available before and after the treatment and if not all individuals receive the treatment. The estimator is called DID since one estimates the difference for the treated and untreated groups and then takes the difference in time differences (CAMERON; TRIVEDI, 2005).

The DID estimator can be extended from panel data to the case where separate cross sections are available. However, it is only possible to do that when it is possible to identify in the pre-treatment periods wheter or not an individual is elegible for treatment (CAMERON; TRIVEDI, 2005). Unfortunately, it is not possible to identify students eligibles for the Science without Borders in pre-treatment cross sections.

As a way of confirming the validity and robustness of the results found through the previous empirical strategies, I chose to carry out another experiment, using panel data, whose unit of identification is not the students but the courses from each university, where the dependent variable is the average grade ($\overline{Grade}$) in Enade:

$$
\begin{aligned}
\overline{Grade}_{i,t} = {} & \beta_1 CSF(\%)_{i,t} + \beta_2 \overline{age}_{i,t} + \beta_3 \overline{age^2}_{i,t} + \\
& \beta_4 Female(\%)_{i,t} + \beta_5 FamilyIncome(\%)_{i,t} + \\
& \beta_6 Races(\%)_{i,t} + \beta_7 FatherEducation(\%)_{i,t} + \\
& \beta_8 MotherEducation(\%)_{i,t} + \beta_9 CourseXUniversity_i + \\
& \beta_{10} Year_t + \mu_{i,t}
\end{aligned}
\tag{5.8}
$$

where $CSF(\%)$ varies between 0% and 100% for a course/university i in period t, identifying the percentage of students the went abroad through the program. I include a set of dummies for each course from each university $CourseXUniversity$ and $Year$ controls, completing the DID equation.

Controls $\overline{age}$ and $\bar{(}age^2)$ represent the average ages and ages squared for each i at a given t. $Female(\%)$ represents the percentage of women. $FamilyIncome(\%)$ represents a vector of percentages identifying the percentage of students in the following income groups: "less than 3 MW", "3 MW - 10 MW", "10 MW - 30 MW" and "30 or more MW". $Race(\%)$ represents a vector of percentages identifying the percentage of students in the following race groups: "White", "Black", "Mixed Race", "Indigenous" and "Yellow". $FatherEducation(\%)$ and $MotherEducation(\%)$ represent two vector of percentages identifying the percentage of students in the following education groups: "No education", "Secondary Education (age 6 to 11)", "Secondary Education (age 12 to 14)", "High School", "Graduation".

It is important to remember that each year, different areas of knowledge are evaluated, so that each area is evaluated at intervals of no more than three years. Using the "2007-2016" sample, I create a panel data of ten years, with each course/university appearing three years (2008-2011-2014 and 2009-2012-2015) or four years (2007-2010-2013-2016). I also create a panel data of nine years as a robustness check, with each course/university appearing three years (2007-2010-2013, 2008-2011-2014 and 2009-2012-2015).

In order to account for the number of students in each average grade, I use Weighted Least Squares (WLS) for my grouped data, weighting by the number of individuals at each course/university at each given year. I exclude any course/university made of five students or less at any point in time.

5.4.1 Instrumental Variable

Nevertheless, the inclusion of fixed effects does not ensure that the estimates are unbiased. The student's decision to spend some time abroad may indicate something about his/her motivation and skills. Since the proportion of students motivated and skilled are not constant across time or course/universities, this might lead to a spurious correlation between the proportion of students going abroad and subsequent course/university grade.

One way of addressing this source of endogeneity is to identify an instrumental variable that is correlated with the endogenous variable $CSF(\%)$ but is uncorrelated with the term μ. My instrumental variable strategy exploits cross-course variation in a course/university exposure to the Science without Borders. As explained in Section 2, the concession of scholarships were destined to priority areas defined by the government. This means that courses that are part of priority areas are more likely to have a higher proportion of students going abroad, satisfying the condition of being correlated with the endogenous variable by capturing an important dimension of the supply-side of the CSF scheme. The use of supply-side measures as instruments in the IV procedure is widely established, especially among papers investigating the causal impact of education on labour market outcomes CARD (2001).

The instrument also appears to meet the condition of not being correlated to the error term. The government decision of granting more scholarships to certain areas of knowledge was not correlated with the proportion of students more motivated or skilled. Hence, the instrument's variation is not correlated with the dependent variable, except through the endogenous variable. The measure is an indicator, which takes the value 1 if the undergraduate course is part of a priority area.

With such an instrument *priority*, I estimate the following two-stage least squares (2SLS) approach:

$$\begin{aligned}\widehat{CSF(\%)}_{i,t} = {} & \beta_1 priority_{i,t} + \beta_2 \overline{age}_{i,t} + \beta_3 \overline{age^2}_{i,t} + \\ & \beta_4 Female(\%)_{i,t} + \beta_5 FamilyIncome(\%)_{i,t} + \\ & \beta_6 Races(\%)_{i,t} + \beta_7 FatherEducation(\%)_{i,t} + \\ & \beta_8 MotherEducation(\%)_{i,t} + \beta_9 CourseXUniversity_i + \\ & \beta_{10} Year_t + \eta_{i,t}\end{aligned} \tag{5.9}$$

$$\begin{aligned}\overline{Grade}_{i,t} = {} & \beta_1 \widehat{CSF(\%)}_{i,t} + \beta_2 \overline{age}_{i,t} + \beta_3 \overline{age^2}_{i,t} + \\ & \beta_4 Female(\%)_{i,t} + \beta_5 FamilyIncome(\%)_{i,t} + \\ & \beta_6 Races(\%)_{i,t} + \beta_7 FatherEducation(\%)_{i,t} + \\ & \beta_8 MotherEducation(\%)_{i,t} + \beta_9 CourseXUniversity_i + \\ & \beta_{10} Year_t + \nu_{i,t}\end{aligned} \tag{5.10}$$

In order to establish which courses are part of the priority areas I use the official public calls documents for undergraduate students. The documents can be found on the website: *http://www.cienciasemfronteiras.gov.br/web/csf/inscricoes-resultados*. Most of documents contain, on their "Attachment" section, a list of more than 500 courses that were considered part of the priority areas. The courses used as instruments will be listed in Section 6.

6 RESULTS

In this section, I assess whether the correlations documented to this point are causal. First, I use OLS regression controlling for observable characteristics of students. Second, I follow a propensity score strategy in order to take self-selection into account and test our PSM results sensitivity to unobserved heterogeneity. Third, I analyse if there is inequality in the effects of the program, using an UQR strategy. Fourth, I aggregate my data at a course/university level in order to follow a differences-in-differences approach. Finally, I combine the DID technique with an instrumental variable strategy, exploring the variation on supply of scholarships.

6.1 Controlling for Observables: OLS Results

The empirical analysis starts with an OLS model using the "2013-2016" sample. Table 6.1 shows the estimated effects of the CSF program on Enade's grades, where Panel A has effects on the "General Grade", Panel B has the effect on the "Specific Knowledge Grade" and Panel C has the effect on the "General Education Grade".

Beginning the analysis with Panel A, the first specification, column (1), has no controls and shows a positive and significant effect on the General Grade of 0.735 standard deviations. Column (2) introduces controls for the 76 courses evaluated, increasing the coefficient to 0.754 standard deviations and remains highly significant. Column (3), on the other hand, has "Universities" controls, controlling for each of the 2156 institution. As can be seen, the coefficient falls to 0.314 SDs, but still highly significant. Column (4) shows the results when controlling for the interaction

Table 6.1: CSF Effects on Enade's Grades - OLS Results (2013 - 2016)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: General Grade							
CSF	0.735***	0.754***	0.314***	0.314***	0.314***	0.303***	0.285***	0.281***
	(0.0574)	(0.0593)	(0.0514)	(0.0369)	(0.0366)	(0.0354)	(0.0341)	(0.0340)
R^2	0.005	0.005	0.106	0.177	0.177	0.185	0.195	0.201
	Panel B: Specific Knowledge Grade							
CSF	0.692***	0.710***	0.273***	0.273***	0.273***	0.264***	0.248***	0.244***
	(0.0589)	(0.0611)	(0.0515)	(0.0378)	(0.0375)	(0.0364)	(0.0353)	(0.0351)
R^2	0.004	0.004	0.104	0.175	0.175	0.182	0.190	0.195
	Panel C: General Education Grade							
CSF	0.507***	0.520***	0.268***	0.277***	0.276***	0.267***	0.249***	0.246***
	(0.0369)	(0.0374)	(0.0373)	(0.0254)	(0.0252)	(0.0246)	(0.0236)	(0.0237)
R^2	0.002	0.002	0.042	0.083	0.083	0.088	0.094	0.098
Courses	No	Yes	No	No	No	No	No	No
Universities	No	No	Yes	No	No	No	No	No
Courses X Universities	No	No	No	Yes	Yes	Yes	Yes	Yes
Year	No	No	No	No	Yes	Yes	Yes	Yes
Individual Characteristics	No	No	No	No	No	Yes	Yes	Yes
Family Background	No	No	No	No	No	No	Yes	Yes
Quota	No	No	No	No	No	No	No	Yes
Observations	1,189,769	1,189,769	1,189,769	1,189,769	1,189,769	1,189,769	1,189,769	1,189,769

Data: National Examination of Student Performance (Enade) 2013, 2014, 2015 and 2016. Microdata.
Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year; Family Background controls include: Family Income, Father Education and Mother Education; Individual Characteristics controls include: Race, Female, Age and Age squared; Standard errors in parentheses; clustered at Course level; *** p < 0.01, **p < 0.05, * p < 0.1

between "Courses" and "Universities", meaning that there are 16,471 control dummies for each course from each tertiary institution. The coefficient remains the same at 0.314 standard deviations, highly significant. When including time dummies ("Year"), the CSF effect also remains intact. Columns (6) to (8) introduce the socioeconomic background control variables. The CSF coefficient remains positive after adding all covariates to the regression at 0.281 standard deviations and remains highly significant through all columns.

Panels B and C (Table 6.1) show OLS regressions for the estimated effects of the CSF program on Enade's specific knowledge grade and general education grade, respectively. The CSF coefficients variations from both tables follow a similar path from Panel A. The "Course X University" control dummies reduce in half the magnitude of the impact of the Science without Borders program, but the statistical significance remains untouched. Even after the addition of socioeconomic background control variables, the CSF coefficients values remain stable and highly significant. The OLS coefficients with the full specification for the specific knowledge and general education grades are 0.244 and 0.246 standard deviations, respectively.

I also run regressions using the "2009-2016" and "2007-2016" samples as robustness tests. Table B1 shows the estimated effects of the CSF program on Enade's grades using the "2009-2016" sample, where Panel A has effects on the "General Grade", Panel B has the effect on the "Specific Knowledge Grade" and Panel C has the effect on the "General Education Grade". There are 19,445 control dummies for each course from each university. As can be seen, the coefficients maintain a similar trajectory as Table 6.1 across specifications. The OLS coefficients with the full specification for the general grade, specific knowledge and general education grades are 0.286, 0.244 and 0.269 standard deviations, respectively.

Table B2 shows the estimated effects of the CSF program on Enade's grades using the "2007-2016" sample, where Panel A has effects on the "General Grade", Panel B has the effect on the "Specific Knowledge Grade" and Panel C has the effect on the "General Education Grade". There are 19,909 control dummies for each course from each university. As can be seen, the coefficients maintain a similar trajectory as Table 6.1 across specifications. The OLS coefficients with the full specification for the general grade, specific knowledge and general education grades are 0.287, 0.245 and 0.265 standard deviations, respectively.

When analysing the courses independently, it is possible find very heterogeneous CSF effects. Tables 6.2, 6.3, 6.4, 6.5 show regressions for each course who had students going abroad in 2013, 2014, 2015 and 2016, respectively. Each line from each table is an OLS regression estimating the effect of CSF on the general grade, with the same controls of column (8) from Table 6.1, except for the "Year" control. Also, the first line of each table has a regression including all students from the respective year sample.

Table 6.2: CSF Effect on Enade's General Grade - OLS Results (2013)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.14	0.07	0.04	0.23	158,709
Agribusiness	-0.15	0.21	0.47	0.16	1,399
Agronomy	0.47	0.09	0.00	0.24	7,412
Biomedicine	0.12	0.10	0.23	0.29	5,242
Dentistry	-0.04	0.12	0.76	0.28	9,554
Environmental Management	-0.12	0.20	0.53	0.16	6,777
Hospital Management	-0.65	0.12	0.00	0.20	1,584
Medicine	-0.07	0.11	0.52	0.28	15,163
Nursing	-0.08	0.10	0.44	0.26	24,450
Nutrition	0.09	0.16	0.57	0.27	10,337
Pharmacy	0.33	0.09	0.00	0.29	12,165
Physical Education	-0.05	0.22	0.81	0.14	13,364
Physiotherapy	0.35	0.13	0.01	0.28	10,622
Radiology	0.64	0.70	0.36	0.24	2,438
Social Work	-0.18	0.17	0.28	0.22	27,796
Speech Therapy	0.81	0.34	0.02	0.30	1,368
Veterinary Medicine	0.11	0.15	0.47	0.23	7,010
Zootechnic	0.52	0.27	0.06	0.28	2,028

Data: National Examination of Student Performance (Enade) 2013. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

The first line from Table 6.2 shows that the average effect of the Science without Borders on 2013 Enade was of 0.14 standard deviations, at a statistically significant level of 4%. The results in general show positive effects for each course, but most effects are also statistically insignificant. The courses that present statistically significant (p-value $< 5\%$) CSF effects are: Agronomy (0.47 standard deviations), Hospital Management (-0.65 standard deviations), Pharmacy (0.33 standard deviations), Physiotherapy (0.35 standard deviations) and Speech Therapy (0.81

Table 6.3: CSF Effect on Enade's General Grade - OLS Results (2014)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.37	0.03	0.00	0.21	392,701
Analysis and Systems Development	0.50	0.16	0.00	0.24	11,060
Architecture and Urbanism	0.28	0.05	0.00	0.15	13,884
Biological Sciences	0.49	0.05	0.00	0.28	21,440
Chemical Engineering	0.28	0.05	0.00	0.34	4,218
Chemistry	0.59	0.07	0.00	0.26	8,376
Civil Engineering	0.46	0.04	0.00	0.23	21,498
Computer Engineering	0.41	0.07	0.00	0.33	2,406
Computer Networks	-0.06	0.40	0.89	0.24	3,842
Computer science	0.45	0.05	0.00	0.35	10,014
Control and Automation Eng.	0.39	0.06	0.00	0.45	3,550
Electrical Engineering	0.39	0.05	0.00	0.32	9,802
Engineering	0.45	0.05	0.00	0.34	4,718
Environmental Engineering	0.34	0.06	0.00	0.34	6,534
Food Engineering	0.42	0.11	0.00	0.30	1,556
Forest Engineering	0.36	0.11	0.00	0.27	1,819
Geography	0.35	0.15	0.02	0.21	12,120
History	0.05	0.22	0.83	0.27	18,387
Industrial Automation	-0.61	0.32	0.06	0.28	1,676
Industrial Production Management	0.18	0.60	0.76	0.13	2,200
Information system	0.49	0.10	0.00	0.22	13,197
Language-Portuguese	-0.47	0.20	0.02	0.19	13,447
Language-Portuguese and English	-0.37	0.24	0.12	0.25	9,821
Language-Portuguese and Spanish	-0.20	0.30	0.51	0.31	3,288
Mathematics	0.32	0.15	0.03	0.22	13,673
Mechanical Engineering	0.39	0.05	0.00	0.29	10,584
Music	0.55	0.35	0.11	0.19	2,273
Pedagogy	-0.36	0.09	0.00	0.15	110,942
Philosophy	-0.64	0.60	0.28	0.33	4,637
Physical Education	-0.30	0.15	0.06	0.14	24,206
Physics	0.28	0.13	0.03	0.24	3,226
Production Engineering	0.36	0.05	0.00	0.26	15,040
Social Sciences	0.09	0.24	0.71	0.23	4,596
Visual Arts	0.29	0.25	0.25	0.21	4,671

Data: National Examination of Student Performance (Enade) 2014. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

standard deviations).

However, the 2013 edition only has 683 students out of 158,709. Table 6.5 contains the 2016 sample, which evaluated almost the same courses as in 2013, with the advantage of having 2900 CSF students. The average effect of the Science without Borders on 2016 Enade was of 0.27 standard deviations, at a statistically significant level of 0%. The results show mostly positive effects and most of the effects are

Table 6.4: CSF Effect on Enade's General Grade - OLS Results (2015)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.07	0.15	0.65	0.19	444,871
Accounting Sciences	-0.33	0.12	0.01	0.20	54,857
Administration	-0.19	0.08	0.01	0.22	122,420
Advertising and Design	0.31	0.13	0.01	0.16	14,603
Commercial Management	-0.08	0.26	0.76	0.16	4,851
Design	0.36	0.04	0.00	0.24	6,203
Economics	-0.13	0.28	0.64	0.26	7,775
Executive Secretariat	2.19	0.18	0.00	0.20	1,418
Fashion Design	0.74	0.43	0.08	0.17	1,330
Financial Management	0.01	0.48	0.98	0.21	5,625
Foreign Trade	0.26	0.86	0.76	0.17	2,045
Gastronomy	-0.85	0.33	0.01	0.23	4,528
Graphic Design	-0.02	0.22	0.91	0.21	2,047
Human Resources Management	-0.67	0.16	0.00	0.13	27,950
Interior Design	0.04	0.51	0.94	0.17	2,369
Journalism	0.29	0.19	0.12	0.20	8,950
Law	-0.32	0.10	0.00	0.18	106,916
Logistics	-0.04	0.32	0.91	0.15	10,562
Management Processes	-0.81	0.33	0.01	0.14	10,016
Marketing	-0.46	0.73	0.53	0.14	5,638
Psychology	0.26	0.15	0.09	0.20	24,079
Public Administration	-0.27	0.26	0.31	0.32	3,261
Public Management	-0.51	0.83	0.54	0.24	4,292
Quality Management	0.62	0.20	0.00	0.18	1,889
Theology	0.25	0.31	0.43	0.21	3,454
Tourism	-0.17	0.36	0.63	0.19	3,449

Data: National Examination of Student Performance (Enade) 2015. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

statistically significant. The statistically significant effects (5%) are: Agribusiness (-0.59 SDs), Agronomy (0.31 SDs), Biomedicine (0.38 SDs), Dentistry (0.25 SDs), Nursing (0.28 SDs), Nutrition (0.46 SDs), Pharmacy (0.37 SDs), Physiotherapy (0.5 SDs), Radiology (0.54 SDs), Social Work (-0.32 SDs), Veterinary Medicine (0.37 SDs) and Zootechnic (0.65 SDs).

The first line from Table 6.3 show that the average effect of the Science

Table 6.5: CSF Effect on Enade's General Grade - OLS Results (2016)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.27	0.05	0.00	0.24	193,488
Agribusiness	-0.59	0.20	0.00	0.17	1,405
Agronomy	0.31	0.04	0.00	0.23	11,119
Biomedicine	0.38	0.07	0.00	0.28	7,706
Dentistry	0.25	0.06	0.00	0.26	14,187
Environmental Management	0.55	0.58	0.34	0.17	4,774
Medicine	0.06	0.04	0.16	0.20	15,837
Nursing	0.28	0.07	0.00	0.27	32,619
Nutrition	0.46	0.08	0.00	0.27	12,644
Pharmacy	0.37	0.05	0.00	0.29	13,140
Physical Education	0.03	0.11	0.81	0.17	19,015
Physiotherapy	0.50	0.08	0.00	0.26	14,682
Radiology	0.54	0.26	0.04	0.25	2,364
Social Work	-0.32	0.16	0.04	0.29	27,018
Speech Therapy	0.01	0.21	0.97	0.27	1,832
Tech in Aest and Cosmestics	-0.81	0.47	0.09	0.18	4,133
Veterinary Medicine	0.37	0.05	0.00	0.24	8,734
Zootechnic	0.65	0.12	0.00	0.28	2,279

Data: National Examination of Student Performance (Enade) 2016. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

without Borders on 2014 Enade was of 0.37 standard deviations, at a statistically significant level of 0%. Table 6.3 contains courses mostly for STEM fields, the areas of knowledges that received more scholarships during the program's existence and the results in general show positive and statistically significant CSF effects for almost all courses, specially for the engineering courses. The statistically significant effects (5%) are: Analysis and Systems Development (0.5 SDs), Architecture and Urbanism (0.28 SDs), Biological Sciences (0.49 SDs), Chemical Engineering (0.28 SDs), Chemistry (0.59 SDs), Civil Engineering (0.46 SDs), Computer Engineering (0.41 SDs), Computer Science (0.45 SDs), Control and Automation Engineering

(0.39 SDs), Electrical Engineering (0.39 SDs), Engineering (0.45 SDs), Environmental Engineering (0.34 SDs), Food Engineering (0.42 SDs), Forest Engineering (0.36 SDs), Geography (0.34 SDs), Information System (0.49 SDs), Language-Portuguese (-0.47 SDs), Mathematics (0.32 SDs), Mechanical Engineering (0.39 SDs), Pedagogy (-0.36 SDs), Physics (0.28 SDs) and Production Engineering (0.36 SDs).

The first line from Table 6.4 show that the average effect of the Science without Borders on 2015 Enade was of 0.07 standard deviations but statistically insignificant. Table 6.4 contains courses mostly for humanities and social social sciences, the areas of knowledges that received less scholarships during the program's existence and the results show both positive and negative CSF effects for the courses. The statistically significant effects (5%) are: Accounting Sciences (-0.33 SDs), Administration (-0.19 SDs), Advertising and Design (0.31 SDs), Design (0.36 SDs), Executive Secretariat (2.19 SDs), Gastronomy (-0.85 SDs), Human Resources Management (-0.67), Law (-0.32 SDs), Management Processes (-0.81 SDs) and Quality Management (0.62 SDs).

The effects on the specific knowledge and general education grades can be found on Tables B3, B4, B5, B6, B7, B8, B9 and B10.

The OLS regressions suggest a positive causal relation relationship between studying abroad through the CSF program and Enade's grades on average. However, the effects can vary from highly negative to highly positive across different areas of knowledge. The STEM fields seem to be positively affected in general by program, as was show in Tables 6.3, B4 and B8. The courses from biological and health sciences also appear to be positive affected in general, although the program's effect on Medicine is not statistically significant (Tables 6.2, B3, B7, 6.2, B3 and B7. The social and humanities sciences appear not be affected by the program or even negatively affected (Tables 6.4, B5 and B9).

The results indicate that students from priority areas were benefited by the program, gaining more knowledge abroad, while students from not priority areas spent one year abroad for nothing. It is possible that students from some fields of study did not have access to the best foreign universities of their respective fields. In other words, some of the partnerships established by the government with foreign universities might have been worse than others, which may partially help explain the results. However, as was previously discussed, OLS regressions are likely to be biased, since students are selected according to their grades and students need to apply for the program before being selected. Positive results might be correlated to the selection of better and more motivated students. While negative results might be correlated with worst and less motivated students being granted scholarships.

6.2 Matching Similar Individuals: PSM Results

Taking a closer look to characteristics that explain whether or not a student gains a CSF scholarship, Table 6.6 presents results of a probit regression. Marginal effects are displayed for a benchmark student who is white, male, from a poor family background, who was admitted into college without the use of a quota criteria and with parents who do not have formal education.

The coefficients show that older students are less likely to gain a CSF scholarship, although the effect is lessoned for older students. Students with parents who have tertiary education are more likely to study abroad through the CSF in comparison to parents with no formal education. However, students with parents with secondary education are also less likely to go abroad. “Black” students are less likely to go abroad than white students. All quota categories have positive and significant coefficients, except for “Other criterions” category. Students from richer families are also more likely to go abroad.

Table 6.6: Probability of Becoming a CSF exchange student - Probit Results (2013-2016

Variable	Coefficients	Marginal Effects	Variable	Coefficients	Marginal Effects
Age	-0.0338***	-0.0015515***	**Race**		
	(0.00672)	(0.0003082)	Black	-0.0517**	-0.0023075**
Age squared	0.000295***	0.0000135***		(0.0245)	(0.0010585)
	(0.000101)	(4.64e-06)	Mixed Race	-0.0248	-0.0011279
Female	-0.0157	-0.000723		(0.0153)	(0.0006897)
	(0.0120)	(0.0005529)	Yellow	-0.0128	-0.0005885
Father Education				(0.0208)	(0.0009476)
sec school (age 6 to 11)	-0.0722**	-0.0028643*	Indigenous	0.0330	0.0015658
	(0.0355)	(0.0014679)		(0.0738)	(0.0035895)
sec school (age 12 to 14)	-0.0247	-0.0010154	**Mother Education**		
	(0.0376)	(0.0015661)	sec school (age 6 to 11)	-0.0835*	-0.0036182*
high school	0.0310	0.0013335		(0.0437)	(0.0019938)
	(0.0360)	(0.0015175)	sec school (age 12 to 14)	-0.0793*	-0.0034484*
graduation	0.154***	0.0072928***		(0.0458)	(0.0020805)
	(0.0371)	(0.001612)	high school	-0.0587	-0.0025936
postgraduation	0.245***	0.0124485***		(0.0443)	(0.002035)
	(0.0392)	(0.0018202)	graduation	0.0676	0.0032803
Family Income				(0.0452)	(0.0021058)
1,5 - 3 MW	-0.00502	-0.0002154	postgraduation	0.112**	0.0056223**
	(0.0213)	(0.0009138)		(0.0461)	(0.0021772)
3 - 4,5 MW	0.00850	0.0003683	**Quota**		
	(0.0224)	(0.0009707)	Racial	0.277***	0.0151053***
4,5 - 6 MW	0.0381	0.0016883		(0.0398)	(0.0025902)
	(0.0234)	(0.0010299)	Income	0.213***	0.0110423***
6 - 10 MW	0.0772***	0.0035232***		(0.0303)	(0.0017985)
	(0.0232)	(0.0010421)	Públic School	0.0545***	0.0025196***
10 - 30 MW	0.121***	0.0057064***		(0.0198)	(0.0009458)
	(0.0245)	(0.0011361)	2 or more previous criterions	0.214***	0.0111182***
30 or more mw	0.0628*	0.0028349*		(0.0312)	(0.0018589)
	(0.0349)	(0.0016052)	Other criterions	-0.000460	-0.0000204
				(0.0472)	(0.0020954)
Observations	383,496				
Pseudo-R^2	0.27352216				
Log Likelihood	-33,635.71				

Data: National Examination of Student Performance (Enade) 2013, 2014, 2015 and 2016. Microdata. Probit estimation; Additional controls: CourseXUniversities and Year; Standard errors in parentheses; *** p < 0.01, **p < 0.05, * p < 0.1

Based on the probit regression, I apply a propensity matching strategy as described in Section 5. Table 6.7 shows the average treatment effect on the treated according to different matching algorithms. I also include the CSF coefficient of column (8) from OLS regressions of Table 6.1. Panel A refers to the CSF effect on the general grade. The CSF has an estimated effect on the general grade positive and highly significant for all PSM algorithms. The nearest neighbor algorithm returns a coefficient of 0.297 standard deviations. The Radius algorithm returns a larger coefficient of 0.354 standard deviations, as do the Kernel algorithm, with the ATET coefficient returned being of 0.351 SDs. The larger coefficients from the last two algorithm can be explained by the fact that they make use of more control group individuals, but these additional matches are not as close as the nearest neighbor.

Table 6.7: CSF Effect on Enade's grades - PSM Results (2013-2016)

	(1) OLS	(2) NN	(3) Radius	(4) Kernel
	Panel A: General Grade			
CSF	0.281***	0.297***	0.354***	0.351***
	(0.0340)	(0.0159)	(0.0114)	(0.0115)
	Panel B: Specific Knowledge Grade			
CSF	0.244***	0.259***	0.321***	0.319***
	(0.0351)	(0.016)	(0.0115)	(0.0116)
	Panel C: General Education Grade			
CSF	0.246***	0.257***	0.274***	0.273***
	(0.0237)	(0.0152)	(0.0109)	(0.0109)
Treated Observations	9,992	9,988	9,988	9,989
Untreated Observations	1,189,769	373,506	373,506	373,506

Data: National Examination of Student Performance (Enade) 2013, 2014, 2015 and 2016. Microdata.
Notes: Grades were standardized at Course-Year levels; Propensity score matching average treatment effects on the treated using nearest neighbor matching with caliper 0.05, kernel matching with an Epanechnikov kernel function, bandwidth 0.06, and radius matching with caliper 0.05 calculated using PSMATCH2 package for Stata by LEUVEN; SIANESI (2003) Version 4.0.11; Only observations on common support are used; Controls: CourseXUniversities, Year, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Standard errors in parentheses; OLS has stardard error clustered at Course level; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

The CSF has estimated effects on the specific knowledge grade of 0.259 (nearest neighbor), 0.321 (Radius) and 0.319 (Kernel) SDs, all highly significant. For the general education grade, the ATETs effects are 0.257 (nearest neighbor), 0.274 (Radius) and 0.273 (Kernel) SDs.

All PSM strategies show even larger CSF coefficients in comparison to the OLS coefficient of studying abroad with the full specification on Column 1 (Table 6.7). As explained in Section 5, many of the students from my sample cannot have their propensity scores estimated since many of them come from courses and universities without Science without Borders, in other words, "perfect failure": outcome does not vary at some levels of the independent variables. Table 6.7 shows that the OLS regression uses 1,189,769 control observations, while the NN regression uses only 373,506 control observations. The loss of almost 1/3 of the control sample explain partially why the estimated effect of the nearest neighbor regression is higher than the OLS result.

Figure 6.1 and Figure 6.2 present the propensity score distribution of students in both groups by their propensity score before and after nearest neighbor matching. Table 6.8 shows the summary statistics of socioeconomic backgrounds for the treatment group and control group, after the nearest neighbor matching.

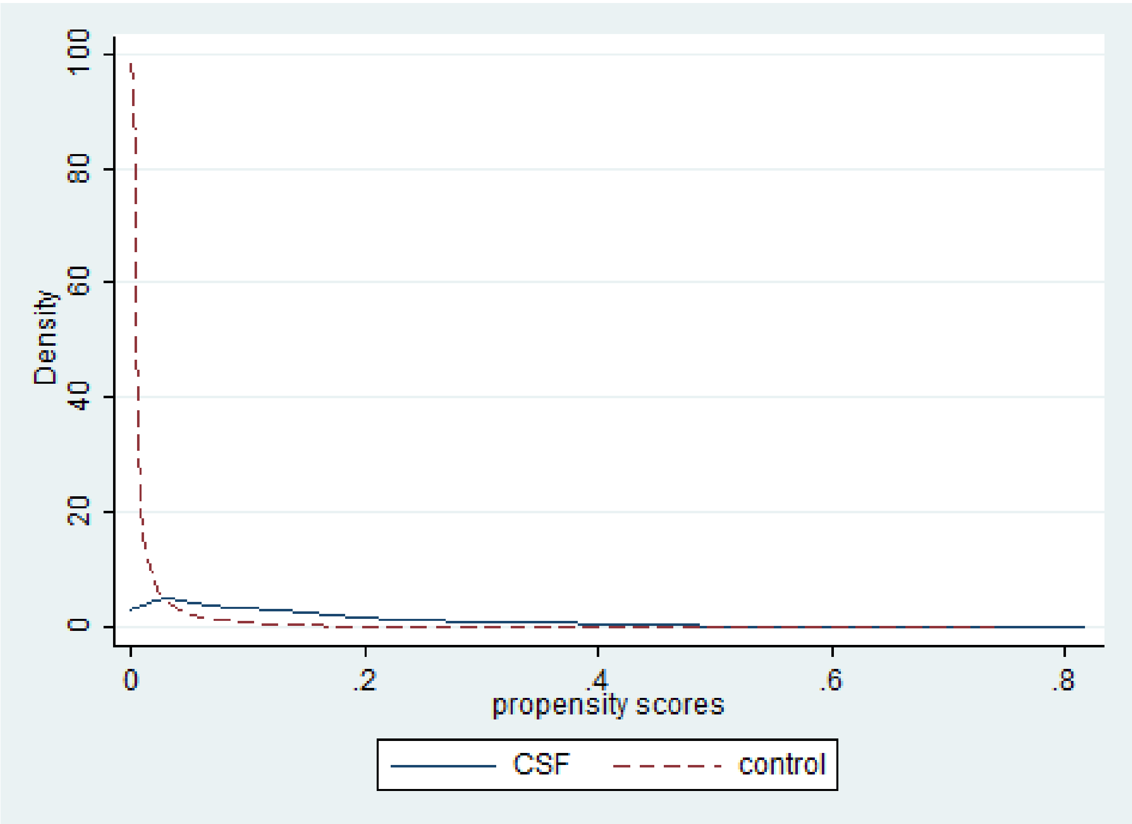

Figure 6.1: Before Matching

Figure 6.2 show that the PSM was able to generate a better distribution

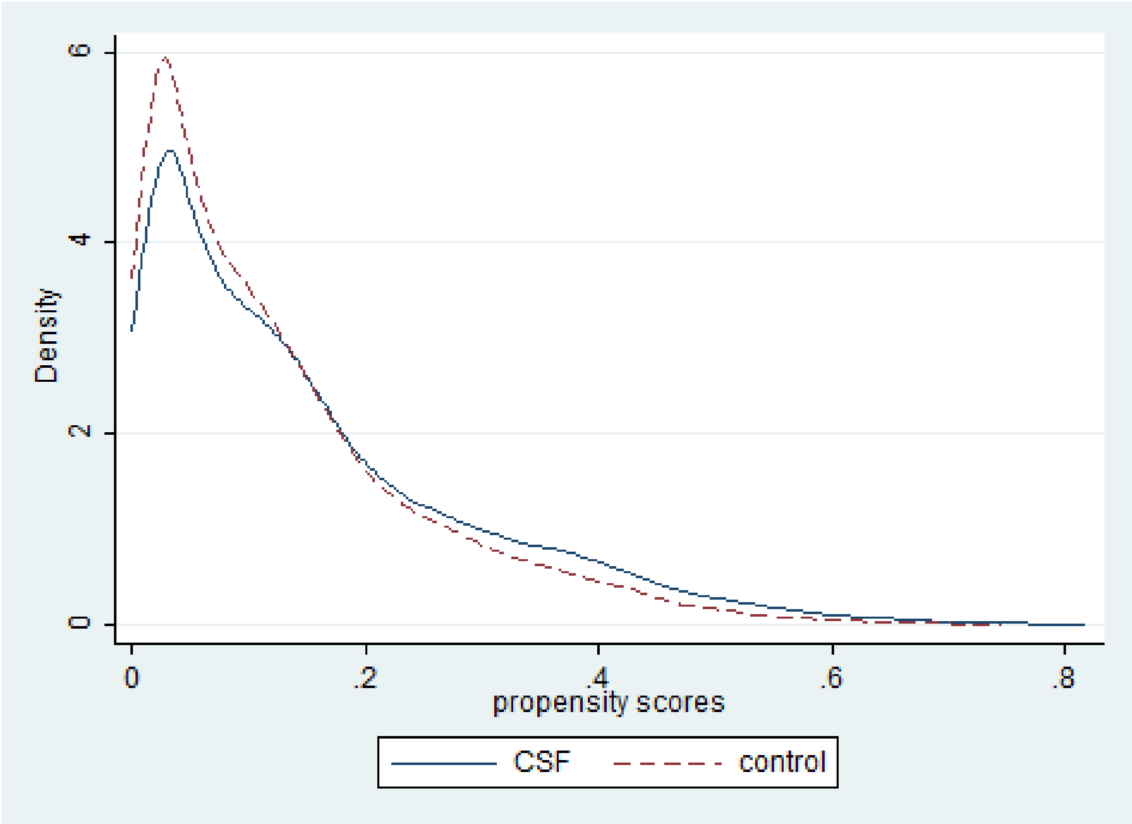

Figure 6.2: After Nearest Neighbour Matching

of propensity scores for the control and treatment groups in comparison to before matching (Figure 6.1), although the control group remains with higher proportion of smaller propensity score students. Table 6.8 shows that not only the distribution of propensity are similar but also the the characteristics of the matched control individuals are also very similar to the treatment group, however, the statistics still show that the matching was not perfect. There are still statistically significant differences between the control and treatment group as shown by the $p - value$ column, including: CSF students remain younger, having a higher proportion of members in public universities and higher proportion of students from better socioeconomic background (including Family Background and Parents Education).

Table 6.8: Nearest Neighbor Matching - Summary Statistics (2013 - 2016)

	Total N = 18,609	**CSF = 1 N = 9,988**	**CSF = 0 N = 8,621**	**Difference**	**p-value**
Race					
White	0.66	0.67	0.66	0.01	0.18
Black	0.05	0.05	0.05	-0.01	0.09
Mixed Race	0.17	0.17	0.18	-0.01	0.34
Yellow	0.09	0.09	0.09	0.00	0.81
Indigenous	0.00	0.00	0.00	0.00	0.49
Father Education					
none	0.02	0.02	0.02	-0.00	0.19
sec school (age 6 to 11)	0.11	0.10	0.11	-0.01	0.01
sec school (age 12 to 14)	0.09	0.09	0.09	-0.01	0.22
high school	0.30	0.30	0.30	-0.01	0.35
graduation	0.32	0.32	0.31	0.01	0.05
postgraduation	0.17	0.17	0.16	0.01	0.02
Mother Education					
none	0.01	0.01	0.02	-0.00	0.02
sec school (age 6 to 11)	0.08	0.07	0.09	-0.01	0.01
sec school (age 12 to 14)	0.07	0.07	0.07	0.00	0.89
high school	0.29	0.29	0.29	-0.01	0.42
graduation	0.34	0.34	0.33	0.01	0.17
postgraduation	0.21	0.21	0.20	0.01	0.09
Family Income					
1,5 MW	0.08	0.07	0.08	-0.01	0.00
1,5 - 3 MW	0.15	0.14	0.15	-0.01	0.03
3 - 4,5 MW	0.14	0.14	0.14	-0.00	0.37
4,5 - 6 MW	0.14	0.14	0.14	0.00	0.81
6 - 10 MW	0.21	0.21	0.20	0.01	0.14
10 - 30 MW	0.24	0.24	0.23	0.01	0.07
30 or more MW	0.05	0.05	0.05	0.01	0.04
Quotas					
No quota	0.83	0.83	0.83	0.00	0.69
Racial	0.02	0.02	0.02	-0.00	0.07
Income	0.03	0.03	0.02	0.00	0.15
Public School	0.09	0.09	0.09	-0.00	0.92
2 or more previous criterions	0.03	0.03	0.03	-0.00	0.75
Other criterions	0.01	0.01	0.01	-0.00	0.78
Other Controls					
Age	24.97	24.86	25.11	-0.26	0.00
Female	0.52	0.51	0.52	-0.01	0.06
Public University	0.75	0.76	0.74	0.02	0.00

Data: National Examination of Student Performance (Enade) 2013, 2014, 2015 and 2016. Microdata.

The findings show evidence of the average positive effect on Enade's grades from studying abroad through the Science without Borders program. One main strand of interpretation can be thought of, concerning the channels through which the CSF affects the grades: the objective of the program was to send students to the best foreign universities and research institutions, as explained in Section 2. Spending part of tertiary education at foreign universities of academic excellence potentially allows students to be confronted by different styles of teaching, learning and studying, complementing their education in Brazil.

However, the analysis of distribution of propensity scores for the control and treatment groups after matching (Figure 6.2) and the comparison of control variables after matching between CSF and other students (Table 6.8) suggest that the matching technique was not capable of creating an ideal untreated counterpart for the treatment group. In other words, the propensity score matching is not guaranteed to have taken the the self-selection problem into account.

6.2.1 Sensitivity to Unobservable Characteristics

As discussed in Section 5, the estimated effects may be biased if there are unobserved factors that affect both treatment and outcome variable. Following the bounding approach of ROSENBAUM (2002), I test my results sensitivity to unobserved heterogeneity by analyzing how much an omitted variable could cause two students with the same pre-treatment characteristics to differ in their probabilities of studying abroad without changing the estimated effects.

Sensitivity analysis using the nearest neighbour results for the general grade, specific knowledge grade and general education grade can be found in Table 6.9. Variable Γ values give the differences in the odds of treatment assignment for students with the same pre-treatment characteristics that can occur due to unobserved variables.

Table 6.9: Rosembaum Bounds Sensitivity Analysis - Enade's Grades - Nearest Neighbor (2013-2016)

	Upper Bound Significance Level		
Γ	General Grade	Specific Knowledge	General Education
1	0	0	0
1.05	0	0	0
1.1	0	0	0
1.15	0	0	0
1.2	0	0	0
1.25	0	0	0
1.3	0	<0.00001	<0.00001
1.35	0	<0.00001	<0.00001
1.4	<0.00001	0.000025	<0.00001
1.45	<0.00001	0.005008	0.00151
1.5	0.000017	0.126854	0.062623
1.55	0.002811	0.596821	0.441197
1.6	0.075329	0.943821	0.883609

Data: National Examination of Student Performance (Enade) 2013, 2014, 2015 and 2016. Microdata.
Data: Γ are the odds of differential assignment due to unobserved factors for the nearest neighbor method;
Upper Bound Significance Level calculated using the rbounds Package for Stata by GANGL (2004), Version 1.1.6.

I find a positive and significant CSF effect when assuming there is no hidden bias ($\Gamma = 1$) for the three outcome variables. Table 6.9 shows that the effect on the general grade turns insignificant at critical value between 1.55 and 1.6. This result means that an unobserved variable could cause a difference in the probability of becoming a CSF exchange student for two individuals with the same pre-treatment observable characteristics of more than 55% without changing the nearest neighbor ATET result. The effects on the specific knowledge and general education grade turns insignificant at a critical value between 1.45 and 1.5.

Although it is impossible to guarantee that there are not unobserved variables that affect both studying abroad through the CSF and success at Enade, the sensitivity analysis results indicate that the PSM estimations are robust to unobserved heterogeneity.

6.3 Score Distribution: UQR Results

Turning to the results from the quantile regressions in Table 6.10, it becomes apparent that the mean regressions are hiding large differences in the grade effects of studying abroad through the CSF across the distribution. Comparing the results from the 10th to the 90th percentile, I find a similar pattern for all three grades types: There is a small premium for studying abroad at the bottom of the grades distribution, which gradually turns into a large grade premium towards the top of the distribution.

Table 6.10: CSF Effect on Enade's Grades - UQR Results (2013 - 2016)

	Quantile 10 (1)	Quantile 25 (2)	Quantile 50 (3)	Quantile 75 (4)	Quantile 90 (5)
			Panel A: General Grade		
CSF	0.0366***	0.0989***	0.237***	0.440***	0.632***
	(0.0124)	(0.0105)	(0.0134)	(0.0198)	(0.0321)
R^2	0.0443	0.0693	0.0832	0.0801	0.0726
			Panel B: Specific Knowledge Grade		
CSF	0.0398***	0.0904***	0.197***	0.371***	0.530***
	(0.0119)	(0.0106)	(0.0138)	(0.0193)	(0.0319)
R^2	0.0428	0.0590	0.0712	0.0728	0.0645
			Panel C: General Education Grade		
CSF	0.119***	0.170***	0.254***	0.320***	0.363***
	(0.0159)	(0.0136)	(0.0130)	(0.0169)	(0.0222)
R^2	0.0261	0.0555	0.0900	0.0778	0.0363
Observations	1,189,769	1,189,769	1,189,769	1,189,769	1,189,769

Data: National Examination of Student Performance (Enade) 2013, 2014, 2015 and 2016. Microdata.
Notes: Grades were standardized at Course-Year levels; Unconditional Quantile Regressions calculated using XTRIFREG package for Stata by BORGEN (2016) Version 1.0; Controls: CourseXUniversities (16,471 dummies), Year, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Cluster–robust standard errors in parentheses; *** $p < 0.01$, **$p < 0.05$, * $p < 0.1$

The OLS coefficient of studying abroad with the full specification on Table 6.1 (Panel A, Column 8) showed an increase of 0.281 SDs on the general grade. Table 6.10 shows that the general grade first increases from 0.0366 SDs at the 10th quantile (Panel A, Column 1) to 0.237 at the median (Panel A, Column 3). In other words, the mean effect is larger than the median effect. The effect more than doubles at the 90th quantile to 0.632 SDs (Panel A, Column 5). When looking at the specific knowledge grade (Panel B), it first increases from 0.0398 SDs at the 10th quantile (Column 1) to 0.197 at the median (Column 3). The effect more than double at the 90th quantile to 0.530 SDs (Column 5). The general education grade (Panel C) first increases from 0.119 SDs at the 10th quantile (Column 1) to 0.254 at the median (Column 3). The effect increases at the 90th quantile to 0.363 SDs (Column 5). All the coefficients presented are statistically significant.

I also run unconditional quantile regressions using the "2009-2016" and "2007-2016" samples as robustness checks. Table B11 and Table B12 shows the estimated effects of the CSF program on Enade's grades using the "2009-2016" sample, where Panel A has effects on the "General Grade", Panel B has the effect on the "Specific Knowledge Grade" and Panel C has the effect on the "General Education Grade". As can be seen, the coefficients maintain a similar trajectory as Table 6.10 across percentiles.

The results have highlighted that a focus on the mean grades disguises important inequalities. The unconditional quantile regressions show that students on the bottom of the scores distributions are much less benefited by the Science without Borders than the those on the top of the distribution. Supposing that there are not unobserved heterogeneity, one main strand of interpretation can be thought of: worst students (students with smaller grades) do not have the same level of academic and social skills, compared to more successful students, necessary to live abroad and absorb all the potential new knowledge that foreign universities have to offer.

6.4 Aggregating: Dif-in-Dif Results

Previous results show that the Science without Borders have a positive impact on the standardized students grades in general. However, students are selected according to their grades, leading to a possible omitted variable bias in the results so far. As explained in Subsection 5.4, I carry out another experiment, using panel data, whose unit of identification is not the students but the courses from each university, where the dependent variable is the average grade in Enade and the treatment variable is the percentage of students going abroad through the program.

Table 6.11 uses the "2007-2016" sample, with an unbalanced dataset of 6,843 course/universities. It can also be seen as a combination of 3 balanced datasets of: 1,255 course/universities appearing in the years 2007,2010, 2013 and 2016; 2,479 course/universities appearing in the years 2008, 2011 and 2014; 3,109 course/universities appearing in the years of 2009, 2012 and 2015. Table 6.11 shows the estimated effects of the CSF program on the average Enade's standardized grades, where Panel A has effects on the "General Grade", Panel B has the effect on the "Specific Knowledge Grade" and Panel C has the effect on the "General Education Grade".

Beginning the analysis with Panel A (Table 6.11), the first specification, column (1), has no controls and shows a positive and significant effect on the general grade of 3.359 standard deviations (SDs). Column (2) introduces controls for the 54 courses evaluated, increasing the coefficient to 3.463 standard deviations and remains highly significant. Column (3), on the other hand, has "Universities" controls, controlling for each of the 1,396 institutions. As can be seen, the coefficient falls to 0.128 SDs and becomes statistically insignificant, meaning that there is a huge positive correlation between the quality of universities and the percentage of students that goes abroad, eliminating the effects on the general grade. Column (4) shows the results when controlling for the interaction between "Courses" and "Universities", meaning that there are 6,843 control dummies for each course from each tertiary institution. The coefficient falls to 0.0976 standard deviations, statistically insignificant. When including time dummies ("Year"), the CSF effect falls to 0.0231. Columns (6) introduces the "Individual Characteristics" control variables,

Table 6.11: CSF Effects on Enade's Grades - DID-in-DIF Results (2007 - 2016)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A: General Grade						
CSF(%)	3.359***	3.463***	0.128	0.0976	0.0231	0.0728	-0.126
	(0.358)	(0.375)	(0.322)	(0.201)	(0.222)	(0.196)	(0.183)
R^2	0.032	0.042	0.532	0.790	0.791	0.797	0.801
	Panel B: Specific Knowledge Grade						
CSF(%)	3.228***	3.311***	-0.0481	-0.0985	-0.150	-0.106	-0.292
	(0.345)	(0.364)	(0.318)	(0.222)	(0.241)	(0.216)	(0.205)
R^2	0.031	0.042	0.542	0.801	0.802	0.808	0.813
	Panel C: General Education Grade						
CSF(%)	2.167***	2.287***	0.470*	0.631***	0.524***	0.563***	0.415***
	(0.268)	(0.271)	(0.251)	(0.121)	(0.132)	(0.125)	(0.110)
R^2	0.025	0.030	0.374	0.640	0.641	0.646	0.650
Courses	No	Yes	No	No	No	No	No
Universities	No	No	Yes	No	No	No	No
Courses X Universities	No	No	No	Yes	Yes	Yes	Yes
Year	No	No	No	No	Yes	Yes	Yes
Individual Characteristics	No	No	No	No	No	Yes	Yes
Family Background	No	No	No	No	No	No	Yes
Observations	21,784	21,784	21,784	21,784	21,784	21,784	21,784

Data: National Examination of Student Performance (Enade) 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016. Micro-data.
Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year; Weighted Least Squares is used for weighting by the number of individuals at each course/university at each given year; Family Background controls include: Family Income, Father Education and Mother Education; Individual Characteristics controls include: Race, Female, Age and Age squared; Standard errors in parentheses; clustered at Course level; *** p < 0.01, **p < 0.05, * p < 0.1

making the coefficient increase to 0.0728 but still statistically insignificant. Column (7) has addition of the "Family Background" controls, turning the CSF coefficient negative (-0.126 SDs), in other words, if 100% of students from a course/university participate in the program, the average standardized grade of a course/university would decrease -0.126 SDs. However the coefficient is statistically insignificant.

Column (1) in Panel B (Table 6.11) has no controls and shows a positive and significant effect on the specific knowledge grade of 3.228 standard deviations (SDs). Column (2) introduces controls for the 54 courses evaluated, increasing the coefficient to 3.311 standard deviations and remains highly significant. Column (3), on the other hand, has "Universities" controls, controlling for each of the 1396 institutions. As can be seen, the coefficient falls to -0.0481 SDs and becomes statistically insignificant, eliminating the effects on the specific knowledge grade. The coefficient remains negative and statistically insignificant across the following specifications. Column (7) shows a CSF coefficient of -0.292 SDs.

Column (1) in Panel C (Table 6.11) has no controls and shows a positive and significant effect on the specific knowledge grade of 2.167 standard deviations (SDs). Column (2) introduces controls for the 54 courses evaluated, increasing the coefficient to 2.287 standard deviations and remains highly significant. Column (3), on the other hand, has "Universities" controls, controlling for each of the 1396 institutions. As can be seen, the coefficient falls to -0.47 SDs and becomes statistically significant at 10%. Column (4) shows the results when controlling for the interaction between "Courses" and "Universities", meaning that there are 6,843 control dummies for each course from each tertiary institution. The coefficient increases to 0.631 standard deviations, and becomes statistically significant at 1%. The coefficient remains positive and statistically significant across the following specifications. Column (7) shows a CSF coefficient of 0.415 SDs.

In order to have another robustness check, I eliminate the year of 2016 from the sample, meaning that all course/universities are evaluated only three years and more courses/universities are included in the sample. Table 6.12 uses the "2007-2016" sample, eliminating the year of 2016, with an unbalanced dataset of 6,939 course/universities. It can also be seen as a combination 3 balanced datasets of: 1,351 course/universities appearing in the years 2007,2010 and 2013; 2,479 course/universities appearing in the years 2008, 2011 and 2014; 3,109 course/universities appearing in the years of 2009, 2012 and 2015. Table 6.12 shows the estimated effects of the CSF program on the average Enade's standardized grades, where Panel A has effects on the General Grade, Panel B has the effect on the "Specific Knowledge Grade" and Panel C has the effect on the "General Education Grade".

Table 6.12: CSF Effects on Enade's Grades - DID-in-DIF Results (2007 - 2015)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Panel A: General Grade						
CSF(%)	3.305***	3.512***	0.312	0.272	0.331*	0.309*	0.0610
	(0.399)	(0.416)	(0.292)	(0.203)	(0.171)	(0.163)	(0.167)
R^2	0.023	0.028	0.534	0.792	0.792	0.799	0.804
	Panel B: Specific Knowledge Grade						
CSF(%)	3.301***	3.488***	0.253	0.146	0.210	0.183	-0.0492
	(0.403)	(0.423)	(0.281)	(0.227)	(0.188)	(0.178)	(0.181)
R^2	0.023	0.029	0.547	0.804	0.805	0.812	0.816
	Panel C: General Education Grade						
CSF(%)	1.791***	1.966***	0.259	0.546***	0.578***	0.575***	0.388***
	(0.217)	(0.218)	(0.241)	(0.127)	(0.126)	(0.132)	(0.126)
R^2	0.012	0.015	0.367	0.639	0.639	0.645	0.650
Courses	No	Yes	No	No	No	No	No
Universities	No	No	Yes	No	No	No	No
Courses X Universities	No	No	No	Yes	Yes	Yes	Yes
Year	No	No	No	No	Yes	Yes	Yes
Individual Characteristics	No	No	No	No	No	Yes	Yes
Family Background	No	No	No	No	No	No	Yes
Observations	20,817	20,817	20,817	20,817	20,817	20,817	20,817

Data: National Examination of Student Performance (Enade) 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014 and 2015. Microdata. Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year; Weighted Least Squares is used for weighting by the number of individuals at each course/university at each given year; Family Background controls include: Family Income, Father Education and Mother Education; Individual Characteristics controls include: Race, Female, Age and Age squared; Standard errors in parentheses; clustered at Course level; *** $p < 0.01$, **$p < 0.05$, * $p < 0.1$

Beginning the analysis with Panel A (Table 6.11), the first specification, column (1), has no controls and shows a positive and significant effect on the general grade of 3.305 standard deviations (SDs). Column (2) introduces controls for the 54 courses evaluated, increasing the coefficient to 3.512 standard deviations and remains highly significant. Column (3), on the other hand, has "Universities" controls, controlling for each of the 1,412 institutions. As can be seen, the coefficient falls to 0.312 SDs and becomes statistically insignificant, meaning that there is a huge positive correlation between the quality of universities and the percentage of students that goes abroad, eliminating the effects on the general grade. Column (4) shows the results when controlling for the interaction between "Courses" and "Universities", meaning that there are 6,939 control dummies for each course from each tertiary institution. The coefficient falls to 0.272 standard deviations, statistically insignificant. When including time dummies ("Year"), the CSF effect increases to 0.331, becoming significant at 10%. Columns (6) introduces the "Individual Characteristics" control variables, making the coefficient fall to 0.309 but still statistically significant at 10%. Column (7) has addition of the "Family Background" controls, decreasing the coefficient to -0.0610 SDs), in other words, if 100% of students from a course/university participate in the program, the average standardized grade of a course/univerisity would increase -0.0610 SDs. However the coefficient is statistically insignificant.

Column (1) in Panel B (Table 6.12) has no controls and shows a positive and significant effect on the specific knowledge grade of 3.301 standard deviations (SDs). Column (2) introduces controls for the 54 courses evaluated, increasing the coefficient to 3.488 standard deviations and remains highly significant. Column (3), on the other hand, has "Universities" controls, controlling for each of the 1,412 institutions. As can be seen, the coefficient falls to 0.253 SDs and becomes statistically insignificant, eliminating the effects on the specific knowledge grade. The coefficient remains positive and statistically insignificant across the following specifications. Column (7) shows a CSF coefficient of -0.092 SDs and statistically insignificant.

Column (1) in Panel C (Table 6.12) has no controls and shows a positive and significant effect on the specific knowledge grade of 1.791 standard deviations (SDs). Column (2) introduces controls for the 54 courses evaluated, increasing the coefficient to 1.966 standard deviations and remains highly significant. Column (3), on the other hand, has "Universities" controls, controlling for each of the 1,412 institutions. As can be seen, the coefficient falls to 0.259 SDs and becomes statistically insignificant. Column (4) shows the results when controlling for the interaction between "Courses" and "Universities", meaning that there are 6,939 control dummies for each course from each tertiary institution. The coefficient increases to 0.546 standard deviations, and becomes statistically significant at 1%. The coefficient remains positive and statistically significant across the following specifications. Column (7) shows a CSF coefficient of 0.388 SDs.

Both Tables 6.11 and 6.12 have similar patterns. The effects on the "General Grade" and "Specific Knowledge Grade" are null (statistically insignificant). However the effect of the program on the "General Education Grade" remains statistically significant even after the inclusion of all controls. This result is interesting since it would mean that the Science without Borders is not increasing students knowledge in their specific areas of study (which was the main objective of the program) but is increasing the knowledge and competences to understand themes outside the specific scope of the chosen profession, linked to the Brazilian and world reality and other areas of knowledge.

6.4.1 Exogenous Supply Variation: IV Results

Following the IV approach, Table B13 shows which courses are part of priority areas (1) and which are not (0).

Table 6.13 shows 2SLS results along with the CSF coefficients of column (7) from OLS regressions of Table 6.11 for the three grades. Panel B shows that the instrumental variable *priority* is positively correlated and statistically significant at the 1% level with the treatment variable $CSF(\%)$ and the F-statistic suggests that there is not a weak instrument. A rule of thumb put forward by BOUND; JAEGER; BAKER (1995) and STAIGER; STOCK (1997) is that the F-statistic should be larger than 10, or at least larger than 5.

Column (1) of Panel A (Table 6.13) shows the OLS regression: if 100% of students from a course/university participate in the program, the average standardized general grade of a course/university would decrease -0.126 SDs. Column (2) shows the IV result, with a negative coefficient of -1.446 and statistically significant at the 10% level. Column (4) shows the IV result for the effect of the percentage of

Table 6.13: CSF Effects on Enade's Grades - DID-in-DIF with IV Results (2007 - 2016)

	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
	General Grade		Specific Knowledge		General Education	
Panel A: Ordinary Least Squares and Two Stage Least Squares						
CSF(%)	-0.126	-1.446*	-0.292	-1.480*	0.415***	-0.554
	(0.183)	(0.772)	(0.205)	(0.799)	(0.110)	(0.407)
R^2	0.801	0.799	0.813	0.811	0.650	0.648
Panel B: First Stage Least Squares						
priority	-	0.0234***	-	0.0234***	-	0.0234***
	-	(0.00542)	-	(0.00542)	-	(0.00542)
R^2	-	0.555	-	0.555	-	0.555
F-statistic	-	18.69	-	18.69	-	18.69
Observations	21,784	21,784	21,784	21,784	21,784	21,784

Data: National Examination of Student Performance (Enade) 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016. Micro-data.
Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year; Weighted Least Squares is used for weighting by the number of individuals at each course/university at each given year; Controls: CourseXUniversities, Year, Family Income, Father Education, Mother Education, Race, Female, Age and Age squared; Standard errors in parentheses; clustered at Course level; *** $p < 0.01$, **$p < 0.05$, * $p < 0.1$

students on the "Specific Knowledge Grade": -1.480 SDs and statistically significant at the 10% level. Column (6) shows the IV result for the effect of the percentage of student on the "General Education Grade": -0.554 SDs and statistically insignificant.

As made previously, I eliminate the year of 2016 from the sample, meaning that all course/universities are evaluated only three years and more courses/universities are included in the sample. Table 6.14 shows 2SLS results along with the CSF coefficients of column (7) from OLS regressions of Table 6.12 for the three grades. Panel B shows that that the instrumental variable *priority* is positively correlated and statistically significant at the 1% level with the treatment variable $CSF(\%)$ and the F-statistic suggests that there is not a weak instrument.

Column (1) of Panel A (Table 6.14) shows the OLS regression: if 100% of

Table 6.14: CSF Effects on Enade's Grades - DID-in-DIF with IV Results (2007 - 2015)

	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	IV	OLS	IV	OLS	IV
	General Grade		Specific Knowledge		General Education	
Panel A: Ordinary Least Squares and Two Stage Least Squares						
CSF(%)	0.0610	-1.578*	-0.0492	-1.625*	0.388***	-0.530
	(0.167)	(0.822)	(0.181)	(0.870)	(0.126)	(0.400)
R^2	0.804	0.801	0.816	0.814	0.650	0.648
Panel B: First Stage Least Squares						
priority	-	0.0213***	-	0.0213***	-	0.0213***
	-	(0.00609)	-	(0.00609)	-	(0.00609)
R^2	-	0.535	-	0.535	-	0.535
F-statistic	-	12.20	-	12.20	-	12.20
Observations	20,817	20,817	20,817	20,817	20,817	20,817

Data: National Examination of Student Performance (Enade) 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014 and 2015. Microdata. Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year; Weighted Least Squares is used for weighting by the number of individuals at each course/university at each given year; Controls: CourseXUniversities, Year, Family Income, Father Education, Mother Education, Race, Female, Age and Age squared; Standard errors in parentheses; clustered at Course level; *** p < 0.01, **p < 0.05, * p < 0.1

students from a course/university participate in the program, the average standardized general grade of a course/university would increase 0.0610 SDs. Column (2) shows the IV result, with a negative coefficient of -1.578 and statistically significant at the 10% level. Column (4) shows the IV result for the effect of the percentage of students on the "Specific Knowledge Grade": -1.625 SDs and statistically significant at the 10% level. Column (6) shows the IV result for the effect of the percentage of student on the "General Education Grade": -0.30 SDs and statistically insignificant.

The magnitudes of the effects on grades are larger than its OLS counterparts, which seems to be in line to the literature on schooling returns. Instrumental variables estimates on the return of schooling typically exceed the corresponding OLS estimates (CARD, 2001). Another interesting fact is that the coefficients for the general grade and specific knowledge grade are negative and statistically significant at the 10%, while the IV estimate for the general education grade is negative and statistically insignificant. The results indicate that percentage of students going abroad through the Science without Borders has no strong statistically significant effect on the average grade of a course/university.

7 CONCLUSION

This work empirically investigates the academic gains from studying abroad through the Science without Borders, a large scale nationwide scholarship program funded by the Brazilian government. It also adds to a new and growing literature in economics that seeks to better understand the gains to expect from a temporary study-related visit to a foreign university.

Using a rich dataset from the Brazilian National Student Performance Exam (Enade), I apply a series of econometric strategies in order to estimate the effects of the program on Enade's grades. My dataset is composed of ten editions of Enade from before the creation of the CSF program (2007, 2008, 2009, 2010, 2011 and 2012) and four editions from after the creation of the Science without Borders (2013, 2014, 2015 and 2016).

Summary statistics show that undergraduate students who go abroad during their university studies through the CSF program have on average higher grades than other students. In addition, the socioeconomic characteristics of both groups are quite distinct: CSF students are usually richer and have parents with higher levels of formal education.

In order to correct the endogeneity problem, OLS regressions with fixed effects of thousands undergraduates courses of Brazilian universities are used, along with socioeconomic controls, leading to positive, statistically significant and stable CSF coefficients effects. The full specification coefficients found for Enade' general grade, specific knowledge grade and general education grade indicate that there is an increase in standard deviation points of 0.281, 0.244 and 0.246, respectively, when using only Enade's editions from after the program's creation. The coefficients remain positive and statistically significant when using all editions: 0.287 (general grade), 0.245 (specific knowledge) and 0.265 (general education).

The PSM strategy is used with the objective of correcting the self-selection bias into studying abroad, using the same control variables from the OLS regressions when estimating the propensity scores. The empirical analysis using only Enade's editions from after the program's creation shows that the CSF improves students general grade between 0.297 and 0.354 standard deviation points. The effect on the specific knowledge grade is between 0.259 and 0.321 standard deviation points while the effect on general education grade is between 0.257 and 0.274 standard deviation points. All coefficients statistically significance. I test the results sensitivity to unobserved heterogeneity by following the bounding approach of ROSENBAUM (2002). The results show that an unobserved variable could cause a difference in the probability of becoming a CSF exchange student for two individuals with the same pre-treatment characteristics of more than 55% without changing the PSM estimates for the effects on the general grade. However, the analysis of distribution of propensity scores for the control and treatment groups after matching and the comparison of control variables after matching between CSF and other students suggest that the matching technique was not capable of creating an ideal untreated counterpart for the treatment group. In other words, the propensity score matching is not guaranteed to have taken the the self-selection problem into account.

Students who studied abroad through a CSF scholarship have better performances than other students not only on the specific knowledge test but also on the general education test. This can be explained by the fact that the CSF program sought to send students to the top foreign universities. Spending part of tertiary education at foreign universities of academic excellence potentially allows students to be confronted by different styles of teaching, learning and studying, complementing their education in Brazil.

However, the effects are heterogeneous when running OLS regression across different areas of knowledge. The STEM, health and biological fields seem to be positively affected in general by program, although the program's effect on Medicine is not statistically significant. The social and humanities sciences appear not be affected by the program or negatively affected depending on course. It is possible that students from the last fields of study did not have access to the best foreign universities of their respective fields, in other words, some of the partnerships established by the government with foreign universities might have been worse than others, which may partially help explain the results. Moreover, quantile regressions show that the mean regressions are hiding large differences in the grade effects of studying abroad across the distribution. The results show small premiums of studying abroad at the bottom of the distribution and larger grade effects towards the top distribution. One interpretation is that students within the lower grade distribution do not have the necessary level of academic and social skills necessary to live abroad and absorb the potential knowledge that foreign universities have to offer.

The results found on OLS, PSM and UQL regressions are likely to be biased, since students are selected according to their grades and students need to apply for the program before being selected. Positive results might be correlated to the selection of better and more motivated students. While negative results might be correlated with worst and less motivated students being granted scholarships.

A panel data strategy would eliminate unobserved individual heterogeneity constant across time, unfortunately the Enade dataset is a repeated cross-section data at the students level. For that reason, I aggregate the data at the course/university level, in order to follow a differences-in-differences strategy and estimate the effect of the percentage of students that went abroad through the CSF on the average grade of the course/university. Since the proportion of skilled and motivated students are likely to not be constant across time, the inclusion of fixed effects does not ensure that the estimates are unbiased. For that reason, I complement my DID approach with an instrumental variable strategy, using a dummy variable identifying courses that are part of priority areas of the program, exploiting a cross-course variation in a course/university exposure to the CSF.

The DID full specification coefficients found for Enade's general grade and specific knowledge grade are -0.126 and -0.292 standard deviation points, both negative and statistically insignificant. The general education grade effect coefficient remained positive and significant: 0.451. This result would indicate that the CSF is not increasing students specific areas of study knowledge (which was the main objective of the program) but is increasing the knowledge and competences to understand themes linked to the Brazilian and world reality and other areas of knowledge. However, the IV strategy, shown to have a strong instrument, turns the CSF effect on the general education grade negative and statistically insignificant (-0.554 SDs), while the coefficients for the general grade and specific knowledge grade remain negative and become significant (p-value < 0.1): -1.446 and -1.480, respectively.

While the analysis at the student level data indicates that the program had an average positive impact on students grades, the estimated coefficients are likely to still be biased by unobserved heterogeneity. The general conclusion of this work, based on the data available and evidence found, is that the Science without Borders effect on the academic performance of students was null for the general knowledge test and negative for the specific knowledge test. Does this mean that the Science without Borders and other exchange semesters are not worthwhile? No, because students also derive other benefits that have not been examined in this study. It is well possible that student mobility increases the awareness of cultural differences and other things and that these effects generate a private and social return not covered by the present analysis.

Future evaluations are needed for a definitive answer on the real effects of the CSF and exchange programs in general. Firstly, one way of expanding the present analysis would be by finding a new covariate that would be a proxy to the students academic qualification prior to studying abroad. This covariate would likely remove most of the omitted bias present in this study. Secondly, future evaluations should focus not only on students grades, but students employment outcomes. Thirdly, the average cost for sending an undergraduate student abroad is very high. Each scholarship had a cost five times the public spending on undergraduate students of public universities on average. From the public policies subject point-of-view, is it more efficient to spend on national universities infrastructures and qualification of teachers than subsidize a select group of students to study one or two semesters abroad? Should students pay for their studies when coming from richer backgrounds? Would society benefit more by sending abroad only graduate students? I highlight the importance of new researches on the cost-effectiveness of the Science without Borders and international mobility programs in general.

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APPENDIX A

Table A1: Summary Statistics - Specific Knowledge Grades Comparison (2013)

Course	**Grade**^{total}	**Grade**^{tr}	**Grade**^{nt}	**Difference**	**p-value**	**Obs.**^{tr}	**Obs.**^{nt}
Agribusiness	50.62	47.57	50.63	-3.06	0.71	3	1,396
Agronomy	55.28	64.89	55.18	9.71	0.00	82	7,330
Biomedicine	47.30	55.84	47.22	8.63	0.00	52	5,190
Dentistry	46.19	48.48	46.18	2.30	0.23	57	9,497
Environmental Management	34.86	35.03	34.86	0.18	0.96	15	6,762
Hospital Management	35.44	39.10	35.43	3.67	0.69	2	1,582
Medicine	45.26	44.97	45.26	-0.29	0.88	59	15,104
Nursing	53.76	53.48	53.76	-0.28	0.85	106	24,344
Nutrition	42.67	50.39	42.64	7.75	0.00	37	10,300
Pharmacy	40.18	51.11	40.08	11.03	0.00	111	12,054
Physical Education	51.95	51.60	51.96	-0.36	0.90	33	13,331
Physiotherapy	49.55	58.04	49.53	8.51	0.00	33	10,589
Radiology	39.96	45.53	39.95	5.59	0.32	6	2,432
Social Work	35.75	35.84	35.75	0.09	0.98	24	27,772
Speech Therapy	55.56	70.52	55.51	15.01	0.01	5	1,363
Veterinary Medicine	44.69	49.50	44.66	4.84	0.01	47	6,963
Zootechnic	46.93	55.95	46.88	9.06	0.04	11	2,017

Data: National Examination of Student Performance (Enade) 2013. Microdata.

Table A2: Summary Statistics - Specific Knowledge Grades Comparison (2014)

Course	**Grade**^{total}	**Grade**^{tr}	**Grade**^{nt}	**Difference**	**p-value**	**Obs.**^{tr}	**Obs.**^{nt}
Analysis and Systems Development	35.43	46.91	35.40	11.52	0.00	38	11,022
Architecture and Urbanism	43.90	53.25	43.62	9.63	0.00	404	13,480
Biological Sciences	41.19	58.29	40.90	17.40	0.00	365	21,075
Chemical Engineering	39.97	50.71	38.81	11.90	0.00	408	3,810
Chemistry	35.92	51.27	35.60	15.67	0.00	170	8,206
Civil Engineering	41.31	55.19	41.00	14.20	0.00	468	21,030
Computer Engineering	42.79	54.92	41.60	13.32	0.00	215	2,191
Computer Networks	39.07	41.83	39.07	2.77	0.57	9	3,833
Computer Science	40.94	57.31	40.48	16.83	0.00	273	9,741
Control and Automation Eng.	37.84	54.96	36.70	18.25	0.00	222	3,328
Electrical Engineering	38.10	51.53	37.44	14.09	0.00	461	9,341
Engineering	44.51	57.92	43.37	14.55	0.00	372	4,346
Environmental Engineering	42.26	58.27	41.67	16.60	0.00	232	6,302
Food Engineering	48.40	60.64	47.66	12.98	0.00	89	1,467
Forest Engineering	45.22	55.35	44.83	10.52	0.00	68	1,751
Geography	36.71	48.18	36.67	11.51	0.00	51	12,069
History	36.73	35.98	36.73	-0.75	0.85	20	18,367
Industrial Automation	46.01	46.10	46.01	0.09	0.99	3	1,673
Industrial Production Management	46.66	49.30	46.65	2.65	0.79	2	2,198
Information system	39.34	50.52	39.25	11.27	0.00	98	13,099
Language-Portuguese	38.84	34.42	38.85	-4.42	0.18	18	13,429
Language-Portuguese and English	40.01	32.54	40.02	-7.48	0.11	11	9,810
Language-Portuguese and Spanish	34.36	28.64	34.36	-5.72	0.39	5	3,283
Mathematics	26.18	34.81	26.14	8.67	0.00	62	13,611
Mechanical Engineering	42.21	56.27	41.50	14.77	0.00	505	10,079
Music	43.50	56.93	43.47	13.47	0.02	6	2,267
Pedagogy	45.99	41.66	45.99	-4.33	0.00	121	110,821
Philosophy	38.09	49.25	38.09	11.16	0.35	2	4,635
Physical Education	42.07	38.45	42.08	-3.63	0.08	53	24,153
Physics	34.62	42.96	34.45	8.51	0.00	65	3,161
Production Engineering	40.98	57.01	40.42	16.59	0.00	505	14,535
Social Sciences	41.46	43.20	41.46	1.74	0.71	11	4,585
Visual Arts	40.32	51.95	40.29	11.66	0.01	13	4,658

Data: National Examination of Student Performance (Enade) 2014. Microdata.

Table A3: Summary Statistics - Specific Knowledge Grades Comparison (2015)

Course	**Grade**^{total}	**Grade**^{tr}	**Grade**^{nt}	**Difference**	**p-value**	**Obs.**^{tr}	**Obs.**^{nt}
Accounting Sciences	37.22	31.79	37.23	-5.43	0.00	58	54,799
Administration	37.93	35.45	37.93	-2.48	0.02	153	122,267
Advertising and Design	49.93	62.16	49.89	12.28	0.00	50	14,553
Commercial Management	49.49	45.71	49.49	-3.78	0.51	7	4,844
Design	48.27	60.35	47.20	13.14	0.00	503	5,700
Economics	36.89	33.73	36.89	-3.17	0.67	4	7,771
Executive Secretariat	49.01	73.30	48.99	24.31		1	1,417
Fashion Design	51.12	60.65	51.10	9.55	0.31	2	1,328
Financial Management	34.82	34.77	34.82	-0.06	0.99	3	5,622
Foreign Trade	46.46	58.60	46.45	12.15	0.26	2	2,043
Gastronomy	52.28	35.07	52.32	-17.25	0.00	10	4,518
Graphic Design	51.54	63.47	51.41	12.06	0.00	22	2,025
Human Resources Management	38.12	29.39	38.13	-8.75	0.00	31	27,919
Interior Design	44.84	46.93	44.84	2.10	0.71	6	2,363
Journalism	43.68	52.35	43.65	8.70	0.00	30	8,920
Law	41.19	36.32	41.19	-4.88	0.00	98	106,818
Logistics	45.93	48.64	45.93	2.71	0.55	9	10,553
Management Processes	53.99	41.14	54.01	-12.86	0.01	9	10,007
Marketing	46.30	40.60	46.31	-5.71	0.52	3	5,635
Psychology	43.93	52.09	43.92	8.17	0.00	44	24,035
Public Administration	54.43	53.87	54.43	-0.57	0.95	3	3,258
Public Management	43.49	41.53	43.49	-1.96	0.83	3	4,289
Quality Management	45.87	45.50	45.87	-0.37	0.97	2	1,887
Theology	58.33	59.13	58.32	0.80	0.93	4	3,450
Tourism	53.19	49.91	53.20	-3.28	0.60	7	3,442

Data: National Examination of Student Performance (Enade) 2015. Microdata.

Table A4: Summary Statistics - Specific Knowledge Grades Comparison (2016)

Course	**Grade**^{total}	**Grade**^{tr}	**Grade**^{nt}	**Difference**	**p-value**	**Obs.**^{tr}	**Obs.**^{nt}
Agribusiness	43.03	33.05	43.06	-10.01	0.15	4	1,401
Agronomy	60.48	67.80	60.25	7.55	0.00	334	10,785
Biomedicine	42.16	51.10	41.89	9.21	0.00	227	7,479
Dentistry	57.17	65.10	57.03	8.07	0.00	239	13,948
Environment Management	41.90	37.70	41.91	-4.21	0.59	3	4,771
Medicine	66.84	69.69	66.72	2.97	0.00	619	15,218
Nursing	41.59	48.71	41.54	7.17	0.00	229	32,390
Nutrition	50.20	64.84	50.01	14.84	0.00	163	12,481
Pharmacy	51.88	62.98	51.50	11.49	0.00	437	12,703
Physical Education	44.14	50.37	44.11	6.26	0.00	94	18,921
Physiotherapy	38.39	49.38	38.29	11.09	0.00	125	14,557
Radiology	41.76	55.12	41.67	13.46	0.00	17	2,347
Social Work	45.41	37.60	45.42	-7.83	0.01	35	26,983
Speech Therapy	53.68	58.64	53.63	5.01	0.08	20	1,812
Tech in Aest and Cosm	45.01	32.60	45.02	-12.42	0.12	3	4,130
Veterinary Medicine	50.22	58.19	49.94	8.25	0.00	300	8,434
Zootechnic	39.60	49.10	39.38	9.72	0.00	51	2,228

Data: National Examination of Student Performance (Enade) 2016. Microdata.

Table A5: Summary Statistics - General Education Grades Comparison (2013)

Course	**Grade**^{total}	**Grade**^{tr}	**Grade**^{nt}	**Difference**	**p-value**	**Obs.**^{tr}	**Obs.**^{nt}
Agribusiness	47.16	48.90	47.16	1.74	0.83	3	1,396
Agronomy	48.56	55.93	48.48	7.45	0.00	82	7,330
Biomedicine	49.73	56.83	49.66	7.17	0.00	52	5,190
Dentistry	48.52	51.33	48.51	2.82	0.15	57	9,497
Environmental Management	46.17	45.86	46.17	-0.31	0.93	15	6,762
Hospital Management	42.85	37.75	42.85	-5.10	0.59	2	1,582
Medicine	56.54	59.35	56.53	2.83	0.16	59	15,104
Nursing	44.94	47.15	44.93	2.22	0.12	106	24,344
Nutrition	45.50	53.94	45.47	8.46	0.00	37	10,300
Pharmacy	47.96	56.33	47.89	8.44	0.00	111	12,054
Physical Education	43.96	42.43	43.97	-1.53	0.54	33	13,331
Physiotherapy	45.94	50.85	45.92	4.93	0.05	33	10,589
Radiology	42.08	38.82	42.09	-3.27	0.57	6	2,432
Social Work	41.85	39.55	41.86	-2.30	0.44	24	27,772
Speech Therapy	45.64	58.14	45.60	12.54	0.07	5	1,363
Veterinary Medicine	48.25	54.61	48.21	6.41	0.00	47	6,963
Zootechnic	47.37	58.14	47.31	10.83	0.01	11	2,017

Data: National Examination of Student Performance (Enade) 2013. Microdata.

Table A6: Summary Statistics - General Education Grades Comparison (2014)

Course	Grade^{total}	Grade^{tr}	Grade^{nt}	Difference	p-value	Obs.^{tr}	Obs.^{nt}
Analysis and Systems Development	55.96	63.59	55.93	7.65	0.01	38	11,022
Architecture and Urbanism	57.61	64.36	57.41	6.95	0.00	404	13,480
Biological Sciences	57.52	69.29	57.32	11.97	0.00	365	21,075
Chemical Engineering	64.09	71.01	63.34	7.66	0.00	408	3,810
Chemistry	57.93	68.56	57.71	10.85	0.00	170	8,206
Civil Engineering	59.69	72.18	59.41	12.77	0.00	468	21,030
Computer Engineering	62.69	69.93	61.98	7.95	0.00	215	2,191
Computer Networks	52.70	47.48	52.71	-5.23	0.38	9	3,833
Computer Science	58.83	69.70	58.52	11.18	0.00	273	9,741
Control and Automation Eng.	61.74	73.00	60.99	12.01	0.00	222	3,328
Electrical Engineering	60.36	68.81	59.94	8.87	0.00	461	9,341
Engineering	62.83	71.59	62.08	9.51	0.00	372	4,346
Environmental Engineering	62.06	72.99	61.65	11.34	0.00	232	6,302
Food Engineering	61.11	67.20	60.74	6.46	0.00	89	1,467
Forest Engineering	63.27	70.89	62.98	7.91	0.00	68	1,751
Geography	54.99	62.02	54.96	7.06	0.00	51	12,069
History	54.74	56.90	54.73	2.17	0.59	20	18,367
Industrial Automation	53.98	50.30	53.98	-3.68	0.71	3	1,673
Industrial Production Management	51.56	38.45	51.58	-13.13	0.26	2	2,198
Information system	56.75	67.33	56.67	10.65	0.00	98	13,099
Language-Portuguese	53.34	45.74	53.35	-7.61	0.06	18	13,429
Language-Portuguese and English	54.74	49.09	54.75	-5.65	0.27	11	9,810
Language-Portuguese and Spanish	52.55	47.82	52.55	-4.73	0.55	5	3,283
Mathematics	52.16	52.62	52.16	0.46	0.84	62	13,611
Mechanical Engineering	61.07	69.77	60.64	9.13	0.00	505	10,079
Music	55.34	68.72	55.31	13.41	0.07	6	2,267
Pedagogy	49.41	45.88	49.41	-3.54	0.02	121	110,821
Philosophy	55.95	43.45	55.95	-12.50	0.33	2	4,635
Physical Education	50.34	47.55	50.34	-2.79	0.25	53	24,153
Physics	56.34	62.50	56.22	6.28	0.01	65	3,161
Production Engineering	60.60	71.60	60.22	11.38	0.00	505	14,535
Social Sciences	56.76	51.83	56.77	-4.94	0.38	11	4,585
Visual Arts	51.07	60.03	51.04	8.99	0.06	13	4,658

Data: National Examination of Student Performance (Enade) 2014. Microdata.

Table A7: Summary Statistics - General Education Grades Comparison (2015)

Course	**Grade**^{total}	**Grade**^{tr}	**Grade**^{nt}	**Difference**	**p-value**	**Obs.**^{tr}	**Obs.**^{nt}
Accounting Sciences	51.10	50.01	51.11	-1.10	0.59	58	54,799
Administration	53.38	49.93	53.39	-3.45	0.00	153	122,267
Advertising and Design	56.72	64.38	56.70	7.68	0.00	50	14,553
Commercial Management	51.18	53.90	51.18	2.72	0.63	7	4,844
Design	56.60	66.15	55.76	10.39	0.00	503	5,700
Economics	58.93	44.58	58.94	-14.36	0.08	4	7,771
Executive Secretariat	52.98	90.70	52.95	37.75		1	1,417
Fashion Design	52.52	56.75	52.52	4.23	0.71	2	1,328
Financial Management	51.41	51.07	51.41	-0.34	0.97	3	5,622
Foreign Trade	54.23	47.85	54.24	-6.39	0.56	2	2,043
Gastronomy	49.41	37.74	49.44	-11.70	0.02	10	4,518
Graphic Design	54.46	67.27	54.32	12.95	0.00	22	2,025
Human Resources Management	48.56	39.30	48.57	-9.28	0.00	31	27,919
Interior Design	50.45	56.07	50.44	5.63	0.38	6	2,363
Journalism	59.63	65.87	59.60	6.27	0.03	30	8,920
Law	59.31	53.47	59.32	-5.85	0.00	98	106,818
Logistics	50.41	45.81	50.41	-4.60	0.35	9	10,553
Management Processes	52.11	43.34	52.12	-8.78	0.08	9	10,007
Marketing	52.55	47.13	52.55	-5.42	0.52	3	5,635
Psychology	57.13	67.44	57.11	10.33	0.00	44	24,035
Public Administration	59.90	61.07	59.90	1.17	0.90	3	3,258
Public Management	53.89	52.33	53.90	-1.56	0.87	3	4,289
Quality Management	50.31	63.40	50.30	13.10	0.19	2	1,887
Theology	54.83	44.95	54.84	-9.89	0.22	4	3,450
Tourism	55.01	45.51	55.03	-9.52	0.10	7	3,442

Data: National Examination of Student Performance (Enade) 2015. Microdata.

Table A8: Summary Statistics - General Education Grades Comparison (2016)

Course	**Grade^{total}**	**Grade^{tr}**	**Grade^{nt}**	**Difference**	**p-value**	**Obs.^{tr}**	**Obs.^{nt}**
Agribusiness	41.17	30.32	41.20	-10.87	0.14	4	1,401
Agronomy	47.99	58.03	47.68	10.35	0.00	334	10,785
Biomedicine	48.46	62.13	48.05	14.08	0.00	227	7,479
Dentistry	47.45	60.99	47.22	13.77	0.00	239	13,948
Environment Management	40.36	42.27	40.35	1.91	0.83	3	4,771
Medicine	60.07	64.56	59.88	4.68	0.00	619	15,218
Nursing	41.07	49.00	41.01	7.98	0.00	229	32,390
Nutrition	44.34	56.96	44.17	12.79	0.00	163	12,481
Pharmacy	46.73	59.69	46.29	13.40	0.00	437	12,703
Physical Education	42.07	46.85	42.05	4.80	0.00	94	18,921
Physiotherapy	45.28	61.44	45.14	16.30	0.00	125	14,557
Radiology	39.68	60.24	39.53	20.71	0.00	17	2,347
Social Work	37.99	36.73	37.99	-1.26	0.63	35	26,983
Speech Therapy	46.38	53.62	46.30	7.32	0.04	20	1,812
Tech in Aest and Cosm	38.18	30.43	38.18	-7.75	0.37	3	4,130
Veterinary Medicine	48.06	58.82	47.68	11.14	0.00	300	8,434
Zootechnic	45.78	59.29	45.47	13.82	0.00	51	2,228

Data: National Examination of Student Performance (Enade) 2016. Microdata.

APPENDIX B

Table B1: CSF Effects on Enade's Grades - OLS Results (2009 - 2016)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				Panel A: General Grade				
CSF	0.732***	0.745***	0.322***	0.320***	0.325***	0.317***	0.292***	0.286***
	(0.0567)	(0.0580)	(0.0548)	(0.0382)	(0.0379)	(0.0370)	(0.0358)	(0.0356)
R^2	0.002	0.002	0.085	0.140	0.140	0.145	0.154	0.161
				Panel B: Specific Knowledge Grade				
CSF	0.690***	0.701***	0.275***	0.273***	0.278***	0.271***	0.249***	0.244***
	(0.0583)	(0.0597)	(0.0540)	(0.0384)	(0.0380)	(0.0373)	(0.0362)	(0.0360)
R^2	0.002	0.002	0.084	0.138	0.138	0.144	0.151	0.157
				Panel C: General Education Grade				
CSF	0.505***	0.514***	0.290***	0.299***	0.302***	0.294***	0.273***	0.269***
	(0.0365)	(0.0368)	(0.0403)	(0.0259)	(0.0255)	(0.0250)	(0.0242)	(0.0242)
R^2	0.001	0.001	0.033	0.065	0.065	0.068	0.073	0.077
Courses	No	Yes	No	No	No	No	No	No
Universities	No	No	Yes	No	No	No	No	No
Courses X Universities	No	No	No	Yes	Yes	Yes	Yes	Yes
Year	No	No	No	No	Yes	Yes	Yes	Yes
Individual Characteristics	No	No	No	No	No	Yes	Yes	Yes
Family Background	No	No	No	No	No	No	Yes	Yes
Quota	No	No	No	No	No	No	No	Yes
Observations	2,272,989	2,272,989	2,272,989	2,272,989	2,272,989	2,272,989	2,272,989	2,272,989

Data: National Examination of Student Performance (Enade) 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016. Microdata.
Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year; Family Background controls include: Family Income, Father Education and Mother Education; Individual Characteristics controls include: Race, Female, Age and Age squared; Standard errors in parentheses; clustered at Course level; *** $p < 0.01$, **$p < 0.05$, * $p < 0.1$

Table B2: CSF Effects on Enade's Grades - OLS Results (2007 - 2016)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Panel A: General Grade			
CSF	0.732***	0.743***	0.319***	0.312***	0.314***	0.305***	0.287***
	(0.0567)	(0.0579)	(0.0527)	(0.0377)	(0.0379)	(0.0370)	(0.0361)
R^2	0.002	0.002	0.085	0.138	0.138	0.144	0.151
				Panel B: Specific Knowledge Grade			
CSF	0.689***	0.700***	0.273***	0.267***	0.269***	0.262***	0.245***
	(0.0583)	(0.0596)	(0.0523)	(0.0378)	(0.0380)	(0.0373)	(0.0364)
R^2	0.002	0.002	0.084	0.137	0.137	0.143	0.148
				Panel C: General Education Grade			
CSF	0.505***	0.513***	0.285***	0.287***	0.289***	0.281***	0.265***
	(0.0366)	(0.0368)	(0.0383)	(0.0254)	(0.0252)	(0.0247)	(0.0241)
R^2	0.001	0.001	0.033	0.063	0.063	0.066	0.071
Courses	No	Yes	No	No	No	No	No
Universities	No	No	Yes	No	No	No	No
Courses X Universities	No	No	No	Yes	Yes	Yes	Yes
Year	No	No	No	No	Yes	Yes	Yes
Individual Characteristics	No	No	No	No	No	Yes	Yes
Family Background	No	No	No	No	No	No	Yes
Observations	2,464,347	2,464,347	2,464,347	2,464,347	2,464,347	2,464,347	2,464,347

Data: National Examination of Student Performance (Enade) 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016. Micro-data.
Notes: Grades were standardized at Course-Year levels, since the Specific Knowledge tests are different for each area of knowledge and both tests are different each year; Family Background controls include: Family Income, Father Education and Mother Education; Individual Characteristics controls include: Race, Female, Age and Age squared; Standard errors in parentheses; clustered at Course level; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table B3: CSF Effect on Enade's Specific Knowledge Grade - OLS Results (2013)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.10	0.07	0.13	0.24	158,709
Agribusiness	-0.26	0.28	0.34	0.15	1,399
Agronomy	0.43	0.09	0.00	0.24	7,412
Biomedicine	0.09	0.11	0.40	0.28	5,242
Dentistry	-0.05	0.12	0.69	0.27	9,554
Environmental Management	-0.07	0.21	0.74	0.15	6,777
Hospital Management	-0.48	0.22	0.03	0.19	1,584
Medicine	-0.12	0.11	0.30	0.27	15,163
Nursing	-0.12	0.09	0.21	0.26	24,450
Nutrition	-0.01	0.15	0.93	0.27	10,337
Pharmacy	0.27	0.09	0.00	0.30	12,165
Physical Education	-0.04	0.21	0.86	0.14	13,364
Physiotherapy	0.33	0.13	0.01	0.28	10,622
Radiology	0.81	0.66	0.22	0.24	2,438
Social Work	-0.14	0.17	0.39	0.25	27,796
Speech Therapy	0.72	0.33	0.03	0.32	1,368
Veterinary Medicine	0.04	0.14	0.77	0.21	7,010
Zootechnic	0.36	0.25	0.14	0.30	2,028

Data: National Examination of Student Performance (Enade) 2013. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

Table B4: CSF Effect on Enade's Specific Knowledge Grade - OLS Results (2014)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.35	0.03	0.00	0.21	392,701
Analysis and Systems Development	0.49	0.16	0.00	0.25	11,060
Architecture and Urbanism	0.29	0.05	0.00	0.14	13,884
Biological Sciences	0.49	0.05	0.00	0.27	21,440
Chemical Engineering	0.25	0.05	0.00	0.34	4,218
Chemistry	0.54	0.07	0.00	0.27	8,376
Civil Engineering	0.41	0.05	0.00	0.22	21,498
Computer Engineering	0.40	0.07	0.00	0.32	2,406
Computer Networks	0.10	0.44	0.81	0.23	3,842
Computer science	0.42	0.06	0.00	0.39	10,014
Control and Automation Eng.	0.34	0.07	0.00	0.47	3,550
Electrical Engineering	0.37	0.05	0.00	0.33	9,802
Engineering	0.44	0.05	0.00	0.35	4,718
Environmental Engineering	0.31	0.06	0.00	0.33	6,534
Food Engineering	0.47	0.10	0.00	0.30	1,556
Forest Engineering	0.34	0.11	0.00	0.27	1,819
Geography	0.37	0.15	0.02	0.20	12,120
History	-0.01	0.20	0.96	0.28	18,387
Industrial Automation	-0.45	0.36	0.21	0.28	1,676
Industrial Production Management	0.44	0.58	0.45	0.13	2,200
Information system	0.43	0.11	0.00	0.22	13,197
Language-Portuguese	-0.35	0.20	0.08	0.18	13,447
Language-Portuguese and English	-0.35	0.24	0.15	0.25	9,821
Language-Portuguese and Spanish	-0.20	0.20	0.34	0.30	3,288
Mathematics	0.40	0.15	0.01	0.22	13,673
Mechanical Engineering	0.35	0.05	0.00	0.30	10,584
Music	0.45	0.37	0.23	0.20	2,273
Pedagogy	-0.35	0.09	0.00	0.15	110,942
Philosophy	-0.26	0.56	0.65	0.34	4,637
Physical Education	-0.29	0.16	0.07	0.14	24,206
Physics	0.26	0.13	0.06	0.25	3,226
Production Engineering	0.36	0.05	0.00	0.26	15,040
Social Sciences	0.19	0.27	0.48	0.23	4,596
Visual Arts	0.25	0.26	0.34	0.20	4,671

Data: National Examination of Student Performance (Enade) 2014. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

Table B5: CSF Effect on Enade's Specific Knowledge Grade - OLS Results (2015)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.07	0.14	0.62	0.18	444,871
Accounting Sciences	-0.37	0.12	0.00	0.20	54,857
Administration	-0.15	0.08	0.05	0.21	122,420
Advertising and Design	0.33	0.12	0.01	0.15	14,603
Commercial Management	-0.14	0.31	0.66	0.16	4,851
Design	0.35	0.04	0.00	0.23	6,203
Economics	0.08	0.22	0.69	0.27	7,775
Executive Secretariat	1.69	0.18	0.00	0.20	1,418
Fashion Design	0.72	0.38	0.06	0.17	1,330
Financial Management	0.04	0.38	0.92	0.21	5,625
Foreign Trade	0.43	0.76	0.57	0.17	2,045
Gastronomy	-0.83	0.31	0.01	0.23	4,528
Graphic Design	-0.07	0.21	0.74	0.20	2,047
Human Resources Management	-0.56	0.15	0.00	0.12	27,950
Interior Design	-0.05	0.52	0.93	0.18	2,369
Journalism	0.25	0.19	0.18	0.19	8,950
Law	-0.28	0.09	0.00	0.17	106,916
Logistics	0.14	0.25	0.57	0.14	10,562
Management Processes	-0.77	0.35	0.03	0.14	10,016
Marketing	-0.38	0.72	0.60	0.14	5,638
Psychology	0.15	0.16	0.34	0.18	24,079
Public Administration	-0.27	0.22	0.22	0.29	3,261
Public Management	-0.53	0.80	0.50	0.23	4,292
Quality Management	0.41	0.10	0.00	0.18	1,889
Theology	0.43	0.30	0.16	0.21	3,454
Tourism	-0.07	0.37	0.85	0.18	3,449

Data: National Examination of Student Performance (Enade) 2015. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

Table B6: CSF Effect on Enade's Specific Knowledge Grade - OLS Results (2016)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.21	0.05	0.00	0.22	193,488
Agribusiness	-0.46	0.23	0.04	0.18	1,405
Agronomy	0.25	0.04	0.00	0.22	11,119
Biomedicine	0.31	0.07	0.00	0.25	7,706
Dentistry	0.17	0.06	0.00	0.24	14,187
Environmental Management	0.47	0.53	0.37	0.15	4,774
Medicine	0.01	0.04	0.88	0.17	15,837
Nursing	0.27	0.07	0.00	0.24	32,619
Nutrition	0.43	0.08	0.00	0.26	12,644
Pharmacy	0.31	0.05	0.00	0.26	13,140
Physical Education	0.02	0.11	0.86	0.17	19,015
Physiotherapy	0.38	0.08	0.00	0.23	14,682
Radiology	0.37	0.28	0.18	0.22	2,364
Social Work	-0.35	0.16	0.03	0.29	27,018
Speech Therapy	-0.02	0.19	0.91	0.24	1,832
Tech in Aest and Cosmestics	-0.72	0.38	0.06	0.19	4,133
Veterinary Medicine	0.30	0.06	0.00	0.20	8,734
Zootechnic	0.51	0.12	0.00	0.27	2,279

Data: National Examination of Student Performance (Enade) 2016. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

Table B7: CSF Effect on Enade's General Education Grade - OLS Results (2013)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.18	0.05	0.00	0.10	158,709
Agribusiness	0.25	0.37	0.50	0.11	1,399
Agronomy	0.37	0.10	0.00	0.10	7,412
Biomedicine	0.18	0.12	0.13	0.13	5,242
Dentistry	0.01	0.13	0.91	0.13	9,554
Environmental Management	-0.20	0.20	0.32	0.10	6,777
Hospital Management	-0.86	0.55	0.12	0.14	1,584
Medicine	0.10	0.13	0.47	0.13	15,163
Nursing	0.09	0.10	0.35	0.12	24,450
Nutrition	0.34	0.16	0.03	0.13	10,337
Pharmacy	0.33	0.10	0.00	0.12	12,165
Physical Education	-0.08	0.18	0.65	0.08	13,364
Physiotherapy	0.23	0.17	0.17	0.13	10,622
Radiology	-0.21	0.53	0.69	0.10	2,438
Social Work	-0.21	0.18	0.26	0.07	27,796
Speech Therapy	0.66	0.49	0.18	0.13	1,368
Veterinary Medicine	0.23	0.15	0.12	0.13	7,010
Zootechnic	0.71	0.35	0.04	0.11	2,028

Data: National Examination of Student Performance (Enade) 2013. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

Table B8: CSF Effect on Enade's General Education Grade - OLS Results (2014)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.24	0.02	0.00	0.10	392,701
Analysis and Systems Development	0.28	0.14	0.05	0.10	11,060
Architecture and Urbanism	0.13	0.05	0.01	0.09	13,884
Biological Sciences	0.30	0.05	0.00	0.15	21,440
Chemical Engineering	0.20	0.05	0.00	0.13	4,218
Chemistry	0.40	0.08	0.00	0.10	8,376
Civil Engineering	0.37	0.04	0.00	0.10	21,498
Computer Engineering	0.23	0.08	0.00	0.17	2,406
Computer Networks	-0.42	0.25	0.09	0.13	3,842
Computer science	0.30	0.05	0.00	0.13	10,014
Control and Automation Eng.	0.33	0.06	0.00	0.15	3,550
Electrical Engineering	0.25	0.05	0.00	0.10	9,802
Engineering	0.28	0.05	0.00	0.14	4,718
Environmental Engineering	0.29	0.06	0.00	0.16	6,534
Food Engineering	0.11	0.13	0.41	0.14	1,556
Forest Engineering	0.24	0.11	0.03	0.14	1,819
Geography	0.18	0.15	0.22	0.11	12,120
History	0.19	0.21	0.36	0.11	18,387
Industrial Automation	-0.75	0.30	0.01	0.15	1,676
Industrial Production Management	-0.57	0.41	0.16	0.08	2,200
Information system	0.41	0.10	0.00	0.10	13,197
Language-Portuguese	-0.58	0.23	0.01	0.11	13,447
Language-Portuguese and English	-0.27	0.23	0.23	0.13	9,821
Language-Portuguese and Spanish	-0.13	0.51	0.80	0.18	3,288
Mathematics	0.00	0.13	0.98	0.09	13,673
Mechanical Engineering	0.30	0.05	0.00	0.09	10,584
Music	0.53	0.22	0.01	0.12	2,273
Pedagogy	-0.25	0.10	0.01	0.10	110,942
Philosophy	-1.44	0.44	0.00	0.16	4,637
Physical Education	-0.19	0.14	0.18	0.09	24,206
Physics	0.19	0.13	0.15	0.11	3,226
Production Engineering	0.20	0.05	0.00	0.12	15,040
Social Sciences	-0.20	0.29	0.50	0.12	4,596
Visual Arts	0.28	0.28	0.30	0.12	4,671

Data: National Examination of Student Performance (Enade) 2014. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

Table B9: CSF Effect on Enade's General Education Grade - OLS Results (2015)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.04	0.12	0.75	0.10	444,871
Accounting Sciences	-0.04	0.14	0.77	0.08	54,857
Administration	-0.21	0.08	0.01	0.09	122,420
Advertising and Design	0.12	0.14	0.40	0.10	14,603
Commercial Management	0.13	0.31	0.67	0.08	4,851
Design	0.27	0.05	0.00	0.14	6,203
Economics	-0.66	0.36	0.07	0.10	7,775
Executive Secretariat	2.62	0.18	0.00	0.13	1,418
Fashion Design	0.48	0.41	0.25	0.13	1,330
Financial Management	-0.06	0.51	0.90	0.09	5,625
Foreign Trade	-0.37	0.81	0.65	0.09	2,045
Gastronomy	-0.57	0.29	0.05	0.12	4,528
Graphic Design	0.11	0.25	0.67	0.15	2,047
Human Resources Management	-0.68	0.17	0.00	0.07	27,950
Interior Design	0.25	0.32	0.44	0.08	2,369
Journalism	0.29	0.17	0.09	0.12	8,950
Law	-0.31	0.10	0.00	0.11	106,916
Logistics	-0.52	0.42	0.21	0.09	10,562
Management Processes	-0.56	0.33	0.09	0.08	10,016
Marketing	-0.49	0.48	0.31	0.09	5,638
Psychology	0.42	0.13	0.00	0.13	24,079
Public Administration	-0.17	0.31	0.59	0.20	3,261
Public Management	-0.27	0.65	0.68	0.15	4,292
Quality Management	0.95	0.60	0.11	0.09	1,889
Theology	-0.43	0.73	0.56	0.12	3,454
Tourism	-0.42	0.34	0.22	0.13	3,449

Data: National Examination of Student Performance (Enade) 2015. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

Table B10: CSF Effect on Enade's General Education Grade - OLS Results (2016)

Course	Coef	se	p-value	R^2	Observations
All Courses	0.30	0.04	0.00	0.15	193,488
Agribusiness	-0.66	0.31	0.03	0.12	1,405
Agronomy	0.32	0.05	0.00	0.15	11,119
Biomedicine	0.37	0.07	0.00	0.20	7,706
Dentistry	0.34	0.06	0.00	0.18	14,187
Environmental Management	0.50	0.66	0.44	0.15	4,774
Medicine	0.15	0.04	0.00	0.11	15,837
Nursing	0.22	0.07	0.00	0.19	32,619
Nutrition	0.36	0.08	0.00	0.15	12,644
Pharmacy	0.37	0.05	0.00	0.19	13,140
Physical Education	0.04	0.10	0.73	0.10	19,015
Physiotherapy	0.54	0.09	0.00	0.16	14,682
Radiology	0.70	0.26	0.01	0.18	2,364
Social Work	-0.09	0.16	0.56	0.13	27,018
Speech Therapy	0.07	0.24	0.76	0.17	1,832
Tech in Aest and Cosmestics	-0.64	1.04	0.53	0.10	4,133
Veterinary Medicine	0.36	0.06	0.00	0.16	8,734
Zootechnic	0.66	0.13	0.00	0.15	2,279

Data: National Examination of Student Performance (Enade) 2016. Microdata.
Notes: Grades were standardized at Course-Year levels; Controls: Universities, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Robust standard errors; First line "All Courses"controls for "Course x University"and has standard errors clustered at Course level

Table B11: CSF Effect on Enade's Grades - UQR Results (2009 - 2016)

	Quantile 10 (1)	Quantile 25 (2)	Quantile 50 (3)	Quantile 75 (4)	Quantile 90 (5)
	Panel A: General Grade				
CSF	0.0467***	0.112***	0.245***	0.389***	0.633***
	(0.0124)	(0.0105)	(0.0133)	(0.0175)	(0.0319)
R^2	0.005	0.011	0.017	0.018	0.012
	Panel B: Specific Knowledge Grade				
CSF	0.0415***	0.0985***	0.199***	0.345***	0.509***
	(0.0111)	(0.0103)	(0.0134)	(0.0176)	(0.0311)
R^2	0.004	0.009	0.015	0.016	0.011
	Panel C: General Education Grade				
CSF	0.122***	0.174***	0.282***	0.353***	0.392***
	(0.0138)	(0.0126)	(0.0129)	(0.0161)	(0.0228)
R^2	0.004	0.008	0.010	0.010	0.006
Observations	2,272,989	2,272,989	2,272,989	2,272,989	2,272,989

Data: National Examination of Student Performance (Enade) 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016. Microdata.
Notes: Grades were standardized at Course-Year levels; Unconditional Quantile Regressions calculated using XTRIFREG package for Stata by BORGEN (2016) Version 1.0; Controls: CourseXUniversities (19,445 dummies), Year, Family Income, Father Education, Mother Education, Race, Female, Age, Age squared and Quota; Cluster–robust standard errors in parentheses; *** p < 0.01, **p < 0.05, * p < 0.1

Table B12: CSF Effect on Enade's Grades - UQR Results (2007 - 2016)

	Quantile 10 (1)	Quantile 25 (2)	Quantile 50 (3)	Quantile 75 (4)	Quantile 90 (5)
	Panel A: General Grade				
CSF	0.0493***	0.117***	0.249***	0.391***	0.628***
	(0.0124)	(0.0105)	(0.0134)	(0.0178)	(0.0317)
R^2	0.003	0.007	0.011	0.011	0.008
CSF	0.0442***	0.102***	0.204***	0.348***	0.508***
	(0.0111)	(0.0104)	(0.0136)	(0.0179)	(0.0311)
R^2	0.002	0.005	0.010	0.011	0.008
	Panel C: General Education Grade				
CSF	0.124***	0.173***	0.284***	0.350***	0.378***
	(0.0139)	(0.0125)	(0.0129)	(0.0160)	(0.0227)
R^2	0.003	0.005	0.006	0.006	0.004
Observations	2,464,347	2,464,347	2,464,347	2,464,347	2,464,347

Data: National Examination of Student Performance (Enade) 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016. Microdata.
Notes: Grades were standardized at Course-Year levels; Unconditional Quantile Regressions calculated using XTRIFREG package for Stata by BORGEN (2016) Version 1.0; Controls: CourseXUniversities (19,909 dummies), Year, Family Income, Father Education, Mother Education, Race, Female, Age and Age squared; Cluster–robust standard errors in parentheses; *** p < 0.01, **p < 0.05, * p < 0.1

Table B13: Priority Courses

Course	Priority	Course	Priority
Accounting Sciences	0	Industrial Production Management	1
Administration	0	Information system	1
Advertising and Design	0	International Relations	0
Agronomy	1	Journalism	0
Analysis and Systems Development	1	Languages	0
Architecture and Urbanism	1	Law	0
Biological Sciences	1	Management Processes	0
Biomedicine	1	Marketing	0
Chemical Engineering	1	Mathematics	1
Chemistry	1	Medicine	1
Civil Eng.	1	Nursing	0
Computer Eng.	1	Nutrition	0
Computer Networks	1	Pedagogy	0
Computer science	1	Pharmacy	1
Control and Automation Eng.	1	Philosophy	0
Dentistry	1	Physical Education	0
Design	1	Physics	1
Economics	0	Physiotherapy	0
Environmental Eng.	1	Production Engineering	1
Executive Secretariat	0	Psychology	0
Financial Management	0	Radiology	0
Food Engineering	1	Social Sciences	0
Forest Engineering	1	Social Work	0
Geography	1	Speech Therapy	0
History	0	Tourism	0
Human Resources Management	0	Veterinary Medicine	1
Industrial Automation	1	Zootechnic	1

Notes: Based on the official list courses from the Science without Borders public call documents.