

Saccaro, Alice; França, Marco Túlio Aniceto; Jacinto, Paulo de Andrade

Article

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Dropout in tertiary education in Brazil: An analysis of the effects of the PNAES *Bolsa Permanência*

Alice Saccaro^{a,*},¹, Marco Túlio Aniceto França^b, Paulo de Andrade Jacinto^c

^a Universidade Federal Fluminense (UFF), Brazil

^b Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS), Brazil

^c Universidade Federal do Paraná, Brazil

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Abstract

In this article, it is explored whether quota students who were enrolled in presential courses at federal institutions between 2009 and 2012 and received PNAES (National Student Support Program) *Bolsa Permanência* dropped out less than those quota students who did not receive this benefit. For this analysis, it was used data collected from the Tertiary Education Census and the Difference in Differences approach to look at how different characteristics influence the dropout rate and the chances that a student will receive a *Bolsa Permanência*. Results show that the chances of receiving the benefit depends on individual and school characteristics, and that the dropout rate among aid recipients is lower than among those who did not receive the benefit.

JEL classification: JEL; C21; H52; H53

Keywords: Dropout; Tertiary education; Student aid

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1. Introduction

Changes in the global economy over the past century have been leading to many transformations in society. One of the most seriously impacted areas is the job market, which now requires more qualified labor. Universities are some of the institutions that are important in this new scenario, providing graduates to meet the growing demand for better qualified labor. Given this situation, where credit is limited and undergraduate courses have a high financial and opportunity cost, student financial aid programs play a very important role.

In the last 15 years, the supply of tertiary education courses has increased significantly in Brazil: in 2000, there were 10,585 presential courses being offered; in 2015, 32,294 (INEP, 2001; INEP, 2016). Some of these, such as public universities, are free of cost, but others require tuition. At the same time, a wide array of loans and stipends has become

* Corresponding author at: Rua Prof. Marcos Waldemar de Freitas Reis, S/N, Bloco F, Campus do Gragoatá, Niterói - RJ, CEP 24210-200 Brazil.
E-mail address: asaccaro@id.uff.br (A. Saccaro).

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available, similar to what happens in the US. This raises an important question: are the resources available for students being well used?

When a student enrolls in a public university and does not graduate, funds have been used on an activity that did not achieve its intended target. In this case, dropping out of tertiary education is not only a personal cost, but a cost to society, since these public funds could have been used for another student or for other purposes. Of course, this is not the only cost. There is also the institutional cost, as the universities' image is adversely affected when students dropout DesJardins et al. (1999)¹.

In the US, this concern is clear in a number of studies. Murdock (1989) published a literature review of existing works analyzing the relationship between financial aid and dropout. Britt et al. (2017), finds that individuals with higher levels of financial stress are more likely to leave college. Nora (1990) looks at whether or not aid programs reduced the dropout rate among Hispanic students enrolled in community colleges in Texas. DesJardins et al. (1999) study the reasons and characteristics influencing students dropping out of the University of Minnesota, using the Event History Modeling approach. Canton and Blom (2004) analyzed SOFES, the Mexican program that offers loans to tertiary education students in Mexico. This study looked at the impact of this benefit on academic performance and on the percentage of these students in the job market, using the Differences in Differences approach. Gross et al. (2007) analyzed the impact of financial aid on student dropout in U.S public universities using the Logical Models approach. Arendt (2013), applying Intention-to-treat (ITT) and instrumental variable (IV) estimates, studies the Danish Student Grant System and conclude that this kind of financial aid is negatively related to dropout. Finally, Castleman and Longman (2012), using the regression-discontinuity (RD) strategy, analyze if the Florida Student Access Grant (FSAG) increased the persistence of the students.

The first studies performed in the US stressed how to increase university access, rather than addressing how to increase retention rates. In 1979, the *Aspen Institute Conference on Student Aid Policy* first noted the need for researches and surveys on the correlation between financial aid and dropout rates among university students. At the time, the hypothesis was that there might be a relationship between free-riders and poor performance among individuals who were receiving this benefits (Murdock, 1989). The belief was that this was happening as the funds used were not personal, but came from society. Therefore, students who were receiving these benefits might be performing below those were not receiving them.

Although the results of pioneering researches were contradictosry, more recent studies show that students receiving benefits-such as scholarships and loans-tend to perform better than those who do not, although each study has its own peculiarities (Murdock, 1989; Nora, 1990; Bettinger, 2004; Gross et al., 2007; Arendt, 2013). According to Murdock (1989), student aid reduces socioeconomic barriers within universities, in a way that students from lower income families can enter and stay at these institutions, completing an undergraduate course.

Nora (1990) analyzed the influence of different types of financial aid on the dropout rates of Hispanic students enrolled in community colleges in Texas. The main finding is that retention and the number of semesters completed were proportional to the amount of aid received. In other words, these students performed better than those receiving little or no financial aid. Analyzing the impact of *Pell Grants* on student retention in Ohio public universities, Bettinger (2004) found that there is a strong relationship between resources provided for students and retention. By using discontinuous regression, the author arrived at the same result, although at a lower correlation rate.

Gross et al. (2007) found that, for individuals enrolled in four-year courses, financial aid provided by the schools has a moderate, yet statistically significant positive effect, on student retention. Among the reasons, they pointed the fact that recipients of student aid do not have to work as much as those who do not receive the benefit, so they can dedicate more time and effort to their courses. Arendt (2013) finds that when students receive more aid, they have a better financial situation, which decreases the dropout rates. But when he analyses the completion of the courses, he concludes that the raise in the grants has no impact between four and eight years of study.

However, there are occasional differences in the results found by each author. Murdock's (1989) main conclusion is that financial aid for low-income students enabled them to display retention rates similar to middle and upper class

¹ Although these are inherent to the use of public funds, investing in higher education has advantages. A country with more college graduates has better human capital externalities. This is because people share their knowledge with society in many ways, including market transactions and social interactions. Consequently, these benefits extend also to those who have not made any personal investment in education. Therefore, it is not only the person completing higher education who gains, but also the society in which he or she lives. (CANTON and BLOOM, 2004).

students. Gross et al. (2007) found that on average, students from lower income families are more likely to remain in school than those from wealthier families. However, among women in the group receiving the most financial aid, there was no statistical difference in completing tertiary education.

DesJardins et al. (1999) found that women are less likely to drop out early in the course, but as time goes by, they have the lowest retention rates. Gross et al. (2007) believe that financial aid is essential, but not a determinant of dropout rates. They claim that other factors, such as grades and living on or off campus, are also definitive contributors. This conclusion is similar to Castleman and Longman (2012): the effects of the analyzed program are larger for academically high achieving students. However, Nora (1990) disagrees, and points out that for individuals enrolled in community college, tertiary education and high-school grades do not determine whether they remain in college. The author believes that students dropout due to financial problems.

The recent expansion of tertiary education in Brazil was based on creating new universities and expanding the existing ones. To reduce the financial burden of remaining in school, mechanisms were created to keep lower income students in school. One of these is the *Bolsa Permanência*, managed by the institutions and funded by PNAES, the National Student Aid Program. The PNAES *Bolsa Permanência* provides a monthly benefit for students that are in socioeconomically vulnerability. This program allows beneficiaries to remain more time in federal public universities by covering the opportunity cost, so it reduces their chances to dropout due to financial difficulties.

Despite the progress made in courses and financial aid available to students, the literature on the influence of aid provided to socially vulnerable students in tertiary education on the dropout rate is still scarce. Araújo and Leite (2014) looked at the impact of the Department of Education *Bolsa Permanência*, a program similar to the PNAES benefit, on a group of 71 students enrolled in 19 undergraduate courses at UNIRIO (Federal University of the State of Rio de Janeiro). Data was collected using a qualitative approach, a questionnaire and interview script. Analysis of this data using descriptive statistics shows that the program may be achieving the purposes for which it was created. However, the main limitation of this study is that the sample was not representative, making it impossible to generalize the results to the program as a whole.

In this way, the present study will contribute to the debate by analyzing if the PNAES *Bolsa Permanência* reduced the dropout rate among students enrolled in presential courses undergraduate programs at federal institutes of tertiary education between 2009 and 2012. It is used the Difference in Differences approach and the Difference in Differences with Propensity Score Matching approach to analyze if there is a difference in the dropout rate among students that received the aid and those who did not, for the three years of the analysis period. Both methods are Differences in Differences controlled by fixed effects.

The sample is made up of individuals who enrolled in tertiary education through the quota system in 2009. It compares the dropout rate among quota students receiving the *Bolsa Permanência* for three years, with quota students who did not receive this benefit at any moment. The main contribution of this study is an assessment of a program whose goal is to provide financial aid to students enrolled in tertiary education who are, on average, less well-off and hence more likely to dropout. Given the shortage and cuts in federal funding, having unoccupied school positions are a burden on society, and any measure to mitigate this situation is important.²

This article has five sections, including this introduction. The second section shows the recent history of tertiary education in Brazil, some of the programs created to increase the number of enrolled students, and benefits designed to reduce the dropout rate. The third section shows the empirical strategy used. The fourth section describes the results, and the last one consists of the final considerations.

2. Changes in tertiary education in Brazil starting in 2000

Tertiary education expansion policies may be split into two categories—those designed for private institutions and those formulated for public institutions. To increase enrollment in private schools, credit and scholarship programs were created. For private universities, the FIES (Tertiary Education Student Financing Fund) was created in 1999 and

² The criterion on choosing this sample is the fact that both the quotas and *Bolsa Permanência* are mechanisms designed for socioeconomically vulnerable individuals. For the purposes of this assessment, any student not enrolled in the years analyzed was considered a dropout. This category includes individuals who suspended their enrollment, those who transferred and those who left. The individuals that graduated during the period of the analysis were not excluded from the sample: since they left college with a degree, which is one of the purposes of the *Bolsa Permanência* Program, they cannot be considered dropped out students,

Table 1
Students enrolled in presental courses in 2008 and 2012, absolute and relative numbers.

	Absolute Numbers		Percent	
	2008	2012	2008	2012
Southeast	2,512,560	2,816,086	49.46%	47.54%
South	887,182	941,738	17.46%	15.90%
Northeast	912,693	1,213,519	17.97%	20.49%
Center-West	444,431	547,768	8.75%	9.25%
North	323,190	404,727	6.36%	6.83%
Total	5,080,056	5,923,838	100%	100%

Source: prepared by the authors based on INEP data (2009b and 2012).

regulated in 2001. FIES offers 50%–100% of the cost of the course. The volume of credit provided to each individual depends on gross household income and how much of it is used to pay tuition (BRASIL, 2015a).

As of 2015, during the course and for the 18 months following the conclusion, the beneficiary would pay a quarterly rate, that corresponded to the interest rates—the maximum value at this point was R\$ 150.00. After this, students will have three times the length of the course to pay off the loan (BRASIL, 2001a,b, 2015a). The largest number of new loan agreements was signed in 2014, when nearly 731,000 students subscribed to the program (BRASIL, 2015c).

In addition to FIES, PROUNI (University for All) was created in 2005, distributing scholarships that cover 50%–100% of the tuition for university courses. The first case applies to students from households with a per capita monthly income of three minimum salaries or less. Full scholarships are for students with per capita household income of up to one and a half minimum salaries a month (BRASIL, 2005). This program significantly increased the funds employed.

In 2005, 112,275 scholarships were offered, 64.04% of them were full scholarships. In 2014, 306,706 scholarships were offered, 66.91% of them were full scholarships (BRASIL, 2015b). To qualify for the program in 2015, students must have taken the ENEM (National Secondary Education Exam) in the previous year, have achieved a score of at least 450 in the objective tests, and a score greater than zero on the essay. For spaces in courses that have not been filled by regular means, qualified candidates must have taken the ENEM in 2010 or after. This shows that PROUNI and FIES are designed to reduce credit restrictions for access to tertiary education.

For public universities, REUNI (Program to Support the Restructuring and Expansion of Federal Universities) was created in 2007. The goal is to create conditions to expand access and retain students in undergraduate courses in federal institutes of tertiary education. Among its mandate is to reduce dropout rates, fill empty positions in courses, increase enrollment - especially in night classes -, and take tertiary education to other cities beside the states' capitals. REUNI also expands inclusion and student aid programs (BRASIL, 2007a). When compared the numbers for tertiary education in Brazil in 2008 and 2012, it is observed a large number of changes. There was a 7.28% increase in the number of universities, from 2252 to 2416. The percentage of private institutions went from 89.52% in 2008 to 87.4% in 2012 (Table 1).

There was a 16.61% increase in the number of students enrolled in presental undergraduate courses. However, students were still concentrated in the southeast, although the region had lost some of its importance. The largest increase in enrollment came in the northeast, although other areas with fewer students, such as the center-west and north, also had an increase in enrollment (INEP, 2009b, 2012a, b) (Table 2).

Clearly the number of opening of vacancies increased in state capitals and in the interior. 130,885 vacancies were created in public universities located in state capitals, and 338,415 in private institutions. In the interior, despite a decline in the openings in city universities, a total of 196,017 new vacancies were created in public universities, and 191,250 in private ones. The number of enrollments increased more in federal institutions than in state or city ones, in particular in the interior. Thus, one of the REUNI targets-taking tertiary education to the interior-is being met, although in a slow way.

In addition to the increase in places, programs were designed to reduce student dropout in tertiary education. It is in this context that in 2007 PNAES (National Student Aid Program) was created, subsequently regulated by Decree 7234 of July 19th, 2010. This program emerged in a scenario of changing socio-demographics of university students, leading to more pressure for student aid facilities. The overall goal of this program is to make easier for young people to remain

Table 2

Number of students enrolled in presential undergraduate courses at public universities located in the state capital and interior, 2008 and 2012.

	Capital			Interior		
	2008	2012	% growth	2008	2012	% growth
Federal	401,457	514,917	28.26	241,644	470,380	94.65
State	137,062	154,487	12.71	363,172	406,209	11.85
City	2496	0	−100	138,133	62,377	−54.84
Private	1,787,189	2,125,604	18.93	2,018,902	2,210,152	9.47

Source: prepared by the authors based on INEP data (2009b and 2012).

in federal universities. The specific goals are to democratize student retention in federal tertiary education, minimize the impact of social and regional inequalities on student retention and completion of tertiary education, reduce the dropout rate and help promote social inclusion through education (BRASIL, 2007b; BRASIL, 2010).

The proposed student aid would include items such as student housing, transportation, food, digital inclusion, healthcare and pedagogical support, along with measures to integrate and develop the gifted and those with special needs. In 2010 the regulation of the program defined that students should not have a familiar wage superior to 1.5 minimum wage salaries, per person, of the family. Also, after this year, the institutions that received the PNAES' resources had to create mechanisms to monitor the students' performance.

Also, it is important to notice that in 2008 R\$ 126,391,633.00 were set aside for federal universities. After the law was regulated in 2010, the resources designated to the program raised. In 2012, the institutions received a total of R\$ 503,843,628.00. This is an approximate increase of 300% in funding in four years (BRASIL, 2012).

To qualify for aid, students must come from households with a per capita income of 1.5 minimum salaries or less, and not have any undergraduate licentiate. Universities are free to stipulate additional criteria and methods to select beneficiaries (BRASIL, 2007b). Retention stipends are among the types of aid offered most often. Each university selects its own name for this type of aid, the most common being *Bolsa Permanência* and *Auxílio Permanência*. The value of aid provided each student varies, as does the number of grants offered by each school.

Between 2008 and 2012, aid ranged from R\$ 150 and R\$ 400 a month, per pupil. Some universities require that students work on a specific project in exchange for the aid, while others have no such requirement. In spite of the similarities, this program should not be confused with the Department of Education *Bolsa Permanência*, created in 2013 for socially vulnerable students, native Indians and *quilombolas* enrolled in federal undergraduate courses of at least five class-hours daily. The amount of this stipend has been R\$ 400 a month since it was created, paid directly to the beneficiary (BRASIL, 2013).

3. Empirical strategy

Difference in differences (Diff-in-Diff) is one of the most often used experimental approaches to measure impact.³ This method can be used in the context of what is known as a natural experiment, creating treatment and control groups that are similar in various aspects. These situations originate in changes that occur in nature and institutional changes. Expanding the number of *Bolsa Permanência* granted since 2010 is consistent with the latter.

The main hypothesis of this approach is that, in the absence of treatment, the results for the control and treatment groups should be similar over time. This is why it is essential that the control group to be as similar as possible to the treatment group. One of the main advantages of this approach is that it allows controlling non-observable characteristics that do not change over time. As the name indicates, this methodology is based on calculating a double subtraction

³ A pioneering effort in which this tool was used is the work done by Ashenfelter and Card (1985), analyzing the effects of a US government training program on participant wages, comparing them to workers who had not participated in the program. Still on the job market theme, Card and Krueger (1994) looked at the recent increase in the New Jersey minimum wage to check on whether or not it had led to higher unemployment. The sample consisted of fast-food workers—a segment that traditionally employs numerous minimum-wage employees. The control group was a similar group of employees in Pennsylvania, a neighboring state where there had been no increase in the minimum wage. Looking at these cases it is clear that to use this approach for analysis, data must be available for both the treatment (those receiving program benefits) and control (individuals with similar observable and non-observable traits but not submitted to the intervention), both before and after the intervention.

(Angrist and Pischke, 2009). The Eq. (1.1) e (2.1) show the Differences-in-Differences model without the use of covariates e with covariates inserted as control. The subscript t represents the moment in time of individual i . For the analyses that are split over two periods in time, the basic equation for the model becomes (2.2).

$$Dropout_{it} = \lambda + \gamma Treated_{it} + \rho Time_{it} + \beta(Treated_{it} * Time_{it}) + \varepsilon_{it} \quad (1.1)$$

$$Dropout_{it} = \lambda + X'_{it}\alpha + \gamma Treated_{it} + \rho Time_{it} + \beta(Treated_{it} * Time_{it}) + \varepsilon_{it} \quad (2.1)$$

To analyze if *Bolsa Permanência* influences the dropout rate, the equations above are interpreted as follows: Time = 0 are student observations in 2009, while Time = 1 are observations between 2010 and 2012; Treated = 1 are students receiving a *Bolsa Permanência* for all the period of time between 2010 and 2012, and Treated = 0 for all others. λ is the term for the intercept. The subscript t indicates the period on which the individual i is. The notation presented above follows the one presented by Foguel (2012). Finally, X_{it} is the covariate vector corresponding to student, course and institution characteristics. The interaction term is used to analyze what happened to the treated group in the period subsequent to the intervention. In other words, it measures the impact of the program, and β measures the causal effect.

Instead of using the Differences-in-Differences methodology above, it was chosen a fixed effects specification. The reasons for this choice are because now there are controls for time-invariant characteristics of the students, μ_i . Also, it is possible to control for characteristics that are not observed through time. This way, the equations used for the two previous Difference-in-Difference estimators in this study are, respectively:

$$Dropout_{it} = \phi + \mu_i + \rho Time_{it} + \beta(Treated_{it} * Time_{it}) + \varepsilon_{it} \quad (1.2)$$

$$Dropout_{it} = \phi + \mu_i + X'_{it}\alpha + \rho Time_{it} + \beta(Treated_{it} * Time_{it}) + \varepsilon_{it} \quad (2.2)$$

In addition to the analyses, it was applied the *Propensity Score Matching* (PSM) on the second and the third Differences-in-Differences. It is important to mention that the *Propensity Score Matching* (PSM) will be used for weighting the Diff-in-Diff-the Diff-in-Diff will be weighted by the inverse of probability of the individual to be treated. This method seeks to build a control group similar to the treatment group, regarding the observable characteristics. The main hypothesis is that a member of the treatment group has a match on the control group. This last factor represents the result for the individual if he had received the treatment.

To complete this last analysis, it is also estimated the robustness of the Differences-in-Differences by using Rosenbaum's sensitivity analysis test (Rosenbaum, 2002). Probably, there are omitted covariates that can influence in the participation in the program, as well as in the decision to dropout. The test analyses how much an omitted covariate that affects the participation in the *Bolsa Permanência* program and in the dropout rates have an influence on the results, related to the effect of the treatment.

Bercker and Caliendo (2007) claim that $P_i = P(x_i | u_i) = P(T_i = 1 | x_i, u_i) = F(\beta x_i + \gamma u_i)$ is the share of the probability of participating in the treatment, where x_i are the observable characteristics of individual i , u_i is the omitted variable and γ is the effect of u_i on the decision to participate in the program. If the study is not affected by the non-observed characteristics bias, γ will be zero and the probability of participating will be determined solely by x_i . However, if $u_i \neq 0$, two individuals with the same observable characteristics will have a different chance of receiving treatment. For the purposes of demonstrating the model, we assume a combined pair of individuals i and j that F is a logistic distribution. The chance that an individual will receive treatment is given by $\frac{P_i}{(1-P_i)}$ and $\frac{P_j}{(1-P_j)}$, and the chance ratio is given by:

$$\frac{\frac{P_i}{(1-P_i)}}{\frac{P_j}{(1-P_j)}} = \frac{P_i(1-P_j)}{P_j(1-P_i)} = \frac{\exp(\beta x_i + \gamma u_i)}{\exp(\beta x_j + \gamma u_j)} \quad (3)$$

$$e^{-\gamma} \leq \frac{P_i(1-P_j)}{P_j(1-P_i)} \leq e^{\gamma} \quad (4)$$

Thus, if there are no differences in the omitted variables, or if they have no influence on the probability of the individual receiving or not receiving the benefit, the ratio of probabilities is 1-in other words, indications are that there is no selection bias. In this context, the role of sensitivity analysis is to assess how the impact of the program is influenced by changes in the value of γ , u_i and u_j . Individuals who appear similar may differ in terms of probability until $e^{\gamma} = 2$. The closer this value, and the closer p -critical gets to 0.05 or exceeds it, more robust are the

Table 3
Variables used and description.

Differences in Differences	
Variable	Description
Sex	1 if the student is female, 0 if the opposite.
Disability	1 if the student was considered to have a disability in the 2009 census.
Accommodation	1 if the student received housing support between the years 2009 and 2012, 0 if the opposite.
Food	1 if the student received a food subsidy between the years 2009 and 2012.
Work aid	1 if the student received financial aid for work between the years 2009 and 2012.
Material	1 if the student received learning material between the years 2009 and 2012, 0 if the opposite.
Completion period	Minimum period for completion of the course, in number of semesters.
Paid activity	1 if the student exercises some kind of paid activity (internship, research, extension or monitoring work).
Unpaid activity	1 if the student exercises some kind of unpaid activity (internship, research, extension or monitoring work).
Propensity score matching	
Variable	Description
Sex	1 if the student is female, 0 if the opposite.
Age	Age of the students in 2009.
Disability	1 if the student was considered to have a disability in the 2009 census.
Licentiate (<i>Licenciatura</i>)	1 if the level of education awarded to the student was licentiate (<i>licenciatura</i>), 0 if the opposite.
Night class	1 if it is a night course, 0 if the opposite.
Accommodation	1 if the student received housing support between the years 2009 and 2012, 0 if the opposite.
Transport	1 if the student received a transport subsidy between the years 2009 and 2012.
Food	1 if the student received a food subsidy between the years 2009 and 2012.
Work aid	1 if the student received financial aid for work between the years 2009 and 2012.
Material	1 if the student received learning material between the years 2009 and 2012, 0 if the opposite.
Completion period	Minimum period for completion of the course, in number of semesters.
Paid activity	1 if the student exercises some kind of paid activity (internship, research, extension or monitoring work).
Unpaid activity	1 if the student exercises some kind of unpaid activity (internship, research, extension or monitoring work).

Source: table based on data obtained in INEP (2009a, b, 2010, 2011 and 2012a, b).

results. This enables finding the limit the sample supports before being affected by the results of the non-observable results.

4. Sources of data and descriptive statistics

To analyze the effects of *Bolsa Permanência*, it was collected data from the 2009 to 2012 Tertiary Education Census published by INEP (Anísio Teixeira National Institute for Educational Research and Studies). This database has annual data provided by tertiary education institutions about the courses they offer (location and international rank), their courses, the units they operate (infrastructure), and their students (individual characteristics), included in the database as of 2009. Although this database does not have data that identifies the students, they can be tracked over time using a random and unique I.D provided by the Ministry of Education when the individual is enrolled in the course on his first year. On the following years, the same I.D is used for the same student, if he stays in the same course. Tertiary Education Census is a dataset openly available at INEP's website.

Every year, INEP collects information about all the students that were enrolled that year. As long as they are enrolled or stopped-out, they will keep appearing on the data. When the student graduates or drop-out, he vanishes from the following dataset. When he transfers, the student changes the I.D, so it is not possible to keep tracking him. Based on this information, it was used this I.D to create a panel of students. Since the sample only contains students that entered on the course in 2009, the covariate for the year that the student entered the higher education, available in all datasets, is used to create the covariate time and to keep only the individuals that first enrolled in the course that year.

The variables selected are described below. The table is separated in two parts: The first one shows the covariates used on the Differences in Differences. The second part describes the variables used on the *Propensity Score Matching* (PSM). The choice of the variables was based on the literature about financial aid for college students, present on the first section. The results found in the present analysis are compared with the conclusions of these works (Table 3).

To perform the proposed study, it was selected students from among those who enrolled in presential undergraduate courses in federal universities in 2009, based on the quota system. This approach was selected as these students are potentially the beneficiaries of *Bolsa Permanência*, coming from households with incomes below that of other students. Since there is no information about the students' family income on the Tertiary Education Census, it had to be found a way to select students. The quota variable was considered the best solution to fill this gap. The quota system for federal universities was regulated in 2011 and prior to this moment, each university had its own quota program, but they basically were designated to support Native-Indians, Afro descendant students and individuals from public schools. These students are usually the ones with the worst financial conditions.

These quota students present a different regional distribution compared to the other individuals enrolled in the Brazilian tertiary education. As mentioned before, the southeast was the region that concentrated more students in 2008: 2.5 million, almost 50% of all the students, follow by the south, with 17%. For the quota students in this sample, the northeast concentrated 35%, the south 28% and the center-west, 16%. This can be explained by the universities that had quota systems in 2009: they were concentrated in these regions. This first quota program in a federal university was created in 2004, in the center-west region, in the *Universidade de Brasília* (UNB, 2013).

The study thus compares quota students who receive aid to quota students who do not receive aid. Another point that must be mentioned is that the distribution of students by subject is very similar between the two groups. The area that concentrates more individuals is the “Social Sciences, Business and Law”, with 22.24% of the students that received the aid and 25.24% of those who did not. The second is “Health”, with 19.79% and 16.8%, respectively. The category that has fewer students is “Service”, with 0.88% and 1.16%, respectively.

There are a few limitations of this work that must be mentioned. First, the sample is small: 13,159 individuals, while there were around 5.92 million students in Brazilian's tertiary education in 2012. Also, the sample contains only students from public and federal institutions. So, it is not analyzed individual from neither other kind of public universities – state and city–nor private. Second, the study is also restricted to quota students. For these reasons, the results may not be generalized to all beneficiaries. Third, it is important to note that individuals that are not beneficiaries from the program may already have a higher propensity to give up and therefore may not seek to participate in the program. Also, since the analysis comprehend the first years of the *Bolsa Permanência*, it could have a problem of asymmetric information, and consequently, a selection bias in the students that applied to the benefit. These last two points show that there are also unobserved covariates that can influence the results.

The PNAES's *Bolsa Permanência* was created in 2007, but until 2009 there were few students that received the benefit. Also, the microdata of the *Censo da Educação Superior* became available for the first time in 2009. For this reason the effect of the program will be analyzed after 2010. It is pertinent to explore whether the consolidation of the program -followed by the changes promoted in 2010, as mentioned in page 8 - was followed by a decrease in dropout

Table 4
Descriptive Statistics and Average Test.

	Non-Treated		Treated		Difference		
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error	Pr(T > t)
Sex	0.502	0.004	0.474	0.037	0.027	0.037	0.458
Age	22.65	0.055	21.26	0.289	1.386	0.466	0.003
Disability	0.008	0.0007	0.005	0.005	0.002	0.006	0.699
Accommodation	0.025	0.001	0.318	0.034	-0.293	0.012	0.000
Food	0.104	0.002	0.536	0.037	-0.431	0.023	0.000
Transport	0.006	0.0006	0.269	0.033	-0.263	0.007	0.0008
Work aid	0.015	0.001	0.162	0.027	-0.146	0.009	0.000
Material	0.0007	0.0001	0.002	0.002	-0.002	0.001	0.180
Completion Period	8.563	0.013	7.960	0.127	0.602	0.116	0.000
Paid activity	0.016	0.001	0.039	0.014	-0.022	0.009	0.022
Non-paid activity	0.009	0.0008	0.005	0.005	0.003	0.007	0.613
Licentiate	0.273	0.003	0.207	0.003	0.065	0.033	0.051
Night Class	0.333	0.004	0.393	0.036	-0.060	0.035	0.091
Completion Period	8.562	0.013	7.949	0.127	0.613	0.116	0.000

Source: Authors. Information is taken from INEP (2009a, 2010, 2011 and 2012a, b).

rates among beneficiary students. As mentioned before, students who have suspended their registration, transferred or left the institution are considered dropouts.

Data for descriptive statistics and an average test for the first year of the sample is presented on [Table 4](#). First of all, the average test show that for 7 out of 14 covariates it is possible to reject the alternative hypothesis, which means that the treatment and the control group are similar regarding these characteristics before treatment. The descriptive statistics show the mean and standard error for the covariates used on the Propensity Score Matching and on the Differences-in-Differences. Regarding age, the students who did not receive the benefit are older than the others. The reasons for older students received less may be related to them entering the job market, which unable them to be contemplated with this grant.

The analysis also includes other types of aid offered by PNAES. According to university regulations, most of the institutions allow these benefits to be offered together with *Bolsa Permanência*. The recipients of *Bolsa Permanência* were those who most often received most of all the benefits. Students who did not receive *Bolsa Permanência* received the most aid in the form of food support. As some universities allow students receiving aid to work in course-related activities, it was also looked at whether or not the students had any paid activity. As seen by the average test, there is not a significant difference between both groups. Regarding information about the course (or major), students who did receive the benefit were enrolled in longer length courses.

5. Analysis of results

In order to analyze the *Bolsa Permanência*'s effect on the dropout rate of quota students in tertiary education, three different estimates were made using the Differences in Differences methodology, controlling for fixed effects. The first consists of a simple estimate of fixed effects without covariates, but with bootstrap. The second fixed effects model was estimated without covariates, but weighted using the Propensity Score Matching, drawing on Kernel. The third is similar to the second, but now variables were included that supposedly both influence participation in the program and that may lead to differences between the two groups in terms of the chance of dropout.

The values and signals of the coefficients for dropout rates that were calculated using the Difference in Differences estimate with covariates were largely consistent with those observed in the descriptive statistical analysis. Firstly, most of the benefits that were included have a negative influence on student dropout. These results are in line with Nora's study (1999) which showed that the greatest impediment for students to graduate was their financial situation, or to put it another way, the more resources that students received, the lower their dropout rate.

The activities that were presented here relate to situations in which a quota student participates in activities related to the course such as research, internships or extension work. Whether the work is remunerated or not, involvement with the university leads to a reduction in the possibility of dropping out. This result is, in part, aligned with the findings of [DesJardins et al. \(1999\)](#) who asserted that participating in a program of this type reduces the chance of leaving the course, but only in the first year. The covariates for age and disability had no statistical significance.

The [Table A1](#) on the appendix shows the results for a Probit Differences-in-Differences model and [Table A2](#) shows the results for the marginal effects⁴. The coefficient for the Diff-in-Diff estimator has the same effect on all the models estimated: the treatment has a negative effect on the student dropout. Some covariates presented different results. In the linear model, sex has no statistical significance, but on the probit it has.

When an estimate is made using Difference in Differences and weighted by Propensity Score Matching based on Kernel, consideration is given to the factors that have the greatest influence on the chances of the individual receiving treatment or not. To complement the analysis of these results, it was consulted information that is present in the ENADE database for the years 2013 and 2014, and also made available by INEP. These years were chosen as they are the first that show for each course if the student is a quota student, thereby making it possible to establish a more accurate sample. The main advantage of this database is that it has the most extensive information regarding the socioeconomic situations of the students who carried out the exam.

An analysis of the coefficients presented in [Table 6](#) shows that the sex, night study, disability and licentiate had no statistical significance. Older students have a lower chance of being considered for aid, since a significant proportion of such students work during the day. But if the student receives another kind of aid provided by funds from the PNAES,

⁴ The authors would like to thank the suggestion of one of the reviewers of this paper, that suggested the insertion of this model.

Table 5
Results for the dropout equation and Differences-in-Differences Method, 2009–2012.

Variable	Diff-in-Diff without covariates, fixed effects (Bootstrap)	Diff-in-Diff without Covariates, fixed effects	Diff-in-Diff with Covariates, fixed effects
Sex	–	–	–0.103 (0.202)
Disability	–	–	Omitted
Accommodation	–	–	–0.0002 (0.011)
Transport	–	–	–0.085*** (0.015)
Food	–	–	–0.030*** (0.009)
Work grant	–	–	–0.136*** (0.008)
Material	–	–	Omitted
Paid activity	–	–	–0.107*** (0.008)
Non-paid activity	–	–	–0.115*** (0.009)
Constant	0.019*** (0.004)	0005** (0002)	0.025 (0.094)
Time	0.290*** (0.004)	0.346*** (0.005)	0.364*** (0.005)
Diff-in-Diff	–0.167*** (0028)	–0.223*** (0007)	–0.230*** (0.007)
N	25,794	25,612	25,612

Source: Authors. Information is taken from INEP (2009a, 2010, 2011 and 2012a, b). Standard deviation in brackets.

*p-value below 0.05 significance level.

** p-value below 0.10 significance level.

*** p-value below 0.01 significance level.

Table 6
Results for the equation regarding the chance of receiving the *Bolsa Permanência*–2009–2012.

Treatment	Coefficient	Treatment	Coefficient
Sex	0.025 (0.069)	Food	0.596*** (0.078)
Age	–0.014* (0.007)	Work grant	1.036*** (0.116)
Disability	<i>omitted</i>	Material	1.462 (0.971)
Licentiate (<i>licenciatura</i>)	–0.056 (0.083)	Paid activity	–0.212 (0.185)
Night study	0.123 (0.084)	Non-paid activity	–0.745** (0.364)
Accommodation	0.910*** (0.108)	Completion period	–0.025*** (0.024))
Transport	1.341*** (0.155)	Constant	–2.005*** (0.282)

Source: Authors. Information is taken from INEP (2009a, 2010, 2011 and 2012a, b). Standard deviation in brackets.

* p-value below 0.05 significance level.

** p-value below 0.10 significance level.

*** p-value below 0.01 significance level.

the chance of being considered for the *Bolsa Permanência* increases. These results can be attributed to the individuals' incomes. The sample taken from the 2013 edition of the ENADE for medical students is related to a course that in most institutions is full-time and lasts an average of six years: in this sample, 23.58% of students had a family income of up to three times the minimum wage, with 88.95% of them not working. Across the whole sample, 5.37% received some sort of financial aid from the government to support them during the course, and 75.82% were not employed and received financial help from their family.

For the licentiate (*licenciatura*) and bachelor's degree in physical education, the profile of the students was found to be different. In the first place, these courses are usually offered as morning or evening study. In the case of licentiates, 61.38% of individuals had a family income of up to three times the minimum salary, 30.91% worked and helped to support the family and 38.17% were not employed. Within the overall sample, 12.5% of students did not work and received government aid to pay for their expenses, and 17.18% did not work and were helped by their family. For the bachelor's students, 54.44% had a family income of up to three times the minimum wage and 44.01% did not work. 9.26% of this sample received financial aid from the government and 22.39% received support from their family, while 13.12% worked and supplemented the family income (INEP, 2013, 2014).

The fact that a student has a job means that he or she is unable to study full time, so this might explain why students enrolled in longer courses received less aid. Another finding was that, the younger the students, the greater are their chances of receiving the benefit; as pointed out earlier, older students tend to have a greater chance of being employed, which means it is not possible for them to receive financial aid.

The results presented in Table 5 show that the three methods reveal similar results: quota students who received financial aid dropped out less than the quota students who did not receive aid through the program prior to 2010. The final dropout rate, shown using the Difference-in-Differences method, decreased by about 16–23% with a 1% significance level for the three methods that were applied. This shows that the awarding of the *Bolsa Permanência* contributed towards a reduction in dropout rates among quota students in tertiary education.

The results presented here are consistent with a significant share of the conclusions found in the international literature about benefits awarded to students who are socially vulnerable: individuals who receive some kind of financial aid tend to dropout less from tertiary education. In the USA, Murdock (1989) argued that the main role of student aid programs was to reduce socioeconomic barriers within universities: students who are in a more fragile socioeconomic position manage to enter and remain in graduation courses. Gross et al. (2007) present data showing that financial aid given by universities has an impact on student retention that is positive but moderate, a result which is consistent with that presented by Araújo and Leite (2014). In this latter study, the authors analyzed the *Bolsa Permanência* at the Department of Education and found that students who received this aid also showed lower dropout rates.

The Difference-in-Differences method, weighted using Kernel's Propensity Score Matching, makes it possible to compare individuals who receive common support, allowing for an evaluation of the *Propensity Score Matching* (PSM) method's robustness by means of Rosenbaum's sensitivity model (2002). To do so, two alternatives were presented: rbounds and mhbounds tests, both of which calculate Rosenbaum's limits for an average treatment effect on the treated with no bias between the treated and the control group. Given that the treatment and reply variables are binary, the chosen test was the mhbounds. Consistency can be verified by increasing the gamma variation until it reaches a value that affects the sigma in terms of significance levels. Table 7 shows the results of the changes in the gammas from one to two. Up until level two, no rupture is found to occur. This result shows that there is no bias in the variables that have been omitted for a level of freedom up to 2, which shows that the parameter is robust.

An analysis of the results presented in this section shows that the *Bolsa Permanência* reduces the dropout rates in a sample of quota students from less favorable socioeconomic circumstances. This group not only has to deal with opportunity costs, but also often faces financial difficulties that may influence their decision to abandon tertiary education. Although the dropout rate has decreased around 23% in the last two models, and by almost 17% on the first model, it is not just the cost of the program that should be taken into consideration when it comes to evaluating its cost-benefit.

The positive impacts that the completion of tertiary education can bring to an individual, such as increased salary during their working life, should also be considered among the benefits. Barbosa Filho and Pessoa's study (2008) showed the increase in salary resulting from tertiary education to be high, despite the fact that it had declined in recent years due to the rise in the number of university enrollments. Society can also benefit from this investment by means of the positive externalities that arise, such as increased productivity. As such, financial aid for such students can be

Table 7
Results–Rosenbaum’s sensitivity test.

Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-	Gamma	Q_mh+	Q_mh-	p_mh+	p_mh-
1	5.06128	5.06128	2.1e-07	2.1e-07	1.52	7.37172	2.96843	8.4e-14	.001497
1.04	5.26715	4.85751	6.9e-08	5.9e-07	1.56	7.52431	2.84372	2.7e-14	.002229
1.08	5.46702	4.66307	2.3e-08	1.6e-06	1.6	7.67421	2.72263	8.3e-15	.003238
1.12	5.66142	4.47723	7.5e-09	3.8e-06	1.64	7.82155	2.60494	2.6e-15	.004595
1.16	5.85072	4.2993	2.4e-09	8.6e-06	1.68	7.96644	2.49047	7.8e-16	.006379
1.2	6.03527	4.12863	7.9e-10	.000018	1.72	8.10899	2.37903	2.2e-16	.008679
1.24	6.21537	3.96467	2.6e-10	.000037	1.76	8.2493	2.27048	1.1e-16	.011589
1.28	6.39129	3.80692	8.2e-11	.00007	1.8	8.38747	2.16465	0	.015207
1.32	6.5633	3.65492	2.6e-11	.000129	1.84	8.52358	2.0614	0	.019632
1.36	6.7316	3.50827	8.4e-12	.000226	1.88	8.65771	1.96062	0	.024962
1.4	6.89641	3.36662	2.7e-12	.00038	1.92	8.78995	1.86218	0	.031289
1.44	7.05793	3.22962	8.4e-13	.00062	1.96	8.92036	1.76596	0	.038701
1.48	7.21631	3.09698	2.7e-13	.000978	2	9.04901	1.67187	0	.047275

Source: authors. Data obtained from INEP (2009a, 2010, 2011 and 2012a, b).

considered an effective mean of reducing dropout rates and increasing the quantity of trained professionals in the work market.

6. Final considerations

The institutional changes that occurred in the latter part of the 1990’s through the creation of a number of programs including REUNI, FIES and PROUNI had the aim of creating a more accessible tertiary education system and ensuring that people in positions of greater socioeconomic vulnerability could receive such an education. In this case it was the REUNI measures that were assessed given their impact on the quantity of institutions established outside of large centers and the increase in the numbers of places in public universities.

However, it is not sufficient just to create the necessary conditions for individuals to enter higher education. After completing a graduation course, students must cover their costs for participating in this sphere - financial or opportunity costs. Differences in the quality of teaching that they received prior to entering higher education should also be taken into consideration. This context means that students from low income families may find it harder to support themselves and to reach the end of their course.

It is important to notice that the years before and during the period that comprehends this study, many institutional changes happened, and those could have affected the results. The quota system became the same for every college, the number of students in higher education raised significantly and the government created a new process for students to access these institutions: the *Sistema de Seleção Unificado* (Sisu). Consequently, the new profile of individuals that enrolled in the higher education could have caused a higher demand for financial aid.

Brazil not only has relatively low levels of enrollment in tertiary education but is also faced with high dropout rates. The establishment of programs such as PNAES are part of an attempt to address these issues: providing different types of financial aid is a mean of addressing students’ financial difficulties during the course. This debate has been going on for some time in other countries, but is something that has received relatively little attention in Brazil. The objective of this paper, then, was to analyze one of these approaches to financial aid – the *Bolsa Permanência* offered through funding from PNAES – using difference in differences and to see if it had an effect on the dropout rate for quota students who are enrolled in graduate courses at federal institutions, when compared with students in the same system who had not received the same benefit.

The results show that the probability of receiving financial aid varies in accordance to the student’s sex and age: women have a greater chance of receiving the benefit, while older students have a lower chance. The proportion of women in higher education is greater than that of men. As age increases, the chance of the individual having started work also rise, thereby reducing his or her chance of being awarded aid.

Furthermore, the dropout rate of students who had received financial aid was lower than that of others, thereby increasing the chance that students from lower income families would complete their course. In other words, the measure can reduce the social cost of dropping out and give rise to positive externalities in relation to increased worker

productivity and the correction of possible distortions arising from the quota system and the increase in the number of places that only guarantee access and not that the student remains in higher education. For this reason, meeting the financial needs of students is important, but other factors, such as shortcomings in primary education, may also have an influence on increasing the dropout rate.

Appendix A.

Table A1
Results for the dropout equation and Differences-in-Differences Method, 2009–2012, Probit Model.

Variable	Diff-in-Diff without Covariates	Diff-in-Diff without Covariates, with inverse_pscore	Diff-in-Diff with Covariates and inverse_pscore
Sex	–	–	–0.133*** (0.024)
Disability	–	–	–0.194 (0.496)
Accommodation	–	–	–0.709*** (0.121)
Transport	–	–	–0.319** (0.161)
Food	–	–	0.470*** (0.062)
Work grant	–	–	–0.343*** (0.047)
Material	–	–	–1.438* (0.759)
Paid activity	–	–	–0.156* (0.070)
Non-paid activity	–	–	–0.515*** (0.043)
Constant	–1.779*** (0.020)	–1.770*** (0.024)	–1.617*** (0.023)
Time	1.225*** (0.023)	1.301*** (0.029)	1.333*** (0.024)
Diff-in-Diff	–0.607***	–0.942***	–0.456***
N	25,794	25,794	25,794

Source: Authors. Information is taken from INEP (2009a, 2010, 2011 and 2012a, b). Standard deviation in brackets.

* p-value below 0.05 significance level.

** p-value below 0.10 significance level.

*** p-value below 0.01 significance level.

Table A2
Results for the dropout equation and Differences-in-Differences Method, 2009–2012, Probit Model – Marginal Effects.

Variable	Diff-in-Diff without Covariates	Diff-in-Diff without Covariates, with inverse_pscore	Diff-in-Diff with Covariates and inverse_pscore
Sex	–	–	–0.025*** (0.003)
Disability	–	–	–0.036 (0.094)
Accommodation	–	–	–0.134*** (0.023)
Transport	–	–	–0.060** (0.030)
Food	–	–	–0.089*** (0.012)
Work grant	–	–	–0.053*** (0.006)
Material	–	–	–0.273* (0.144)
Paid activity	–	–	–0.029* (0.013)
Non-paid activity	–	–	–0.097*** (0.008)
Time	0.251*** (0.004)	0.280*** (0.006)	0.264*** (0.004)
Diff-in-Diff	–0.082*** (0.009)	–0.108*** (0.06)	–0.064*** (0.126)
N	25,794	25,794	25,794

Source: Authors. Information is taken from INEP (2009a, 2010, 2011 and 2012a, b). Standard deviation in brackets.

* p-value below 0.05 significance level.

** p-value below 0.10 significance level.

*** p-value below 0.01 significance level.

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