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PRISCILLA BACALHAU VELLOSO DA SILVEIRA

THE ECONOMIC BENEFITS OF HIGHER EDUCATION: FROM HIGH SCHOOL TO LABOR MARKET

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Tese apresentada à Escola de Economia de São Paulo da Fundação Getulio Vargas como requisito para a obtenção do título de Doutora em Economia

Orientador: Enlinson Henrique Carvalho de Mattos

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ABSTRACT

Attaining tertiary education has noteworthy implications for both individuals and society. This thesis is composed of three essays related to Economics of Education. The first chapter investigates whether the informational barriers prevent young students from completing high school and starting higher education, by performing an evaluation of a corporate volunteer program that aims to inform students about the benefits of finishing this level of education. The second chapter estimates the returns to college quality and to individual abilities on early career outcomes in Brazil. A new measure of the signal for college quality is proposed for these estimates. The third and last chapter performs a cost-effectiveness analysis of the public provision of higher education compared to private provision in Brazil.

Key-words: returns to education, informational barrier, signaling, college quality, cost-effectiveness, public higher education institution

RESUMO

Completar um curso de ensino superior tem implicações notáveis para os indivíduos e para a sociedade. Esta tese é composta por três ensaios relacionados à Economia da Educação. O primeiro capítulo investiga se as barreiras informacionais impedem que os jovens concluam o ensino médio e iniciem o ensino superior, realizando uma avaliação de um programa de voluntariado corporativo que visa informar os jovens sobre os benefícios de terminar esse nível de ensino. O segundo capítulo estima o retorno à qualidade da faculdade e às habilidades individuais nos resultados iniciais de carreira no Brasil. Uma nova medida do sinal de qualidade do ensino superior é proposta para essas estimativas. O terceiro e último capítulo realiza uma análise de custo-efetividade da provisão pública de ensino superior comparada à provisão privada no Brasil.

Palavras-chave: retornos à educação, barreira à informação, sinalização, qualidade da faculdade, custo-efetividade, instituição pública de ensino superior

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INTRODUCTION

Attaining tertiary education has noteworthy implications for both individuals and society. At the individual level, the college wage premium is a relevant benefit, especially in developing countries. For society, a more educated population leads to economic growth and social improvements. However, various barriers to transitioning to college may emerge, including financial and informational ones. For those individuals who do access higher education, the quality of the institutions, and its variability, can also affect returns, which would then lead to distributional issues. Due to potential externalities effects associated with higher education provision, public expenditures in higher education should be carefully analyzed and made efficiently. This thesis presents three empirical essays on different aspects of accessing and benefiting from higher education. By providing empirical evidence for Brazil, my work contributes to the literature on higher education and the public debate on this matter, which is central not only for Brazil, as a developing and unequal country, but also to the world.

The first chapter evaluates a corporate volunteer program in Brazil that aims to inform young students in public high schools about the benefits of finishing the secondary level of schooling. By presenting the returns to education, the program seeks to reduce dropout rates and motivate the students to apply for college. The results suggest that the students involved in the program do not have all available information about the process of applying for college. However, there is no robust evidence of effects on school dropout and the proportion of college applications.

The second chapter estimates the returns to college quality and to individual abilities on early career outcomes in Brazil, contributing to this literature on developing countries. We propose a new measure of college reputation: the performance of the previous cohort that has graduated three years before the individual in the same institution and major. The results indicate that the percentage of the previous cohort graduates who are employed two years after their graduation is a relevant predictive variable of both employability and earnings in the formal sector up to eight years after the individual's graduation.

The third and last chapter performs a cost-effectiveness analysis of public higher education institutions compared to private ones in Brazil. Considering the primary input for human capital accumulation in the tertiary level comes from the instruction provided by the professors, we use the total faculty wage bill as the cost of the investment in each institution. Our results indicate that the public faculty wage expenditure per pupil predicts total individual earnings, conditional on individual's college entrance test scores.

Part I
"Done with High School. What's next?": Informational barrier to college

1 "DONE WITH HIGH SCHOOL. WHAT'S NEXT?": INFORMATIONAL BARRIER TO COLLEGE

Abstract

This paper evaluates a corporate volunteer program in Brazil that aims to inform young students in public high schools about the benefits of finishing this level of education. The program seeks to reduce dropout rates and motivate the students to apply for college, by presenting the returns to schooling through several mechanisms - a role model approach, games, discussing concepts, and mentoring. There is a growing body of literature on the many factors that prevent youth from choosing to continue their education. In particular, other than financial constraints, the uncertainty and incomplete information about the costs and lifelong benefits of attending college may emerge as a barrier. Young people may not make decisions about either continuing their education or entering the job market based on all available information. I find evidence that the students involved in the program do not have all information available about the process of applying to college. However, aligned to the literature on higher-income developing countries, there is some evidence that the program decreased the likelihood of school dropout among students in the first year of high school, but no evidence that the program increased college applications.

Keywords: high school completion, access to college, informational barrier, impact evaluation.

1.1 INTRODUCTION

Although developing countries have seen an increase in access to primary and secondary school in the past few decades, the completion rates and subsequent access to higher education are still far from universal. There is a growing body of literature on the many factors that prevent youth from choosing to continue their education. In particular, other than financial constraints, behavioral barriers may emerge, such as lack of information. Young people make decisions about either continuing their education or entering the job market may not be based on all available information.

This paper evaluates a corporate volunteer program in Brazil to inform young students in public high schools about the benefits of finishing high school and the possibilities after completing this stage. As part of the program, the volunteers assist the students in the development of a life plan. The program relies on the premise that often young students in disadvantaged schools, likely to drop out, do not receive enough external motivation to engage in studies, and they do not have information about the returns to education and the required steps to reach more advanced stages of schooling. By presenting the returns to education, the volunteers seek to reduce the dropout rates and motivate the students to apply for college. This study presents two independent analyses. First, I investigate to what extent the students in the intervention are aware of the process of applying for college. Second, I examine the effects of participating in the intervention, in the school level, on dropout rates and participation in college admission exam. This is the first evaluation of the program. Subsequently, this study aims to contribute to the body of literature on the barriers to attending college with a focus on vulnerable neighborhoods in developing countries.

The age group formally appropriated to continue with higher education, from 18 to 24 years, is the one with the highest proportion of young people who neither work nor study. In Brazil, 27.4% of individuals in this age group were neither in employment nor in education nor in training (NEET) (IBGE, 2016). In Latin America, this proportion is 19%, and most of these youth are in the bottom 40 percent of the income distribution (HOYOS; ROGERS; SZéKELY, 2016). Besides the NEET group, there is a subgroup of young people that only work. Together, these two categories add up to almost 70% of the Brazilian youth population between 18 and 24 years old that are not continuing their education. The transition between high school and adulthood - whether going to post-secondary education or entering the labor market - involves a series of decisions that young people need to make, taking into account the expected investment returns to each year of schooling. During the last stage of secondary education, young people need to decide on their next steps based on available information and financial constraints that impel them to enter the labor market.

The upper secondary education, especially the public schools, is still a major constraint of the Brazilian system. This stage exhibits the lowest promotion rates across grades and the highest dropout rates. Between 2014 and 2015, the promotion rate for high school was 76.3%,

compared to 80.9% and 90.3% in the initial and final years of middle school, respectively (INEP, 2017). In addition, the high school dropout rate was 11.2% in the same period, six percentage points more than in the previous grades. For the public schools in the states' system, the dropout rate reaches 12.4%.

Various factors may explain the high dropout rates of the school-age youth. The determinants to go through impediments beyond the will of the young - immediate financial needs, lack of engagement due to the low perception of quality and importance of education, lack of support, or even a lack of information about the returns of education. For those who complete high school, these same factors can also affect their decision to continue with higher education or to enter the job market.

The returns to attending higher education institutions have been proven to be positive for both pecuniary and nonpecuniary outcomes, like health outcomes, geographical mobility, and competitive marriage markets[1]. Chen (2018) finds evidence for developing countries that those who attend college experience a faster rate of transition to work. Although there is a decreasing pattern on the returns to education attainment over time (MONTENEGRO; PATRINOS, 2014), the share of the population, especially in developing countries, who attains the tertiary level is still low, which associated to the large labor returns may aggravate inequalities. In Brazil, achieving a bachelor's degree provides over 2.4 times larger earnings than stopping at the upper secondary education, while this gap for the average of OECD countries is 1.5 times (OECD (2017) and similar results are presented in Barbosa-Filho e Pessôa (2008) and Barros (2017) for Brazil). Teixeira e Menezes-Filho (2012) find that one year of schooling contributes to between 6 and 12% of the individual's income. The unemployment inequality is also significant in Brazil: an adult who attended higher education is 40% less likely to be unemployed than someone who only completed high school (OECD, 2017).

Positive returns to schooling also emerge for those who complete vocational education in Brazil. Nastari (2015) explores the wage premium associated with this level and finds that the vocational certificate increases the chances of employment compared to the workers who have only completed high school (a 1.6 percentage points increase). The premium increases to 2.4 percentage points if, in addition to the vocational education, the individual also holds a higher education degree.

According to the human capital theory, a young individual could consider these differentials of return in their decision-making process of investing in more schooling, both in the entrance and completion of high school and in proceeding to post-secondary education. However, the returns to education are not always perfectly perceived by individuals. According to Manski (1993), without the understanding of expectations, it is neither possible to interpret the behavior of acquisition of schooling nor measure returns to education. In French and Oreopou-

[1] See Oreopoulos e Petronijevic (2013) and Barrow e Malamud (2015) for reviews on the returns to higher education.

los' 2017 review on the behavioral barriers transitioning to college, the authors claim that youth are worse than adults at evaluating decisions with long-term consequences. Together with high monetary and non-monetary costs of school, myopic preferences, low motivation and social influences, this lack of information may influence the youth's decision to invest in schooling (BARROS, 2017; FRENCH; OREOPOULOS, 2017; HOYOS; ROGERS; SZéKELY, 2016).

Due to the uncertainty and possibly incomplete information about the costs and lifelong benefits of attending college, there is an emerging body of literature on the effects of providing accurate information to youth on the investments in human capital. The simple intervention of providing information on the net-benefits of attending college has been proven to raise students' awareness of the true expected returns to a college education (DINKELMAN; MARTíNEZ, 2014; FRYER, 2016; JENSEN, 2010; OREOPOULOS; DUNN, 2013; MCGUIGAN; MCNALLY; WYNESS, 2016). Besides, it can increase school attendance, at least in developing countries (JENSEN, 2010; NGUYEN, 2008). These types of interventions, many of them with experimental designs, have been held all around the globe, in places like the United States (BETTINGER et al., 2012; FRYER, 2016; HOXBY; TURNER, 2013), Canada (OREOPOULOS; DUNN, 2013), the United Kingdom (MCGUIGAN; MCNALLY; WYNESS, 2016), Finland (KERR et al., 2015), Chile (BUSSO et al., 2017; DINKELMAN; MARTíNEZ, 2014; HASTINGS; NEILSON; ZIMMERMAN, 2015), Madagascar (NGUYEN, 2008) and the Dominican Republic (JENSEN, 2010).

These interventions use an array of approaches to provide accurate information on the benefits of education, that might interfere with the following results. For instance, (NGUYEN, 2008) holds an experiment in Madagascar, in which she provides information about the returns to education for the students and their parents in disadvantaged contexts. She exploits two alternative ways to provide additional information during a teacher-parent meeting: a person sharing her life story (a role model's speech) or by providing statistics on schooling returns. In this framework, she finds a rise in the school attendance and performance due to the increasing perceived returns to education when agents underestimate the actual returns, but only in the first months of the intervention. The evidence points out that representative matters: if the speaker (acting as a role model) is from a poor background, there is a positive impact of 0.27 standard deviations on the poor students' test scores.

Without making use of the role model approach, Jensen (2010) develops an intervention and experimental evaluation to measure the impact of providing information to high school students in the Dominican Republic. He explores the differences between actual returns and returns perceived by young people, indicating that the lack of access to information may affect their decisions to continue in school. The intervention consists of presenting a sheet to high school students containing information on average salaries by level of schooling. The results indicate that receiving this information about the returns to education raises schooling: students

at treated schools completed between 0.20 and 0.35 more years of schooling than those who did not receive the information.

Similar to Jensen (2010), an experiment with upper secondary students was held in Mexico, finding no effect on dropout rates (AVITABILE; HOYOS, 2015). They suggest that information-providing-only treatment could be sufficient only in low-income countries since in higher income countries the higher probability of finding a job could lead to increased dropout rates. Hoyos, Rogers e Székely (2016) suggest that information-providing-only interventions are more likely to work best where students are initially less informed. As the evidence for Mexico, recent studies in Chile on providing information about the returns to college attendance do not show positive effects on college enrollment rates(BUSSO et al., 2017; HASTINGS; NEILSON; ZIMMERMAN, 2015)[2].

Also for developed countries, the evidence shows that information-providing-only interventions are less effective. For instance, in the United States, several experimental studies have found no impact on college enrollment decisions of interventions that communicate to the students the link between human capital investment and future outcomes (BETTINGER et al., 2012; FRYER, 2016; HOXBY; TURNER, 2013). On the other hand, interventions carried out in Canada (OREOPOULOS; DUNN, 2013), the United Kingdom (MCGUIGAN; MCNALLY; WYNESS, 2016) and also Chile (DINKELMAN; MARTíNEZ, 2014) provide information about the costs and benefits of school by exhibiting a video to the students. Besides raising student awareness of the real expected returns to college, they find positive impacts on student ambitions to pursue post-secondary education.

Another type of information that the students may not be aware of, besides the real expected returns of high school and college, is the whole process to apply and enroll in college. In fact, even if the students aspire to attend college, many of them fail to complete a college application (RODERICK et al., 2009). One reason for this incomplete step can be the complexity of the college application process, especially for students from disadvantaged schools and students that may be the first generation in their families with the possibility to access post-secondary education. This lack of awareness about the steps of applying to college may also cause an undermatching between students and colleges: high-achieving students from low-income families tend not to apply to selective colleges, even when it would be less costly to them (DILLON; SMITH, 2017; HOXBY; AVERY, 2013; RODERICK et al., 2009; SMITH; PENDER; HOWELL, 2013). Nevertheless, a yet less desired scenario is when students who potentially would benefit from continuing schooling do not apply to any college because they are not aware of the college-process.

[2] While Busso et al. (2017) send emails to high school senior students about financial aid and the expected returns of selective and less selective colleges, Hastings, Neilson e Zimmerman (2015) provide information about expected earnings and program costs for the chosen program and alternative ones, only for those who had applied to college.

Programs designed to guide students through the process of college search and applications had increased enrollment in college (AVERY, 2013; BETTINGER et al., 2012; CARRELL; SACERDOTE, 2013; CASTLEMAN; GOODMAN, 2014) and increased the number of high-achieving students that apply for more selective colleges (AVERY, 2012; AVERY, 2013; HOXBY; TURNER, 2013). Bos et al.'s (2012) intervention also shows positive effects in California, where near-aged peers provide advice to students, while Dinkelman e Martínez (2014) used a 15-minute video to provide information explaining student eligibility for financial aid in Chile. Moreover, even programs in which the intervention consists only in nudging senior-year high-school students through text messages or emails about the steps needed to complete financial aid applications increased college enrollment (BIRD et al., 2017). By finding a significant impact related to college application fee waivers instead of personalized assistance in the process, Oreopoulos e Ford (2016) suggest that fine details in the implementation of an intervention matter significantly.

The success of such programs seems to shed light to the relevance of context for the success of any program that aims to shed light on the returns to education for prospective college students: how information is provided matters, who provides it matters and whether the young students are willing to absorb it matters. For instance, specifically for senior-year high school students who had expressed interest in attending college but had not yet applied, Carrell e Sacerdote (2017) test the effects of three alternative types of treatment: students in the program received either a mentor, or a cash bonus for completing the application process, or application fee waivers. The mentoring treatment, for example, increased enrollment into college only for women.

Finally, there is evidence that the lack of financial resources is also a barrier to transitioning to college, although not the only one (BETTINGER et al., 2012; BULMAN et al., 2016; DINKELMAN; MARTíNEZ, 2014). For the case there is no financial aid available for the families whose children cannot afford attending college, the literature has still not elucidated the extension of the financial barrier.

The volunteer program that I analyze in this paper uses several mechanisms aiming to achieve the goals: a role model approach, games to provide information and discuss concepts, and mentoring. I find evidence that the students involved in the program do not have all information available about the process to apply to college. However, aligned to the literature on higher-income developing countries, there is some evidence that the program decreased the likelihood of school dropout among students in the first year of high school, but no evidence that the program increased college applications. Therefore, this paper contributes to the increasing literature on the informational and behavioral barriers to transitioning to college.

The remainder of this paper is organized as follows: section 1.2 explains the mechanisms of the program, section 1.3 explores a survey of students to present evidence on the lack

of information, section 1.4 proposes an evaluation of the effects of the program on dropout rates and college admission exam participation, and section 1.5 concludes the paper.

1.2 CORPORATE VOLUNTEER PROGRAM

The corporate volunteer program has started in 2010 and is carried out in public high schools in Brazil in schools located at peripherical regions of the municipalities. The meetings with the students always occur during night classes, which are believed to comprise the most vulnerable students. The program consists of providing to the students attending these classes information on the benefits of completing high school and the possibilities after the conclusion of this stage. A large bank institution has developed and is responsible for the program. The volunteers include employees of the bank institution and their guests. During the intervention in the schools, the volunteers discuss with the students an array of concepts, such as the relationship between today's decisions and future consequences, the steps required for the students to continue their studies, the links between education and future earnings and employability, and important factors to success. They are also asked to share their successful professional trajectories with the students, highlighting the role of education in it.

The institution responsible for the intervention establishes a partnership with the state education system. Schools are invited to participate, respecting priority criteria: the program prioritizes inviting schools that present higher dropout rates in high school grades. The rationale is to offer the program for the schools that need the most, which means higher dropout rates, usually associated with other disadvantaged characteristics. The served schools must be no more than 20 km away from the volunteers' meeting place for logistical constraints. In order to get the intervention, the school administration has to join the program and accept the terms, at no cost to the school. In this sense, one may expect to find selection bias in the treated schools, since the schools that end up receiving the intervention have accepted to participate in, besides serving low-income communities.

For the volunteer, the process takes place in three stages: signing up, training and acting. In the signing up stage, the bank employees and their guests voluntarily join the program, through an online platform. During the signing-up period, the bank advertises the program for its employees, enhancing its direct expected results: improving students' motivation towards school and volunteers' sense of accomplishment. It is emphasized that it is a volunteer program, meaning that it takes place out of the working hours. Thus, the meetings in the school take place exclusively in the evening - out of the volunteers' working hours.

All volunteers, including the guests, undergo prior training and access the full supporting material for the intervention. The training lecture takes 3 hours, also on a chosen evening or on a Saturday. The volunteers receive explanations about the objectives of the intervention and instructions for using the supporting material. They are also guided through how to behave in case of many possible kinds of conflicts in the school and anticipating possible problems that may arise throughout the interaction with the students. Most importantly, volunteers receive the orientation that they must tell their life trajectories to the students as a way to stimulate reflection on the importance of completing high school. Volunteers are strongly encouraged to bond

with students through this exchange of experiences, thus serving as role models to the students. If they succeed in building this relationship, the young students may connect with the volunteers and thus be open to listening to the information the volunteers are going to provide during the two meetings.

During the training, the volunteers divide themselves into groups of three or four people. Then, the program management assigns each group to a specific class of a participating school, in one of the three high school grades. Because the highest dropout rates in secondary schools in Brazil happen in the freshman year, the program prioritizes this grade to receive the volunteers, but the sophomore and senior years are also incorporated, depending on the number of volunteers available.

Finally, on the selected days, the bank institution responsible for the program provides transportation to each school, usually located in some peripheral region of the capital. The intervention takes place in the classroom in the evening, for two meetings in the same class. Each meeting lasts 3 hours, and there is a lag of at least two weeks between meetings. The school does not previously announce the intervention to the students, so they are in school on the night of the meeting, but they expect to attend a regular class until the moment the volunteers get into the classroom. The bank institution makes this strong recommendation to the schools, based on the anecdotal evidence that the students would miss the meeting if they knew it would not be a regular class. In the classroom, during these two meetings, the volunteers engage in group dynamics exercises, games, conversations, and life-story exchanges with the students, following the instructions and planned activities from the training they have attended.

In the first meeting, volunteers should tell their life trajectories to the students as a way to stimulate reflection on the importance of finishing high school. In addition to the volunteers' life trajectory, they play a board game specially developed for this activity. Through this game, the students access several examples that relate individual decisions with consequences. The volunteers shall emphasize the positive relationship between studies and employability. After the first meeting, it is expected that the students can:

1. understand the relationship between today's decisions and future consequences;
2. and understand the relationship between schooling, employability, and income.

In the second meeting, the volunteers return to the same classroom. The students already know the visitors, and the meeting is supposedly easier to handle by the volunteers. They present and discuss several educational and professional opportunities the students will access after completing high school. To support this activity, volunteers present to the students a card game included in the material for this meeting. The game shows various careers and their characteristics, such as required qualification, expected wages, and skills involved, highlighting the link between studies and future outcomes. The information that the game provides is a way to

motivate the students to conclude this level of education, in order to access further opportunities and higher income. Besides the game and its discussion, the volunteers guide the students in drawing up a life map for the next five years, considering that knowledge and information are essential to project the future. The material is also provided as part of the program. Through this life mapping exercise, the students are invited - and challenged - to think about their future, their goals and the steps they will have to take to accomplish these goals. Finally, the volunteers also provide during this meeting an orientation guide on professional and educational trajectories. In this guide that the students take home, they will find information on the various degrees options, websites to research and apply to college, vocational schools options and training classes for work, among other information. It is expected that the students may, by the end of this meeting:

1. understand the relationship between commitment and success;
2. know the ways and steps to continue the studies and begin to develop a small life mapping;
3. understand that school is relevant for personal development and insertion in the world of work.

The program has already taken place in five states in Brazil. The locality with the most substantial number of volunteers and the most durable partnership is the São Paulo state, where there are 104 schools involved between 2010 and 2015 in the metropolitan region of the capital.

Table 1.1 presents the numbers referring to the coverage of the program in the São Paulo region. There is a priority for 1st-grade high school classes since they have the highest dropout rates. The number of schools and classes that are effectively served by the program depends not only on the initial invitation acceptance of the school but also on factors such as teachers' strikes, violent situations and the number of volunteers available for action. Thus, sometimes schools that have joined the program may not receive it that year. However, this information, which could be used to correct a school selection bias, is not documented over time.

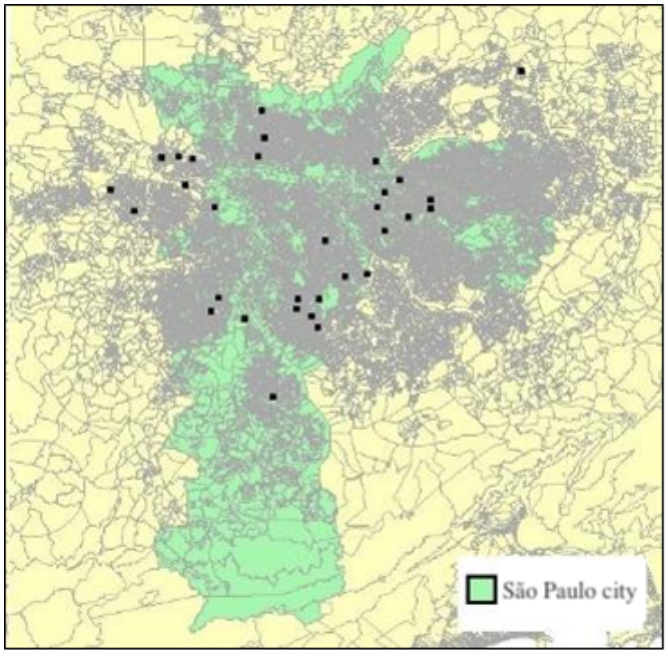
As a representation of the geographical distribution of the treated schools in São Paulo state, the map in Figure 1.1 represents those schools in 2014. From the total of 31 treated schools, 24 are located on the periphery of the capital, half of them in the South Zone, seven in the East Zone, four in the West and one in the North. The other seven schools are in the cities of Osasco, Carapicuíba, and Guarulhos, part of the metropolitan area of São Paulo.

Table 1.1: Number of volunteers and participating schools, São Paulo State District, metropolitan region

	2010(1)	2011(2)	2012	2013	2014	2015
Volunteers						
Signed up			1175	2404	1371	1261
Trained			663	1545	933	918
Present			578	1265	765	772
Schools	11	24	36	45	31	41
Classrooms	61	168	436	782	212	209
1st grade HS	57	76	125	288	90	88
2nd grade HS	0	33	93	244	79	83
3rd grade HS	4	59	218	250	43	38
Students(2)	1220	3360	7175	13720	6240	6270

Source: Administrative data of the program.
(1) In 2010 and 2011, the administrative records of the program are not complete, so it is not possible to determine the number of volunteers involved.
(2) The number of students benefited for these years is estimated considering 20 students per class

Figure 1.1: Program coverage in 2014



Source: Administrative records of the program.

1.3 LACK OF INFORMATION AND STUDENT'S ASPIRATION

The literature on behavioral barriers transitioning to college suggests that the lack of information on the returns and on the college application process affects the decision to apply. There is evidence that information-providing-only interventions are less effective to increase college applications. Moreover, the approach used to provide the information may also interfere. As exposed in the last section, the program evaluated in this paper uses several mechanisms - role model approach, games, discussing concepts, and mentoring - to inform and motivate the students. In this section, I investigate whether the students that participate in the intervention are not aware of the process of applying for college.

In order to gather evidence on the fact that students lack information on the benefits of finishing high school, I exploit a survey that was conducted with the students in the intervention. Only the students who were present at the first meeting answered the questionnaire. Since the students are not informed about the intervention, we assume the absent students were a random case. There is no available information for students or schools that did not participate in the intervention.

The questionnaire was carried out in 2014[3] and covered 4,720 students in 33 schools: 30 in São Paulo[4] and 3 in Rio de Janeiro[5]. The volunteers were responsible for presenting the questionnaire to the students at the end of the first meeting. They explained to the students that it was an opinion survey about the activity they had just experienced and aimed primarily at collecting their expectations about school and future perspectives, as well as evaluating the volunteer program.

The students answered the anonymous questionnaire at the end of the first meeting, i.e., after they had the first contact with the volunteers. That means the students had heard about the volunteers' life trajectories and had reflected on the relationship between studies, employability, and income.

The demographics of the group of young people surveyed is 46% female students. The age-grade distortion does not affect the mean age in each grade, which corresponds to the appropriate one: 15 years old in the 1st grade, 16 in the 2nd grade, and 17 years in the last grade of high school. Table 1.2 shows the number of respondents per grade and the average of some of the measured variables. Due to the program target, it is possible to observe the higher volume of students in the initial grade. This is equivalent to the distribution of the number of classrooms that receive the intervention in each grade, according to Table 1.1.

[3] The questionnaire is presented in Annex A.

[4] In one of the treated schools in São Paulo, it was not possible to apply the questionnaire due to the lack of time by the end of the meeting schedule.

[5] Three state schools in the city of Rio de Janeiro / RJ also participated in this research. There was a total of 8 classrooms and 156 respondent students, all of them in the 1st grade.

However, there are significant differences in the profile of the students according to their grades. The first variable indicates the percentage of students who declare that they have already been held back one year in school due to dropping out. In this indicator, 28% of the students in the 1st grade report that they were held back from the previous year due to dropping out, while less than one-fifth of the other grades fit into this profile. This result is consistent with the differences in dropout rates in Brazil, which are lower for the final grades in this education level.

Table 1.2: Survey: Descriptive statistics for the 33 participant schools

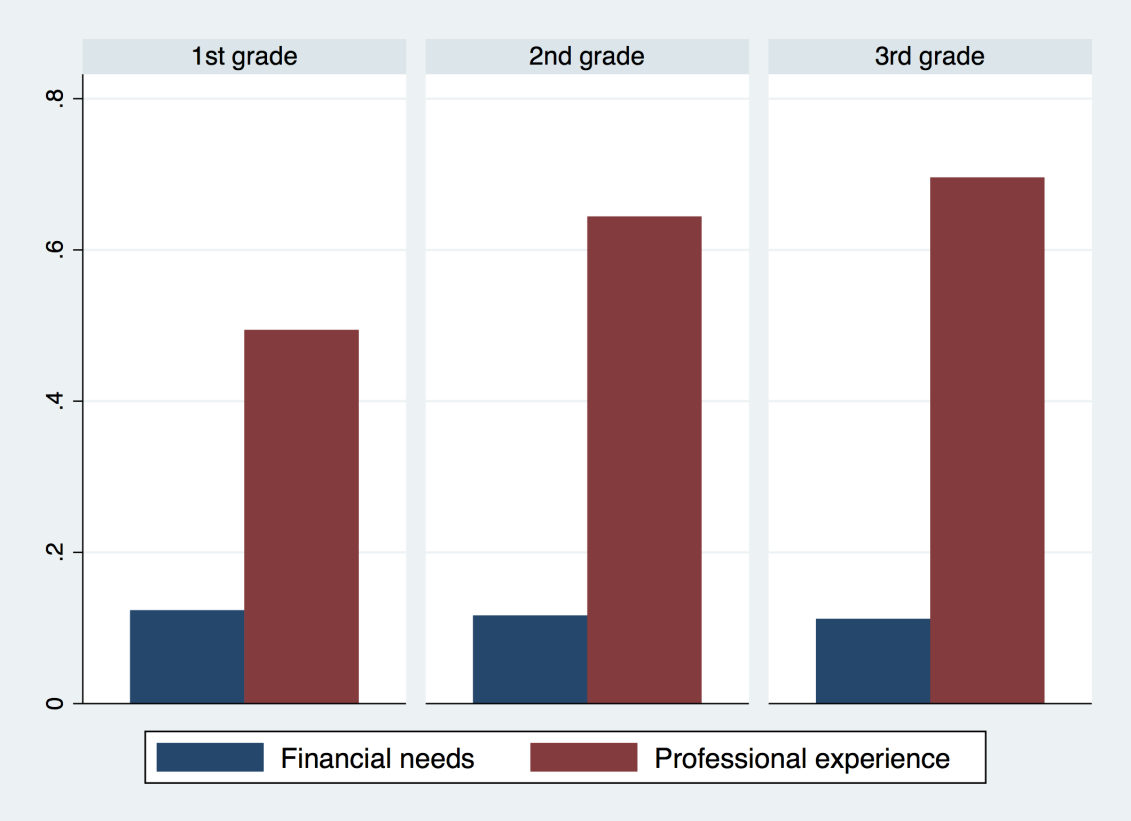
	Number of students	Held back due dropout[1]	Working[2]	Intention *ENEM*[3]	Intention College[4]
1st grade HS	2114	28%	30%	58%	81%
2nd grade HS	1541	18%	46%	65%	87%
3rd grade HS	1065	19%	60%	76%	90%
Total	4720	23%	42%	64%	85%

(1) Question in the survey: "Have you missed the year because you dropped out of school (for giving up attending classes)?"
(2) Question in the survey: "Do you currently work?"
(3) Question in the survey: "Do you intend to take ENEM?"
(4) Question in the survey: "Do you intend to go to college?"

In the questionnaire, the students answered whether they had an occupation at the time of the volunteer program. 60% of the 3rd-grade students answered yes, twice the proportion of the 1st-grade students. The difference between grades is expected: as the high school completion gets closer, older students are more likely to enter the job market. It is relevant to look at the reasons the students claim for working while still studying in high school, especially in the context of this program. It is important to remember that the treated schools are public schools, presenting high dropout rates, in regions of high vulnerability, and these students attend night classes exclusively. In this context, it could be argued that students seek the night classes due to the need to work since they face less privileged socioeconomic status. The immediate financial needs could then be pointed out as a relevant reason to drive students out of high school or eventually out of higher education. However, those students who claimed to be working do not relate to the need to provide at home as the main reason to be working. The main reason for all grades, but especially for the 3rd grade, is gaining professional experience and investing in the future (see Figure 1.2). There is no variation across grades in the proportion of students who claim to work to financially support at home: approximately 11%. On the other hand, the proportion of students who declare to work aiming to gain professional experience increases throughout high school: 48% in the first grade and 69% in the concluding grade. Therefore, there is a growing concern with professional experience and their future, facing the imminent completion of secondary education. However, financial constraints do not show up as the main reason that would stop the youth to seek higher education.

Other than the reasons to work, the questionnaire also investigated the link the youth make between work and study. They were asked about what are the most relevant determinants

Figure 1.2: Youth and work: reasons to work, by high school grades



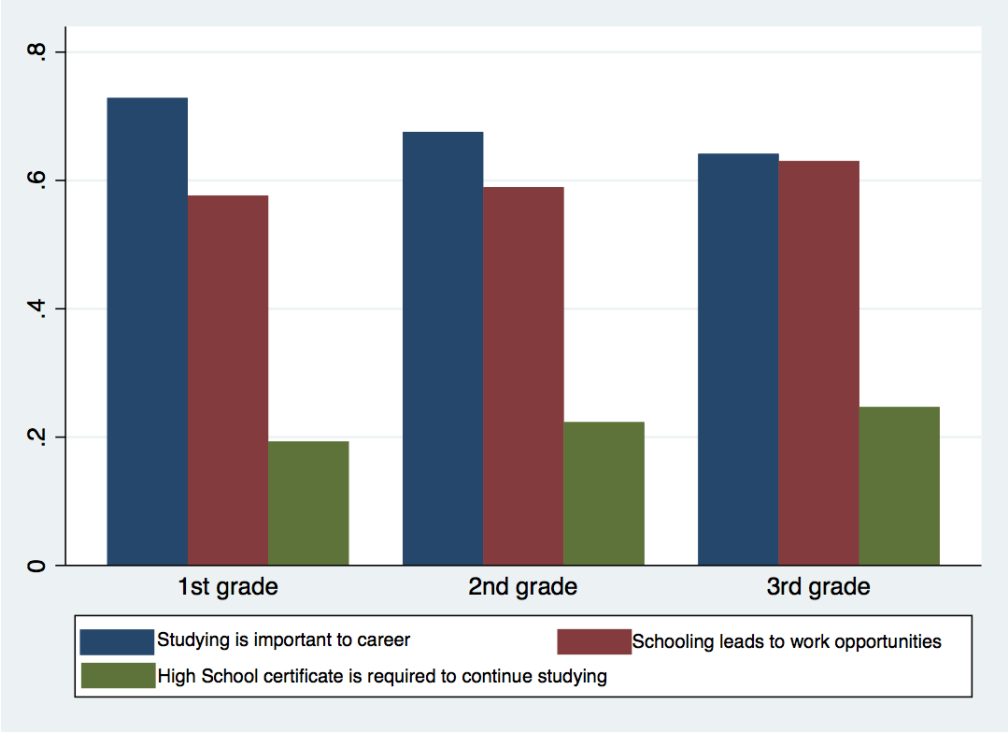
Source: Elaborated by the author.

that they associate with a good job placement. In this sense, the "study" element emerged as the most frequent answer, about 70% of the respondents, although this link is decreasing across the grades (see Figure 1.3). There is also a growing perception across the grades that for every completed level of education they will face new job opportunities.

These two correlations indicate that the youth seem to build a link between the consequences of attending school and succeeding at work. However, the importance the youth may associate with schooling is not persistent when they evaluate the relevance of attending school to progress to post-secondary education. Only a fifth of the students claims that they attend school aiming to get a certificate that will allow pursuing post-secondary education.

On the other hand, there is a high proportion of the youth who declare that they intend to attend higher education: 90% in the 3rd grade and 81% in the 1st grade (Table 1.2). These same proportions are not observed in the intention to take the *ENEM* exam, National High School Exam, the primary mechanism of selection of the Brazilian colleges, which allows accessing the Unified Selection System (*SISU*). While in the 1st grade only 58% of the students stated that they intend to do *ENEM*, in the third grade this proportion is 76%, 23 and 14 percentage points lower than the intention to attend higher education, respectively. The correlation between these two variables is only 0.40. A difference of this magnitude may indicate a lack of information from the students, who are unaware of the possibilities that the *ENEM* perfor-

Figure 1.3: Youth and work: link between schooling and work opportunities, by high school grades



Source: Elaborated by the author.
Blue: "Studying is the most important thing to get a good job"
Red: "I know that for each completed education level I will have new possibilities of work"
Green: "Main reason for going to school: To have a diploma that society values and that allows me to continue studying"

mance can provide for college application. This level of unfamiliarity is, as one might suppose, decreasing across high school grades, since the topic will likely be discussed throughout the years in school and among peers[6].

Using the variables presented previously and others measured in the same research, I estimate a model to identify factors related to the intention to continue studying after completing secondary education and, similarly, to the intention to apply for *ENEM*:

$$College_i = \alpha + \gamma S_i + \lambda R_i + \delta I_i + \eta F_i + \theta X_i + \varepsilon_i \tag{1.1}$$

$$ENEM_i = \alpha + \gamma S_i + \lambda R_i + \delta I_i + \eta F_i + \theta X_i + \varepsilon_i \tag{1.2}$$

Where i represents the student; the outcome $College_i$ is an indicator of the students' intention to go to college and the outcome $ENEM_i$ is an indicator of the students' intention to apply to *ENEM*; S_i is a binary variable that indicates if the student is in the senior year in high school; R_i is a vector of two proxy variables related to the relevance the student attributes

[6] In another research carried out in 2013 with 750 young people participating in the volunteer program in the metropolitan region of São Paulo, there was also a difference between the intention to do *ENEM* and to attend higher education: 51% and 74%, respectively, for the three grades.

to schooling (student claims that studying is essential to get a job and student claims that for every completed level of education they will face new job opportunities, see Figure 1.3); I_i is a vector of variables related to their interests in learning and discussing with the volunteers about either *ENEM*, *Vestibular*, or college; F_i is a vector of variables where students evaluate how the volunteers made them think about the future, pointing out tips about the study, profession or motivation generated by the action; X_i is a vector of socioeconomic and demographic characteristics; and ε_i is the error term.

In addition, the same model is estimated with the "intention to take *ENEM*" variable as the explained variable. Since *ENEM* is the most likely path for accessing the post-secondary education in Brazil, one could expect that the factors related to the intention to take the exam would be similar to the ones related to the intention to attend to college, in the absence of information restrictions. In this sense, comparing the results from equation Equation 1.1 and equation Equation 1.2, ascertaining the difference between the factors associated with each intention, may address an informational issue.

Table 1.3 presents the results of the estimates. For the intention of attending higher education, in column (1), young people who assign relevance to the study regarding professional placement are 3.7 p.p. more likely to attend higher education. There is a positive relationship between the interest in learning about *ENEM* and about College and the intention to attend higher education. These results are consistent with what might be expected from an individual who intends to continue studying, but may also indicate that this group does not have all the information necessary to access the next step, since they demand it from the volunteers.

The intention to take *ENEM*, column (2) in Table 1.3, presents the same signals for these regressors. However, the coefficients are higher for the association between study and work: those students who already know that they want to take *ENEM* assign a higher value (6.1 p.p.) to education for their careers than those students who intend to attend college. This result may be indicative of the difference between the return to the average education perceived by students who see the *ENEM* as a tool to access higher education and the perceived return by those who do not have this information. It is also worth mentioning that the coefficient of the variable of interest in learning with the volunteers about college is lower than in model 1, whose explanatory variable is the intention to attend higher education: those who are going to do the *ENEM* may already have this information about college, while the other group still needs to learn more about the process.

Table 1.3: Youth and study: intention to continue studying

Variables	(1) Intention College	(2) Intention Enem
Relates study and work:		
"Studying is relevant to get a job"	0.0373***	0.0612***
	-0.0116	-0.0162
"Schooling leads to work opprtunities"	0.0522***	0.0698***
	-0.0109	-0.0154
Wants to learn about:		
Enem	0.0585***	0.236***
	-0.0143	-0.0201
Vestibular	0.00162	0.0214
	-0.0151	-0.0212
College	0.107***	0.0635***
	-0.0132	-0.0186
Volunteers helped thinking about the future:		
Tips about studying	-0.0214*	-0.0219
	-0.0119	-0.0168
Tipos about careers	-0.00413	-0.00698
	-0.0119	-0.0167
Hope about the futute	0.0151	-0.00474
	-0.0114	-0.0161
SES:		
Age	0.0069	0.0049
	-0.00522	-0.00737
Female (dummy)	0.0966***	0.0886***
	-0.011	-0.0154
Married (dummy)	0.00755	0.0883**
	-0.0286	-0.0404
Mother - completed high school (dummy)	0.0567***	0.0519***
	-0.0105	-0.0148
Children (dummy)	-0.0743***	-0.0116
	-0.0284	-0.0401
Work (dummy)	-0.00384	-0.0218
	-0.011	-0.0154
Previous Dropout (dummy)	-0.0585***	-0.0503***
	-0.0136	-0.0191
Senior year (dummy)	0.0132	0.0925***
	-0.0139	-0.0195
State (dummy)	0.0607**	-0.0404
	-0.0295	-0.0414
Constant	0.506***	0.351***
	-0.0893	-0.126
N observations	3,547	3,548
Adjusted R2	0.119	0.144

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

1.4 TREATMENT EFFECT

In this section, I estimate an effect of the treatment on the dropout rate and *ENEM* participation rate. This analysis will consider the school as the level of observation, since there is no data on the students who participated in each meeting. The next subsection presents alternatives of comparison groups constructed to estimate the treatment effect, followed by the empirical strategy, and finally the results. The analysis uses data from the program carried out in the schools of the metropolitan region of São Paulo, due to the volume and data availability.

1.4.1 COMPARISON GROUPS

From 2010 through 2015, a total of 104 schools received the volunteer program at least once. In order to construct the comparison groups as counterfactual to these treated schools, all the schools of the São Paulo state network located in the metropolitan region were used, which could initially meet the eligibility criteria to be invited to receive the intervention. Columns (I) in Table 1.4 present the mean of several variables from the INEP School Census for the treated schools and the respective averages for all other schools in the metropolitan region, which did not receive the intervention in any of the years. The test of difference between means of these two groups indicates that for most variables these groups are not comparable: treated schools have higher dropout rates, higher rates of age-grade distortion, lower proportion of students performing *ENEM* and higher proportion of enrollments in night classes. These differences are driven by the school target of the program, since schools presenting higher dropout rates are invited. Hence, it is necessary to find comparable schools for the treated ones, addressing this selection.

Besides the target differentiation between treated and untreated schools, a self-selection bias among the schools may emerge since the school could be invited and not accept to engage in the intervention. Although it exists anecdotal evidence pointing to the inexistence of this self-selection bias, we address this possibility by comparing only schools that have participated in the intervention at least once.

From this universe of schools and possible selection, three alternatives for comparison groups are considered and described below:

- Comparison group A: consider treated schools those that received the intervention in 2013 and untreated schools those that received the intervention only in 2014. Thus, it takes into account only schools at some point that joined the program, addressing a possible selection bias associated with the acceptance to joining the program, since the school principal must be willing to change the routine of the school to receive the intervention, which may be endogenous to other aspects of school management. For this group, the treatment effect is estimated by the difference-in-differences method.

- Comparison group B: consider treated schools those that received the intervention at some point and untreated schools are among those that have never received intervention in the metropolitan area. The method to find comparable schools is the probit model of propensity score $P(X)$, which estimates the probability of receiving the intervention, finding one school of comparison for each treatment, without replacement. The matching aims to ensure balancing in observable characteristics among treatment and control group. Effect of the treatment is estimated by fixed effects, addressing possible differences in unobservable characteristics.

- Comparison group C: consider treated schools those that received the intervention at some point and untreated schools are among those that have never received intervention in the metropolitan area, but it considers only the schools which the propensity score with common support.

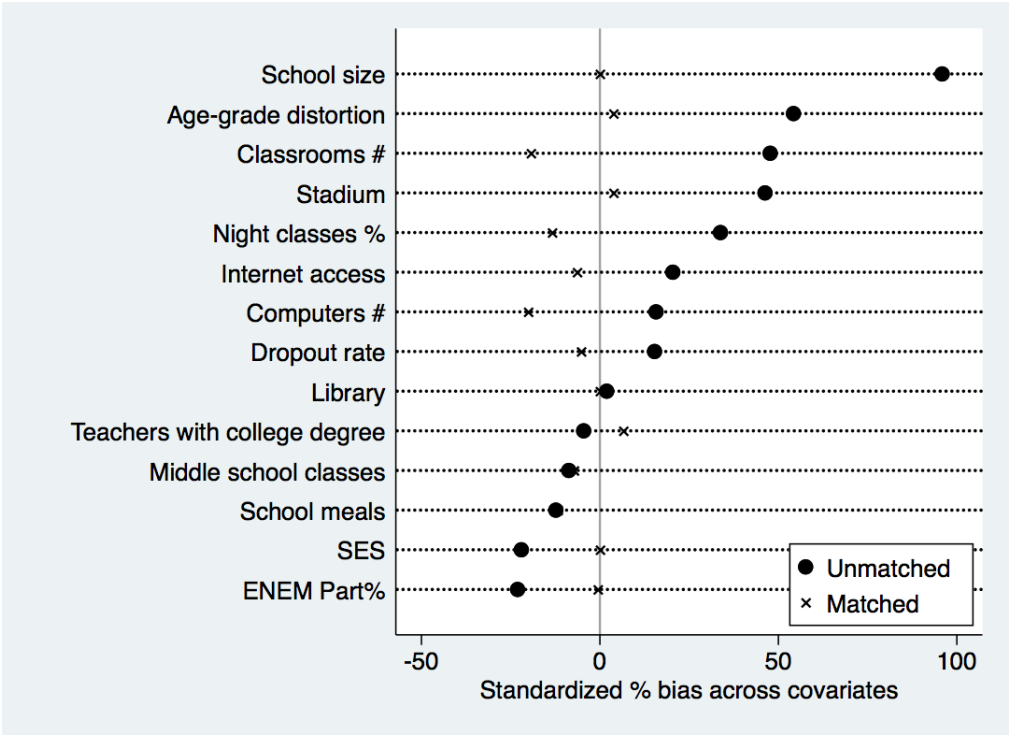
Through the propensity score estimation, it is expected to identify schools that are comparable to the treated ones before the intervention, i.e., in 2009:

$$P_s(X_s) = Pr[T_s = 1|X_s] \tag{1.3}$$

where $T_s = 1$ indicates that school s has received the intervention at some point. It is assumed that these variables X determine the probability of the school joining and receiving the intervention: the propensity score method assumes selection in observables, that is, all the determinants of the intervention can be observed. The observable variables X_s used in the estimation of the propensity score $P_s(X_s)$ are: dropout rate, age-grade distortion, *ENEM* participation rate, a socioeconomic status index, school size, proportion of enrolment in night classes, proportion of teachers holding a higher education degree, infrastructure characteristics. These variables are provided by *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* (INEP/MEC), an autarchy related to the Brazilian Ministry of Education.

Columns (II), (III) and (IV) of Table 1.4 present the difference between means tests for each comparison group. The comparison group B most approached the averages of the treated schools, with a statistically equal mean for all variables. Figure 1.4 shows the pattern of unmatched and matched pairs, representing the percentage difference of the sample mean between treated and untreated as a percentage of the square root of the mean of the sample variances in the two groups (ROSENBAUM; RUBIN, 1985). The pairing reduced the standardized bias for all variables, thus improving the statistical balance between groups.

Figure 1.4: Reduction of standardized bias after propensity score matching



Source: Elaborated by the author.

Table 1.4: Difference between means tests from treated schools and respective comparison group

Variables	(I) All schools			(II) Comparison group A			(III) Comparison group B			(IV) Comparison group C		
	Untreated	Treated	p-valor	Untreated	Treated	p-valor	Untreated	Treated	p-valor	Untreated	Treated	p-valor
Dropout rate - 2009	4.44	5.25	0.13	3.74	6.14	0.11	5.38	5.11	0.72	4.52	5.11	0.27
Dropout rate - 2014	5.05	7.07	0.00	5.73	9.43	0.04	6.19	7.13	0.27	5.34	7.13	0.00
Age-grade distortion - 2009	21.43	26.52	0.00	24.27	29.58	0.05	26.27	26.63	0.81	21.87	26.63	0.00
Age-grade distortion - 2014	17.42	22.55	0.00	23.84	25.65	0.39	20.93	22.99	0.11	17.91	22.99	0.00
Enem participation rate - 2009	0.60	0.54	0.04	0.70	0.50	0.00	0.54	0.54	0.97	0.60	0.54	0.04
Enem participation rate - 2014	0.53	0.46	0.05	0.54	0.43	0.02	0.47	0.45	0.51	0.53	0.45	0.06
SES	52.87	52.38	0.04	54.23	51.74	0.00	52.43	52.43	1.00	52.69	52.43	0.28
School size	5.20	5.94	0.00	5.96	5.91	0.42	5.95	5.95	1.00	5.67	5.95	0.00
Night classes proportion	0.47	0.58	0.00	0.42	0.53	0.10	0.61	0.57	0.29	0.48	0.57	0.01
Middle school classes	0.93	0.90	0.35	0.77	0.91	0.16	0.92	0.90	0.62	0.94	0.90	0.07
Teachers with college degree %	0.99	0.98	0.66	0.99	0.98	0.57	0.98	0.98	0.67	0.99	0.98	0.53
Stadium	0.86	0.98	0.00	1.00	1.00	.	0.97	0.98	0.65	0.95	0.98	0.18
Library	0.07	0.08	0.85	0.12	0.06	0.48	0.08	0.08	1.00	0.09	0.08	0.77
Number of classrooms	13.67	18.06	0.00	17.62	18.53	0.62	19.97	18.19	0.20	14.97	18.19	0.00
Number of computers	15.19	17.14	0.22	17.35	19.19	0.40	19.40	16.91	0.29	16.31	16.91	0.69
Internet access	0.96	0.99	0.10	1.00	1.00	.	1.00	0.99	0.32	0.99	0.99	0.70
School meals	0.95	0.91	0.17	0.77	0.91	0.16	0.94	0.91	0.42	0.95	0.91	0.07
Number of schools	*2225*	*104*		*26*	*32*		*99*	*99*		*1140*	*99*	

Standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

1.4.2 EMPIRICAL STRATEGY

Once the alternative treatment groups have been defined, the treatment effects are estimated in three different outcomes: the dropout rate in the 1st year of high school, using only the treated schools that received the intervention in classes of this grade; the general high school dropout rate; the participation rate in *ENEM*[7]. For the latter outcome variable, the sample of treated schools is restricted to those schools that received the intervention in senior year classes.

For the comparison group A, which considers as treated schools those that received the intervention before 2013 and as untreated those that received from 2014, the treatment effect is obtained using the difference-in-differences method. For each outcome variable, the estimated models are:

$$\begin{aligned} D1_{st} &= \alpha + \gamma T1_s + \lambda d_{2013} + \delta(T1_s * d_{2013}) + \eta X_{st} + \varepsilon_{st} \\ D_{st} &= \alpha + \gamma T_s + \lambda d_{2013} + \delta(T_s * d_{2013}) + \eta X_{st} + \varepsilon_{st} \\ ENEM_{st} &= \alpha + \gamma T3_s + \lambda d_{2013} + \delta(T3_s * d_{2013}) + \eta X_{st} + \varepsilon_{st} \end{aligned} \tag{1.4}$$

Where s represents the school, $D1_{st}$ is the dropout rate for high school first-year grade, D_{st} is the average dropout rate in high school, $ENEM_{st}$ is the *ENEM* participation rate, $T1_s$ is a binary variable that equals 1 if the school was treated in 1^{st} year classes, $T3_s$ is a binary variable that equals 1 if the school was treated in senior year classes, T_s is a binary variable that equals 1 if the school was treated in any class, and d_{2013} indicates the year 2013. In this representation of the differences-in-differences model, the coefficient of interest δ corresponds to the interaction between the treatment variable the and the time dummy that separates the treated schools from the untreated ones. In addition, school control variables X_{st} (Table 1.4) are added to correct for possible heterogeneity.

For the comparison groups B and C, which consider as untreated schools only those matched schools by propensity score, for each outcome variable the estimated models are:

$$\begin{aligned} D1_{st} &= \alpha + \gamma T1_s + \lambda d_t + \theta_s + \eta X_{st} + \varepsilon_{st} \\ D_{st} &= \alpha + \gamma T_s + \lambda d_t + \theta_s + \eta X_{st} + \varepsilon_{st} \\ ENEM_{st} &= \alpha + \gamma T3_s + \lambda d_t + \theta_s + \eta X_{st} + \varepsilon_{st} \\ ENEM_{st} &= \alpha + \gamma T_s + \lambda d_t + \theta_s + \eta X_{st} + \varepsilon_{st} \end{aligned} \tag{1.5}$$

In this case, the variable of interest is the treatment dummy which effect is measured by the parameter λ and fixed effects of school and year are included to control for individual characteristics of these levels.

[7] For the years in the analysis, *ENEM* is the main exam test score used for either college or scholarship application.

1.4.3 TREATMENT EFFECTS RESULTS

Table 1.5 presents the results of the treatment effect on the dropout rate in the 1st grade of high school, for each comparison group. For group A, a negative effect on dropout rates of 4p.p. is found only when control variables are included, thus reducing the dropout rate when schools receive the intervention in this grade. Considering the prior dropout rate for this universe is 6%, this would be a very high effect, but it is not consistent to other model specifications.

On the other hand, group B does not present a significant result in the dropout rate in the first year when considering the fixed school effects, necessary in this estimation to address the selection bias. Without including fixed effects, there would be a positive effect on the dropout rate, indicating that the fixed effect is relevant in this model and its omission introduces a bias in the coefficients.

Regarding the effect on the average dropout rate of high school, the results, in Table 1.6, follow the same trend as those presented only for the 1st grade. However, the reduction in the dropout rate of the group A estimation is not observed for this outcome variable.

Concerning the effect on the participation rate in *ENEM* (Table 1.7), no significant effects are found in the main models, differences-in-differences for group A and fixed effects for groups B and C. Again, the inclusion of fixed effects changes the coefficients of regression, indicating the relevance of the identification for these estimations.

Table 1.5: Effect on the dropout rate – 1st year High School

	A		B				C			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment*2013	-2.358	-4.013*								
	(2.167)	(2.139)								
Treatment	6.519***	7.877***								
	(1.541)	(1.522)								
2013	1.822	2.585								
	(1.603)	(1.595)								
Treatment			2.012***	1.807***	0.630	0.127	2.998***	2.871***	0.742	0.448
			(0.665)	(0.674)	(0.659)	(0.660)	(0.560)	(0.559)	(0.556)	(0.550)
Constant	4.779***	-36.60*	7.187***	6.542***	6.599***	-5.498	6.132***	5.380***	5.298***	-1.802
	(1.192)	(20.82)	(0.236)	(0.493)	(0.395)	(7.867)	(0.0747)	(0.167)	(0.129)	(1.816)
School controls	*N*	*Y*	*N*	*N*	*N*	*Y*	*N*	*N*	*N*	*Y*
Year fixed effects			*N*	*Y*	*Y*	*Y*	*N*	*Y*	*Y*	*Y*
School fixed effects			*N*	*N*	*Y*	*Y*	*N*	*N*	*Y*	*Y*
Observations	*116*	*113*	*988*	*988*	*988*	*968*	*7,470*	*7,470*	*7,470*	*7,163*
Adjusted R-squared	*0.145*	*0.243*	*0.008*	*0.008*	*0.365*	*0.416*	*0.004*	*0.008*	*0.413*	*0.450*

Standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 1.6: Effect on the dropout rate – High School average

	A		B				C			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Treatment*2013	-2.002	-2.164								
	(2.085)	(2.019)								
Treatment	5.466***	6.064***								
	(1.474)	(1.438)								
2013	1.542	1.422								
	(1.549)	(1.504)								
Treatment			1.487***	1.314**	0.641	0.258	2.421***	2.323***	0.791*	0.577
			(0.543)	(0.551)	(0.516)	(0.510)	(0.447)	(0.447)	(0.434)	(0.423)
Constant	4.131***	-23.01	6.290***	5.821***	5.851***	-0.130	5.355***	4.859***	4.743***	-0.851
	(1.095)	(18.18)	(0.201)	(0.419)	(0.324)	(6.393)	(0.0620)	(0.139)	(0.105)	(1.451)
School controls	*N*	*Y*	*N*	*N*	*N*	*Y*	*N*	*N*	*N*	*Y*
Year fixed effects			*N*	*Y*	*Y*	*Y*	*N*	*Y*	*Y*	*Y*
School fixed effects			*N*	*N*	*Y*	*Y*	*N*	*N*	*Y*	*Y*
Observations	116	113	990	990	990	970	7,585	7,585	7,585	7,204
Adjusted R-squared	0.125	0.226	0.007	0.007	0.407	0.460	0.004	0.007	0.443	0.487

Standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 1.7: Effect on participation rate in Enem

	A		B				C				B				C			
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Treatment*2013	-0.00005	-0.00438																
	(0.0634)	(0.0649)																
Treatment	-0.108**	-0.0937**																
	(0.0448)	(0.0462)																
2013	-0.00005	-0.0128																
	(0.0471)	(0.0509)																
Treatment_3rd grade			-0.0429	-0.0154	0.00818	0.0132	-0.103**	-0.0822*	0.00340	0.00329								
			(0.0332)	(0.0339)	(0.0255)	(0.0268)	(0.0498)	(0.0498)	(0.0399)	(0.0412)								
Treatment											-0.0423	-0.0138	0.00991	0.0159	-0.101**	-0.0798*	0.00473	0.00628
											(0.0292)	(0.0298)	(0.0234)	(0.0246)	(0.0435)	(0.0435)	(0.0368)	(0.0377)
Constant	0.542***	0.744*	0.493***	0.542***	0.542***	0.946***	0.550***	0.594***	0.598***	1.173***	0.494***	0.542***	0.542***	0.949***	0.550***	0.594***	0.598***	1.173***
	(0.0333)	(0.405)	(0.00944)	(0.0155)	(0.00968)	(0.239)	(0.00544)	(0.00950)	(0.00627)	(0.119)	(0.00958)	(0.0155)	(0.00968)	(0.238)	(0.00545)	(0.00950)	(0.00627)	(0.119)
School controls	*N*	*Y*	*N*	*N*	*N*	*Y*	*N*	*N*	*N*	*N*	*N*	*N*	*N*	*Y*	*N*	*N*	*N*	*Y*
Year fixed effects			*N*	*Y*	*Y*	*Y*	*N*	*Y*	*Y*	*Y*	*N*	*Y*	*Y*	*Y*	*N*	*Y*	*Y*	*Y*
School fixed effects			*N*	*N*	*Y*	*Y*	*N*	*N*	*Y*	*Y*	*N*	*N*	*Y*	*Y*	*N*	*N*	*Y*	*Y*
Observations	116	114	594	594	594	585	4,264	4,264	4,264	4,088	594	594	594	585	4,264	4,264	4,264	4,088
Adjusted R-squared	0.069	0.085	0.001	0.024	0.619	0.618	0.001	0.008	0.582	0.595	0.002	0.024	0.620	0.618	0.001	0.008	0.582	0.595

Standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

1.5 FINAL REMARKS

This study presents exercises to evaluate a volunteer program that provides information to students in public high school with the objective of motivating them to complete the secondary level of schooling and show the possible returns to education for each completed level. Only those students who are in high school are considered. This is first work investigating this program's effects and, from the best of our knowledge, the only study in Brazil to contribute to the information barrier literature.

A survey with students shows that the intention to attend college is not totally associated with the intention to take the *ENEM* selection exam. This indicates that there is a gap between the interests of young people and the information available to them about the next steps they should take. These young people do not appear to have at their disposal all the available information to decide to pursue their studies or enter the labor market.

However, the treatment effect evaluation did not present the expected significant results in the rates of dropout and participation in the *ENEM*, for school averages. Therefore, I do not find robust evidence on the impact of providing information to the students will affect the dropout and the participation in *ENEM*. Despite the lack of evidence on the effects in average, further investigation of the composition of college applicants and dropouts could show the existence of heterogeneous effects.

Some limitations of this study should be noted. For a better estimation of the program's impact results, it would be ideal to use data specific to the classes that received the intervention, rather than the aggregate results of the school, since there are not always enough volunteers for all classes in a school. Through the identification of the students, it will also be possible to find their individual results of dropout, completion of high school, *ENEM* participation, as well as future results of access to higher education and entry into the formal job market. In addition to these factors, other possibilities of comparison groups can be explored, such as schools that have accepted to join the program but have not received it because of external factors. Broader availability of data and an impact evaluation design could lead to more precise results.

Moreover, we do not have any information on socioemotional skills, that could affect volunteers and students. The volunteers' characteristics could be relevant covariates affecting the program results, such as gender, education background and motivation to engage in the volunteer program. Such data has not yet been collected in order to measure the impact of an intervention with these potential and expected results.

Part II
College quality signaling and individual performance: Effects on labor market outcomes after graduation

2 COLLEGE QUALITY SIGNALING AND INDIVIDUAL PERFORMANCE: EFFECTS ON LABOR MARKET OUTCOMES AFTER GRADUATION

Abstract

The association between college attendance and labor market premium is well-documented in existing literature. The signaling process plays a role in the explanation: college graduation serves as a signal for ability to the labor market. However, not only years of schooling but also the college quality may signal for individuals' ability. In the literature, college quality is mainly measured by the concepts of elite and selective institutions. In this paper, we propose a new measure of the signal for college quality: the performance of the previous cohort that has graduated three years before the individual in the same institution and major. We estimate the returns to college quality and to individual abilities on early career outcomes in Brazil, contributing to this literature on developing countries. Our results indicate that the percentage of the previous cohort graduates who are employed two years after their graduation is a relevant predictive variable of both employability and earnings in the formal sector up to eight years after the individual's graduation. Specifically, we find that an increase of 1 percentage point in the signal variable is related to an increase up to 44% in the early career wage, decreasing over time. We also investigate heterogeneity returns by gender, individual's prior working experience and field of education.

Keywords: signaling, college quality, wage premium

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2.1 INTRODUCTION

The returns associated with college attendance lead millions of individuals to pursue a higher level degree, especially in an economy that still experiences significant levels of inequality. However, the multiplicity of higher education institutions raises the question of how the extent of college quality is related to different effects on individuals, both pecuniary and non-pecuniary effects. Employers in the job market usually cannot perfectly observe someone's abilities, particularly in the first years of her career. Therefore, employers could use her investment in human capital as a signal of her ability - not only the number of years of schooling achieved, but also the quality of the institution attended.

This paper tests if college quality may signal individuals' ability, reflecting on early career outcomes in Brazil. We propose a new measure of signal for college quality: the performance of the previous cohort that has graduated three years before the individual in the same institution and major. We investigate the role of the previous cohort's performance, on test scores and in the labor market, affecting the current cohort's labor market outcomes in the formal sector. These previous cohort's performances may affect employers' perception of the new graduates from the same college and with the same major. We hypothesize that the previous cohort's performance may contribute to building the reputation of the higher education institution (HEI), being consequently predictive of its new graduates' future employment and earnings. We observe in the labor market the individuals of three college entrance cohorts up to 8 years after their expected graduation. These students were first-years in 2004, 2005 and 2006 and have taken an assessment test as freshmen. Pooling the three years, we compile together all majors evaluated in Brazil in the period. Thus, we contribute to literature adding evidence for early career effects of college quality in a developing country, besides proposing a new measure for college signal. To control for selection, we use several measures of individual ability, both general and field-specific, and other observable characteristics.

The college premium is well-documented in existing literature, with empirical investigations about its evolution over decades and covering various countries. The human capital theory introduced the rate of return to years of schooling (BECKER, 1962), but the most extensively used form is the Mincerian-equation (MINCER, 1958; MINCER, 1974), which estimates a regression of log earnings on years of schooling[1]. The Mincerian-equation is often used to answer how much one extra year of schooling improves individual outcomes in the labor market. Through variations of this model, there is evidence of consistent returns to attending college in different scenarios (ATTANASIO; GOLDBERG; PAVCNIK, 2004; LIU; BELFIELD; TRIMBLE, 2015; CARD, 2001)[2]. Besides the effects on earnings and other labor market outcomes, researchers also observe a rise in the college premium (OREOPOULOS; PETRONIJEVIC,

[1] See Heckman, Lochner e Todd (2005) for a discussion on what conditions the Mincer model estimates an ex-post internal rate of return.

[2] Dickson e Harmon (2011) and Lemieux (2006) present more recent reviews.

2013) and non-pecuniary and social returns to schooling (HOUT, 2012). On the other hand, a college degree may not always necessarily relate to better employment prospects in developing countries (e.g., Guarcello et al. (2008), Hanushek e Woessmann (2008), Pauw, Oosthuizen e Westhuizen (2008)). For Brazil, there is evidence the wage premia has been declining (FERREIRA; FIRPO; MESSINA, 2016; LUSTIG; LOPEZ-CALVA; ORTIZ-JUAREZ, 2013).

In a similar way to the human capital theory, the signaling theory is a possible explanation for the positive returns to education. In this sense, the investment one makes in human capital serves as a signal for employers. According to the signaling concept, a wage premium can exist even if a college has no value added and does not improve skills (SPENCE, 1973). Also extensively tested in existing literature, there is significant evidence that the signaling process occurs: college graduation is a signal for ability, playing a direct role in revealing ability to the labor market (e.g., Altonji e Pierret (2001), Arcidiacono, Bayer e Hizmo (2010), Farber e Gibbons (1996), Hershbein (2013)). As workers gain experience, observable characteristics like years of schooling become less correlated with wages in regressions that include unobserved measures of ability. Moreover, Arcidiacono, Bayer e Hizmo (2010) found that college identity is much more predictive of wages than high school identity.

However, it is not a consensus that the signaling channel is always more relevant to explain college returns than the skill acquisition through the investment in human capital. For example, Arteaga (2018) exploits a reform in a top-ranked university in Colombia that decreased the human capital the students graduate with (by reducing the amount of coursework required), but holds the signal constant for the labor market. Her results lead to a rejection of a pure signaling model, since she finds negative effects on earnings and employment, reinforcing the importance of human capital in the determination of wages. Oppedisano (2014), Saavedra e Saavedra (2011) and Hanushek e Woessmann (2008) provide other examples in which skills acquired in college relate to individual earnings, distribution of income, and economic growth.

In both explanations for the returns to college attendance, human capital improvement and signaling, the quality of the college attended might affect the results as well. One can expect that higher quality HEIs provide better resources for human capital accumulation and, furthermore, provide information on its graduates' ability consistent with the signaling theory. Employers may use whatever signals of skill are available to them, including signals of the quality of the institution, at the wage formation.

To define what college quality means, authors have been using several proxies for institutional selectivity, elite schools, and reputation. Authors often measure quality by a single index of institutional selectivity (THOMAS; ZHANG, 2005), a vector of college characteristics which might include: average admission scores, expenditures per student, average faculty salary, student/staff ratio, share of faculty with PhD, share of full-time faculty, tuition, and percent of the college's applicants who are rejected (CHEVALIER, 2014; DALE; KRUEGER, 2014; LONG, 2010; MACLEOD; URQUIOLA, 2015; SAAVEDRA; SAAVEDRA, 2011). Another

measure used is the mere identity of a flagship institution (ANDREWS; LI; LOVENHEIM, 2016; CUNHA; MILLER, 2014). Black e Smith (2006) discuss the multidimensionality of the institutional quality concept. They argue that using a single proxy leads to understated effects of college quality and propose the use of multiple proxies, including retention rate, faculty and selectivity variables.

In fact, there is extensive evidence on the returns to college quality on earnings during one's early career, especially for the United States[3], but the evidence for developing countries is less explored (see Boccanfuso, Larouche e Trandafir (2015) for Senegal, and Saavedra (2009) for Colombia)[4]. This literature on college quality returns has broadly focused on the concepts of elite and selective institutions. The returns to attending elite schools, flagships universities and the most selective colleges in the US are more substantial than less selective schools, even after controlling for selection effects (ANDREWS; LI; LOVENHEIM, 2016; BEHRMAN; ROSENZWEIG; TAUBMAN, 1996; BOWEN; CHINGOS; MCPHERSON, 2009; BREWER; EIDE; EHRENBERG, 1999; HOEKSTRA, 2009; HOXBY, 2009; LOURY; GARMAN, 1995)[5]. Indeed, if stratification arises from the co-existence of selective and non-selective schools, the mere existence of the former is a signal of the students' ability in the latter (MACLEOD; URQUIOLA, 2015). The findings are not so consistent for other developed countries, with positive evidence on the returns of selectivity for Sweden (LUNA; LUNDIN, 2014) and United Kingdom (CHEVALIER, 2014), but no returns in Australia (BIRCH; LI; MILLER, 2009), Finland (SUHONEN, 2014) or Japan (NAKAMURO; INUI; YAMAGATA, 2017).

Apart from the selective and elite college concepts, the reputation concept might be harder to define since it could include nonobservable aspects. MacLeod e Urquiola (2015) propose a model to define reputation as the information that the employer obtains by knowing the identity of the school the individual attends. They use the distribution of skill among the institution's graduates, not just a function of its value-added but also of the ability of its students, both general- and field specific-skills. MacLeod et al. (2017) apply this concept to Colombian universities, using the graduates' mean admission scores as the measure of reputation. They find that college reputation, unlike years of schooling, is correlated with graduates' earnings growth. They detect that the rollout of a new observable signal of skill (college exit exam scores) reduced the return to reputation and increased the return to individual admission scores, consistent with the signaling theory. There is also an increase in the correlation between reputation and

[3] See Oreopoulos e Petronijevic (2013) and Hoxby (2009) for reviews in college quality returns.

[4] The relation between college quality and other non-monetary effects is less explored in literature, although there is evidence of effects of college quality on delaying marriage and childbearing (LONG, 2010), lower divorce rates (BOWEN et al., 1998), partner quality for women (KAUFMANN; MESSNER; SOLIS, 2013), better health (ROSS; MIROWSKY, 1999) and increasing the number of leadership positions (ZIMMERMAN, 2016).

[5] The studies usually report wage premium related to selective colleges, except for Dale e Krueger (2002) and Dale e Krueger (2014). The authors compare students admitted to the same menu of colleges, but a few chose a less-selective college. Hoxby (2009) argues that this identification strategy is less credible because those students who chose to attend a less-selective college are probably characterized by omitted variables that affect both their college decision and labor market outcomes.

labor market outcomes as experience increases, as a possible consequence of a not perfectly observable measure of reputation. However, this increasing correlation could also arise if college membership attributes are related to human capital growth.

Obtaining unbiased estimates of the effect of quality is still a challenge since students and institutions select each other, and the characteristics which affect these choices may also present correlation with labor market outcomes. The most credible studies in trying to isolate these effects use regression discontinuities (HOEKSTRA, 2009; SAAVEDRA, 2009) or quasi-experimental designs, but numerous well-identified studies use regressions of earnings on college quality proxies with controls for characteristics such as students' skills and parental background. Card (2001) highlights the issue that controlling for some abilities but not others may not guarantee that everything else is equal. Not many studies underline the relevance in accounting for various sorts of skills. Grogger e Eide (1995) find that skills attained before college did not affect on the change in college wage premium for men, while skills acquired during college had significant effects on the relative wages of men. MacLeod e Urquiola (2015) also consider the field-specific component of the skills in the wage determination.

In this paper, related to the college quality signal literature, we estimate the returns to quality, measured by an array of proxies. We account for selectivity including proxies for general and field-specific skills, through high school exit exam and college entrance and exit exam, besides individual and college controls. Our results indicate that the percentage of the previous cohort graduates who are employed two years after their graduation is a relevant predictive variable of both employability and earnings in the formal sector up to eight years after the individual's graduation. Measures of general and field-specific skills present an increasing trajectory of wage premium over the years, as predicted by the signaling theory. We also investigate heterogeneity returns by gender, individual's prior working experience and field of education.

We expect that the college signal, in the absence of better observable ability measures for employers, will predict labor market outcomes for students after graduation. As individuals' work experience increases and employers learn about their ability, their skills should become more relevant in explaining labor outcomes, and the college quality signal should become less relevant if it is only a signal of one's ability. Our results indicate that an increase of 1 percentage point in the signal variable is related to an increase up to 44% in the early career wage, decreasing over time.

In our analysis, we do not investigate the effect of quantity of education and its returns since we focus on individuals who have been accepted in college. Instead, we contribute to the literature on college quality, within those individuals who attend college. The analysis sheds light on disparities within the group.

This article is divided as follows: section 2.2 brings a detailed description about the databases and sample; section 2.3 provides empirical strategy; main results are reported in section 2.4; and in conclusion, section 2.5 brings final remarks.

2.2 DATA AND SAMPLE

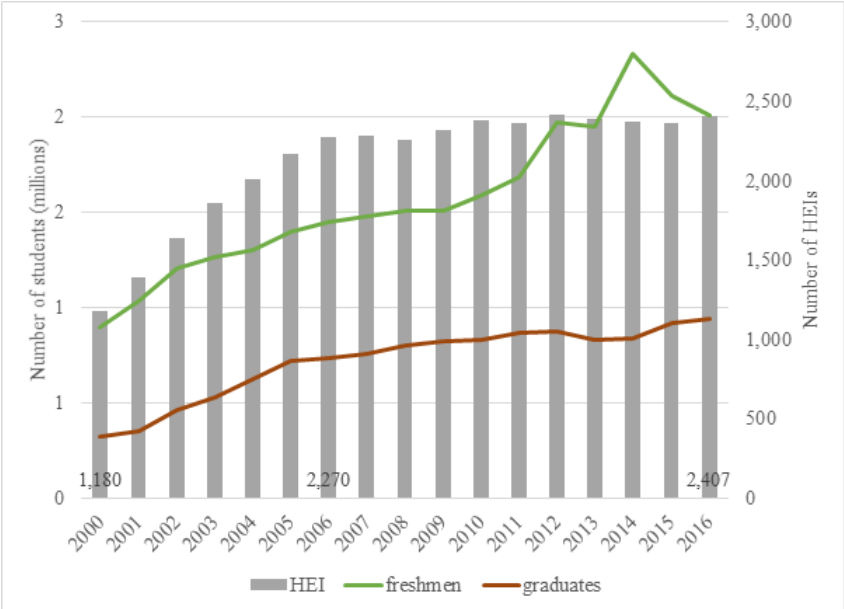
There are three main data sources that we use to identify the students who were admitted to college, their performance in standardized tests and the formal job market, and to extract the quality college signals. For test performance, we use two sources of information (*ENADE* and *ENEM*) for those individuals admitted in Brazilian HEIs in 2004, 2005 and 2006. These students are identified in *RAIS*, the annual reports of social information, which provides information on all the workers in the formal sector in Brazil. In addition to using official college quality indicators, we use and the higher education Census to incorporate controls.

2.2.1 HIGHER EDUCATION IN BRAZIL

The Brazilian higher education system consisted of 1,180 institutions in 2000. This number almost doubled by 2006, then remained stable. The share of public institutions has not changed considerably since 2003: around 11% of all HEIs are public. Public HEIs in Brazil do not charge tuition fees and are usually perceived as having the best programs. These characteristics lead to very competitive admission process in public institutions. On the other hand, the government offers financial incentives to improve students access to private institutions, to expand the higher education supply.

The number of college entrants has risen during this same period (see Figure 2.1). Between 2004 and 2006, 1.4 million students entered college on average each year. However, less than 60% of these freshmen will graduate. The completion rate in higher education has been decreasing in the last years: in 2016, the number of graduates is less than half of the average number of first-year students four years before.

Figure 2.1: Higher Education numbers in Brazil, 2000-2016



Source: Elaborated by the authors based on INEP - Sinopse Estatística da Educação Superior.

Unlike the United States, in Brazil students choose their majors at the college application stage. Admission mostly relied on entrance exam scores (*Vestibular*), in a decentralized process until 2009. From 2004 to 2006, 9% of the new entrants were admitted through other selection processes, such as using *ENEM* scores (see next section for an explanation on the *ENEM* exam).

2.2.2 DATA SOURCES

2.2.2.1 *ENADE*

ENADE (*Exame Nacional de Desempenho de Estudantes* - National Exam of Student Performance) is developed and provided by *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* (INEP/MEC), an autarchy related to the Brazilian Ministry of Education. The purpose is to measure how much knowledge college adds to students and to measure the quality of institutions by the difference in the scores of graduates and first-year students.

In 2004 INEP started administering the *ENADE* annually as a replacement for the National Course Exam. The *ENADE*, according to INEP, was designed for assessing student performance in the program content provided in the curriculum guidelines for undergraduate courses, skills development, and the skills necessary to deepen the general education and training. Thus, the difference between students' scores on this test evaluating field-specific content obtained at the end of the program and as first-year students should represent, to some extent, how students have learned during their studies.

INEP carries out *ENADE* in a sample of students from selected majors, which varies over the years. The *ENADE* evaluation cycle lasts three years, meaning that all majors go through evaluation tests every three years. For instance, all the selected majors evaluated in 2004 were once again evaluated in 2007. For the students in the sample, graduation requires participation in the exam. Therefore, *ENADE* is the central database to define our sample of entrant students. Through the *ENADE*, we identify the sample of first-year college students in 2004, 2005 and 2006 who took the test in these years: these are the three cohorts we use in our analysis. Although we do not observe all the students in Brazil, since the exam is not universal, we do observe all majors evaluated in this period, covering all fields of education. We analyze three cohorts: the First Cohort refers to the freshman students in 2004; the Second Cohort refers to the freshmen in 2005; the Third Cohort refers to the freshmen in 2006.

Students in the *ENADE* sample take the exam twice. At the first time they do, they are considered first-year students and cannot have completed more than 20% of the curriculum – we refer to this as the freshman year exam (2004, for example). Three years later, *ENADE* evaluates the same selected majors, and the students who have completed at least 80% of the course curriculum are considered senior and retake the exam – the senior year exam (2007 in the example).

Each year thousands of first-year and senior students take the exam, according to the majors chosen in evaluation in the cycle. Table 2.1 presents the main majors evaluated in each of the years, classified according to the field of education[6].

The majority of first-year students concentrates in the following fields for each year: Field 6-*Agriculture* and Field 7-*Health and welfare* in 2004 (87% of students); Field 1- *Education*, Field 4-*Science*, Field 5-*Engineering, manufacturing and construction* in 2005 (93%); and Field 3-*Social sciences, business and law* in 2006 (87%).

For the 2004 freshmen cohort, the First Cohort, the senior individual scores in 2007 are also available, allowing setting up a balanced panel of students for this cohort. These students took the test as freshmen in 2004 and again in 2007 as senior-years of the undergraduate programs. The analogous results of senior students are not available for the 2005 and 2006 freshmen cohorts (Second and Third Cohorts).

ENADE evaluates two types of skills: general and field-specific. Thus, it is possible to extract measures of these two types of skills, through *ENADE* individual scores. These skills may act as relevant determinants of labor market outcomes in different ways, reflected in one's earnings.

Each student takes four tests: a general test with objective questions, a general test with open-ended items, a field-specific objective test, and a field-specific test with open-ended items. The field-specific components vary depending on students' major, while the general exams are the same for all students. We do not use the scores of the open-ended tests, because many students choose to leave this exam blank, which could limit the sample in a possibly biased way.

It is important to note the possibility of selection bias in the sample used in the analysis. Within the population of interest, there may be another type of selection because some restrictions are imposed on the sample. Some students choose to boycott the *ENADE* tests. Thus, there is no information on their scores, and so they are not included in our sample. We also exclude from the sample the students who left their test or socioeconomic questionnaire blank (therefore a null score) or responded randomly, namely, choosing the same option for all questions.

Besides the two test scores (general objective test and field-specific objective test), we also extract from *ENADE*: personal characteristics (gender, race, age), family characteristics (family income, mother's education, if has children), and academic characteristics (attended a public high school, takes night classes in college, dropout rate in the college major cohort).

The ENADE scores also integrate another INEP database: the *CPC* (*Conceito Preliminar de Curso* - preliminary program grading), an official quality indicator for the higher education programs. The CPC index provides a quality synthetic index for each undergraduate

[6] We use the International Standard Classification of Education published by United Nations Educational, Scientific and Cultural Organization (SCHNEIDER, 2013).

Table 2.1: Fields of education and majors evaluated by ENADE, 2004-2006

	Field of education (OECD)	**2004**	**2005**	**2006**
1	Education		biology, social sciences, philosophy, physics, geography, history, literature, mathematics, education, chemistry	teacher training (normal superior)
2	Humanities and arts			design, music, theatre
3	Social sciences, business and law			business administration, archival and library science, accounting, economics, media, law, music, psychology, executive secretary
4	Science		computing	biomedicine
5	Engineering, manufacturing and construction		architecture and urbanism, engineering (eight groups)	
6	Agriculture	agronomy, veterinary medicine, animal science		
7	Health and welfare	physical education, nursing, pharmacy, physiotherapy, speech therapy, medicine, nutrition, dentistry, social work, occupational therapy		
8	Services			tourism

college program in the country. According to INEP, its objective is both to contribute to the development of public policies and to provide information to society. Besides the *ENADE* test scores, CPC also compiles the value-added for the students and inputs related to the supply conditions (faculty, infrastructure, and didactic-pedagogical resources). We use the *CPC* synthetic index as one proxy for college quality signal, and faculty characteristics (proportion of professors with doctorates, of full-time lecturers) as control variables.

2.2.2.2 *ENEM*

For the Second and Third Cohorts (freshman students in 2005 and 2006) it is possible to verify at the *ENEM* database (*Exame Nacional do Ensino Médio - High School National Exam*) if they took this exam in the previous year, with scores reflecting their academic performance at the end of high school. Like *ENADE*, *ENEM* is also implemented and provided by INPE/MEC. In 1999, when INEP first established it, its objective was mostly evaluating the education system. Five years later, some universities in Brazil started to accept the *ENEM* individual scores as part of their admission process, primarily to provide scholarships to private colleges. The number of schools using *ENEM* gradually increased over the years in both private and public systems. It was only in 2009 that the use of *ENEM* scores was centralized to make part of the admission process for public universities, although it is not mandatory.

ENEM scores serve as a measure of students ex-ante ability, assessing various competencies of the students for the secondary level of education. This assessment determines to what extent there is a selection of those with better socioeconomic conditions or school performance which could result in access to highly ranked institutions. The objective is to assess students human capital endowments before going to college.

The *ENEM* individual scores represent a proxy for the general skills before entering higher education, which is expected to reflect in future earnings. This human capital endowment is a product of not only one's innate ability but also the quality of their education, family, and social background, among other factors.

For the Second and Third Cohort in our analysis, it is possible to identify which freshman students took *ENEM* in the year before. Thus, the sample is also restricted to students who had taken the *ENEM* exam one year before they entered higher education.

It is important to note that using *ENEM* may introduce a sort of selection since the exam is not a requirement to apply for college. However, *ENEM* scores provide a better measure of one's skills than *ENADE* general test scores because the *ENEM* test evaluates a broader range of competences, while *ENADE* is more devoted to the specific component.

2.2.2.3 *RAIS*

The *RAIS* database (*Relação Anual de Informações Sociais* - Annual Reports of Social Information) is the official source of information for the formal labor market in Brazil, under the supervision of the Ministry of Labor and Employment. *RAIS* compiles a range of information on the formal sector in Brazil, as a longitudinal survey. Every year, since 1975, all the formal companies in the country fill out the forms, providing general information on the organization and also specific information about the employees and their contracts. In this sense, if one individual is an employee for multiple companies, her/his personal data, such as date of birthday and gender, will be repeated in the database and the salary and date of admission will be specific to each registered employment. Although *RAIS* is a complete database about the formal labor sector in Brazil, there is no information about the informal sector.

The individual's performance in the labor market – employability and salary – after their expected year of graduation is the outcome that we investigate, for each year. We expect to find results due to attendance to college, depending on the signal they emit to the market. We verify for all the students in the three cohorts whether they participate in the formal sector and the respective earnings up to eight years after the expected graduation, from 2008 to 2016[7]. Apart from the two outcome variables, we also take from *RAIS* a few control variables for the wage determination equation (whether she has worked while in college, current working hours, tenure in the current job, whether she is employed in December)[8]. We combine information from *RAIS*, *ENADE*, and *ENEM* by individuals' *Cadastro de Pessoa Física* – CPF, the fiscal identification number in Brazil.

It is also from *RAIS* that we extract information about the previous cohort performance at the labor market – employability and earnings two years after graduation. These previous cohort measures are not determinant of current cohort ability and may then serve as a signal.

2.2.3 COLLEGE QUALITY SIGNALS

The moment a student graduates from college, the employers usually do not have perfect information on this individual's ability. Attending college, besides the contribution for the human capital formation, may serve as a signal of one's ability to perform in the job market. We claim that the college quality may also serve as a signal of the ability: if a student attends a college perceived as high quality, that will have a positive effect on her employability and earnings in the job market.

[7] We consider the year following the senior-year exam the expected year of graduation, because the labor market participation is still very low and start to increase only two years after the senior-year exam. See Table 2.2 for a detailed timeline of the analyzed Cohorts

[8] For individuals with multiple job entries in the same year, we consider only the most relevant one, defined by the following criteria: the active job position on December 31st; if not employed on December 31st; the last position the individual held; the most tenured position; finally, randomly choose one entry if still multiple entries are found for the same individual in the year.

We suggest as a relevant channel of college quality signal the information that employers access on the previous cohort that has attended the same college and has graduated with the same major. The previous cohort performance might be a proxy for college reputation, built over the years. We use as the previous cohort the one evaluated at the senior year when the individuals have just entered college. So, for the First Cohort, who have entered college in 2004, we consider as the previous cohort the individuals who took the *ENADE* senior year in 2004. For the Second Cohort, the previous cohort took the *ENADE* senior year in 2005, and the previous cohort of the Third Cohort took it in 2006.

For the previous cohort, we build three variables that might serve as a signal to the ability of the graduates in the specific major for each college:

1. Percentage at formal sector: we observe how many of the previous cohort students were employed in the formal sector two years after they took the *ENADE* senior year exam.

2. Log hourly wage: for those individuals of the previous cohort who were employed two years after they took the *ENADE* senior year exam, we take their real hourly wage as a signal for the current cohort.

3. Specific test - senior year: we take the mean of the *ENADE* specific test senior year score for the previous cohort as a signal of the specific skills for those who graduate in the same college and major.

Since the previous cohort graduates three years before the current cohort, it is most likely that their performance in the formal sector right after their graduation will be exogenous to the current cohort performance at *ENADE* and in the formal sector. We assume there is no peer effect between these two cohorts.

In fact, our hypothesis is that the previous cohort performances at *ENADE* and in the formal sector signal for the employers the ability for the individuals who graduate in the same college and major, at least right after graduation. As employers learn about individuals' abilities, the predictability of the previous cohort signals shall decrease over time.

We also test the predictability of three other possible signals of college quality, besides the previous cohorts signals. They are:

1. Quality Index: the $z-score$ of the *CPC* quality synthetic index published by INEP. The index is calculated for each major in the HEI based on the *ENADE* scores, its value added during the three-year evaluation cycle, and on inputs related to the supply conditions - faculty, infrastructure, and didactic-pedagogical resources.

2. Following cohort general skills: the *ENADE* general test freshman year for the cohort who is entering college in the same year that the current cohort is taking the exam as senior

students. So, for the First Cohort, we take the scores for first-year students in 2007; for the Second Cohort we take the freshmen in 2008, and the for the Third Cohort we take the freshmen in 2009. The following cohort general skills measure (i.e., *ENADE* general test freshman year) could serve as a signal of the average ability for those who attend the same college-major, acting as a proxy for selectivity, and it is exogenous to the current cohort. Although this score is available for public access, it is not likely the employers will use this information when hiring. However, it could be related to other entrance students measures of skills (MACLEOD et al., 2017).

3. Average current cohort general and specific skills: we use the mean *ENADE* senior year scores for the class that is graduating together in the same cohort. In fact, that might be an endogenous measure, once the individual's scores are part of this average of her class. Although the possibility of endogeneity, the average *ENADE* score for a specific major in an HEI is published and accessible for any employer, while the individual score is private information. We test the predictability for both general and specific average score.

2.2.4 INDIVIDUAL SKILLS

We include in our model individual ability proxies, measured by the scores the student got in the *ENEM* and *ENADE* exams. In this sense, the returns to the college quality are conditional to the individuals' measured skills while in high school and college. The scores can indicate two types of skills: general skills and skills specific to the field of one's major. These two types of skills could have different behavior on the determination of employability and earnings. By including the ability proxies in our estimation, we are able, to some extent, to control for selection into college.

There are in total five skill measures, but they are not all available for all the three cohorts in the data we have access to:

1. *ENEM* high school senior (general score) - available for the Second and Third Cohorts;
2. *ENADE* freshman year general test score - available for the all Cohorts;
3. *ENADE* freshman year specific test score - available for the all Cohorts;
4. *ENADE* senior year general test score - available for the First Cohort;
5. *ENADE* senior year specific test score - available for the First Cohort.

Employers do not perfectly observe these measures. In this case, one could expect that the return to the ability on job market outcomes will increase over time, as employers become more informed about the individual's ability.

2.2.5 SAMPLE AND DATA

The freshmen students from 2004 to 2006, according to *ENADE* sample, were identified at *RAIS*, starting in the expected graduation year and up to eight years after graduation. We create an unbalanced panel for each of the three cohorts in our analysis - freshman years 2004 to 2006. Table 2.2 depicts a timeline for the years used in our analysis. For the First Cohort of students, the panel at *RAIS* goes from 2009 to 2016, i.e., up to eight years after expected graduation. For the Second Cohort, the information on the performance in the formal sector is available from 2010 to 2016, and for Third Cohort, the panel goes from 2011 to 2016.

Table 2.2: Timeline for the Cohorts

Cohort\Years	Pre-college	College				Expected graduation and After college								
	High School Senior	*Fresh-man*	*2nd Year*	*3rd Year*	*Senior*	*t0*	*t1*	*t2*	*t3*	*t4*	*t5*	*t6*	*t7*	*t8*
First Cohort	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Second Cohort	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Third Cohort	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018

Note: For the years in the highlighted cells, the identified data is not available: ENEM 2003, ENADE 2008 and 2009, and RAIS 2017 and 2018.

It is important to highlight the differences in available data between the cohorts of analysis. We observe measures of *ENADE* senior individual scores only for the First Cohort. These measures, proxies for general and field-specific measures of individuals' ability, are not observable by employers. So, they are not expected to predict a large part of the labor market outcomes, at least in early years of one's career.

Then, the First Cohort merged with their own senior test scores at *ENADE* constitutes the Sample A of our analysis. We restrict this sample to those students that we observe the *ENADE* scores in both points in time - freshman year and senior year - so we have a balanced panel of students. This restriction substantially drops the sample size, considering the high dropout rates in higher education. However, because the students must have completed 80% of the credits to be eligible for *ENADE* senior year exam, they are likely to graduate in the expected year.

On the other hand, for the Second and Third Cohorts, we observe a better measure of the individuals' general skills: the *ENEM* score. Since these cohorts present the same nature of data, we analyze them pooled together, constituting the Sample B. Thus, in this sample, there are all the freshman students in 2005 and 2006 evaluated in *ENADE* who also took the *ENEM* in the previous year. Nonetheless, it is not possible to assure all those students graduated and at the right time. In this sense, in most of the specifications, we estimate the effects to individuals who applied and attended at least one year of college.

Table 2.3 presents the samples' sizes and descriptive statistics for the test scores, college quality signals, and some controls (see Appendix A for a description of all variables) for each Cohort in our analysis.

Table 2.3: Samples size and descriptive statistics (1)

Variable	First Cohort - Freshmen 2004			Second Cohort - Freshmen 2005			Third Cohort - Freshmen 2006		
	Total	Sample (merge with ENADE senior)	Final sample (only valid ENADE scores)	Total	Sample (merge with ENEM)	Final sample (only valid ENADE scores)	Total	Sample (merge with ENEM)	Final sample (only valid ENADE scores)
Number of observations	100,008	23,874	9,890	207,387	24,951	18,252	107,620	25,940	22,119
Number of observations employed in the formal sector at least once	85,129	20,778	8,752	192,675	24,951	18,252	96,595	25,940	22,119
Number of observations with socioeconomic information	73,425	15,664	9,125	103,712	14,474	13,723	65,565	19,219	18,746
Number of HEIs	529	498	427	1,015	937	913	734	719	710
Number of majors evaluated	2,162	1,814	1,346	5,368	4,435	4,219	2,334	2,188	2,144
Labor Market outcomes									
Employed at formal sector (mean in the period)	0.60	0.65	0.68	0.75	0.80	0.81	0.71	0.80	0.70
Real Hourly Wage (mean in the period)	18.53	17.02	17.07	19.44	19.00	18.53	15.77	13.64	13.78
Individual Scores*									
General test - freshman year	32.44	27.60	40.11	57.06	61.83	68.41	35.29	39.70	46.18
Specific test - freshman year	28.55	25.72	38.14	28.74	30.55	35.00	31.62	35.15	40.98
General test - senior year	NA	26.43	51.30	NA	NA	NA	NA	NA	NA
Specific test - senior year	NA	26.04	50.80	NA	NA	NA	NA	NA	NA
General test - high school senior	NA	NA	NA	NA	50.21	49.71	46.74	46.74	46.67
Signals									
Previous Cohort									
Previous cohort - percentage at formal sector	0.54	0.57	0.59	0.75	0.74	0.74	0.71	0.71	0.71
Previous cohort - Real Hourly Wage	17.02	17.10	17.06	17.52	17.23	16.70	17.08	16.25	16.22
Previous cohort Specific test - senior year*	41.36	39.42	39.99	33.96	33.67	33.98	36.65	36.84	37.37
*Quality Index**									
Major - Quality index	2.41	2.31	2.32	2.41	2.45	2.47	2.28	2.28	2.29
*Current Cohort**									
Average General test - senior year	50.09	47.84	48.41	50.97	51.04	51.49	44.72	44.85	45.04
Average Specific test - senior year	48.70	46.34	46.86	37.95	37.41	38.36	42.59	42.58	42.63
*Following Cohort**									
Following cohort General test - freshman year	47.00	45.34	45.87	47.69	47.83	48.27	40.86	40.95	41.12

Source: Elaborated by authors.

(*) Variables presented in the original units. For estimations, variables are standardized by normal distribution, using mean and standard deviation of the students in the same HEI.

Samples size and descriptive statistics (2)

Variable	First Cohort - Freshmen 2004			Second Cohort - Freshmen 2005			Third Cohort - Freshmen 2006		
	Total	Sample (merge with ENADE senior)	Final sample (only valid ENADE scores)	Total	Sample (merge with ENEM)	Final sample (only valid ENADE scores)	Total	Sample (merge with ENEM)	Final sample (only valid ENADE scores)
Individual Controls									
Worked while in college	0.44	0.51	0.48	0.72	0.67	0.67	0.75	0.78	0.77
Age	22.96	24.09	23.96	24.41	20.11	20.15	24.47	20.89	20.81
Men	0.32	0.30	0.27	0.51	0.50	0.45	0.43	0.36	0.35
Night classes	0.32	0.37	0.38	0.70	0.70	0.71	0.78	0.78	0.78
Children	0.13	0.18	0.18	0.21	0.06	0.06	0.19	0.07	0.07
Black	0.25	0.25	0.24	0.33	0.32	0.32	0.31	0.33	0.33
Public high school	0.55	0.63	0.63	0.72	0.73	0.74	0.67	0.74	0.75
Low income	0.24	0.23	0.23	0.34	0.37	0.37	0.36	0.46	0.46
Mother - high school	0.63	0.55	0.55	0.47	0.56	0.56	0.53	0.56	0.56
College Controls*									
Major - proportion of Prof. PhD	0.17	0.17	0.16	0.20	0.21	0.21	0.13	0.15	0.14
Major - proportion of Prof. full time	0.29	0.25	0.23	0.36	0.34	0.33	0.23	0.22	0.21
Dropout rate	0.20	0.25	0.24	0.44	0.42	0.37	0.43	0.44	0.41
Work Controls*									
Working hours	37.09	37.26	37.05	38.20	38.26	37.90	40.44	40.47	40.48
Tenure (months)	34.58	39.79	39.54	46.83	29.52	29.75	42.02	29.85	29.98
Employed in December	0.78	0.80	0.81	0.81	0.80	0.80	0.78	0.79	0.79

Source: Elaborated by authors.

(*) Variables presented in the original units. For estimations, variables are standardized by normal distribution, using mean and standard deviation of the students in the same HEI.

For the First Cohort, the first restriction we impose to the sample is that the students who took the *ENADE* as freshmen in 2004 retake it in 2007 as senior-years. Because of sample design of *ENADE*, besides retention and absence on the day of the exam, we keep only one-quarter of the original freshman students. The second restriction is related to the *ENADE* scores authenticity: we impose that students have adequate scores in all the objective tests (e.g., cleaning for a boycott). Additionally, we consider only the students who have responded to the socioeconomic questionnaire in the freshman year. Then, the final sample size for the First Cohort, the Sample A, is 9,125 students.

For the Second and Third Cohort, the first restriction to the sample is that the students who took the *ENADE* as freshman students had also taken the *ENEM* exam in the previous year. The final sample includes only students for which *ENEM* information was available. Considering both admission years, on average it is possible to match *ENEM* scores for 20% of first-year students. The same restriction about *ENADE* scores and questionnaire are used for these cohorts. So, Sample B, composed of the Second Cohort and the Third Cohort pooled together, contains over 30,000 students.

Considering the individuals in the final sample, the employment rate is 68 to 81%, on average. Conditional on being employed, the hourly wage varies across cohorts: while for the Second Cohort the mean wage in the period is R$18/hour, in the Third Cohort they earn R$14/hour. The test scores are also higher for the Second Cohort[9]. These differences among the Cohorts may be related to the majors sampled in each year.

The percentage of the previous cohort employed in the formal sector two years after their graduation varies from 59% to 74%. They earn on average R$16/hour.

[9] For the estimations, we use standard scores.

2.3 EMPIRICAL STRATEGY

We estimate the returns to college quality on the labor market outcomes, conditional to individual abilities. Considering the measures of individual skills and college quality are usually not utterly observable by employers, we expect to find dynamic effects for the various sort of variables. For instance, the individual ability measure, since it is private information, is expected to raise its return on wage after a few years in the labor market. On the other hand, a college quality measure, if it serves as a signal of the graduate's ability, should decrease its wage premium over time. The sort of ability, whether it reflects general or field-specific skills, for example, could also present different correlations with the job market performance.

We are interested in the returns on two outcomes for each year after expected graduation: the probability of being employed in the formal sector and log hourly wages (conditional on being employed in the formal sector). When investigating the wage formation, it is possible to observe only those students employed in the formal sector. This selection is a limitation of our study, although this does not occur in investigating the probability of being employed in the formal sector. Despite the richness of our dataset, we cannot control for unobserved characteristics, such as individual's motivation and their college choice process determinants. These facts affect the external validity of our results.

In order to investigate the returns for each college quality and sort of ability, we estimate a model for each year t after expected graduation separately, as described in Equation 2.1[10]:

$$Y_{ij} = \alpha + \beta \cdot A_i + \theta \cdot P_j + \gamma \cdot Q_j + \sigma \cdot C_j + \eta \cdot F_j + \psi \cdot X_{ij} + \varepsilon \tag{2.1}$$

where i refers to the individual, j refers to the institution/major, Y_{ij} is the dependent variable (either employed in the formal sector dummy or log of real hourly wage), A is the vector of skills proxies (*ENADE* and *ENEM* scores). The college quality signal variables are: P is the vector of variables of the previous cohort's performance at the labor market and their correspondent *ENADE* senior scores, Q is the *CPC* indicator of college quality for each major, C refers to the average *ENADE* senior scores for the individual's class, and F refers to the average *ENADE* freshman scores for the next cohort. X is a vector of individual, major and institutions' observable characteristics, such as gender, working experience while in college, (see panel (2) of Table 2.3 for the complete list of control variables), besides institution and major dummies.

[10] We present only the conditional returns, including all measures of college quality and abilities. The college quality returns, for each measure, unconditional to the abilities do not vary significantly from the conditional ones, and are available upon request.

Similar models are used to estimate heterogeneous effects:

$$Y_{ij} = \alpha + \beta \cdot A_i + \theta \cdot P_j + \gamma \cdot Q_j + \sigma \cdot C_j + \eta \cdot F_j + \psi \cdot X_{ij} + \lambda \cdot G_i \cdot A_i + \mu \cdot G_i \cdot P_j + \varepsilon_{ij} \quad (2.2)$$

$$Y_{ij} = \alpha + \beta \cdot A_i + \theta \cdot P_j + \gamma \cdot Q_j + \sigma \cdot C_j + \eta \cdot F_j + \psi \cdot X_{ij} + \lambda \cdot W_i \cdot A_i + \mu \cdot W_i \cdot P_j + \varepsilon_{ij} \quad (2.3)$$

$$Y_{ij} = \alpha + \beta \cdot A_i + \theta \cdot P_j + \gamma \cdot Q_j + \sigma \cdot C_j + \eta \cdot F_j + \psi \cdot X_{ij} + \lambda \cdot E_j \cdot A_i + \mu \cdot E_j \cdot P_j + \varepsilon_{ij} \quad (2.4)$$

where the Equation 2.2 estimates heterogeneous effects of P for gender G_i, Equation 2.3 estimates heterogeneous effects of P if the individuals have worked in the formal sector while in college W_i, and Equation 2.4 investigates if there are heterogeneous effects of P for each field of education E_j. In each equation, the parameters of interest are the interaction ones (λ and μ). Through these models, we examine if the returns to individual abilities vary across the subgroups. The other college quality signals (Q, C, and F) are not included in this analysis, since the overall effects are not consistent and they are not primary in the study.

2.4 EFFECTS ON AFTER GRADUATION OUTCOMES

In this section we explore the conditional returns to individual skills and the various college quality signals on the labor market outcomes after the expected year of graduation[11], according to the models expressed in the Equation 2.1. We investigate two outcomes: the probability of being employed and the log of hourly wage, up to eight years after expected graduation for Sample A and six years for Sample B[12]. Additional findings in respect of heterogeneity of results are presented.

2.4.1 PROBABILITY OF BEING EMPLOYED

The group of individual skills variables is the main difference between Sample A and Sample B, besides the evaluated majors. In this sense, any difference between the results of the two samples could relate to these restrictions. In Sample A, we observe the individuals' scores in the *ENADE* senior year; in Sample B, we observe the individuals' score in *ENEM* as a high school senior student. For individuals from both samples, we access the scores in the *ENADE* freshman year.

The estimated returns to individual skills vary across the sources of measurement and sample (Figure 2.2). The returns for general skills provided by the ENADE freshman year scores are constant with no return on the probability to be employed, except for around 0.015 in a few years. That means that increasing one standard deviation in the *ENADE* freshman year general test score is related to an increase of 1.5% of chance to be employed in the formal sector in these years after graduation. For Sample B, the return of the high school senior measure of general skills (*ENEM*) increases up to 0.015 in the sixth year after expected graduation. The increasing trend is not unexpected: as the employee gets experience in the job market, her probability to be employed is more related to her own skills.

The *ENADE* score in the specific test, which measures the skills specifically related to each major, presents coefficients of 0.01-0.03. The field-specific senior test scores seem to be increasing over time in Sample A. So, this sort of ability may be relevant to determining employability in this universe.

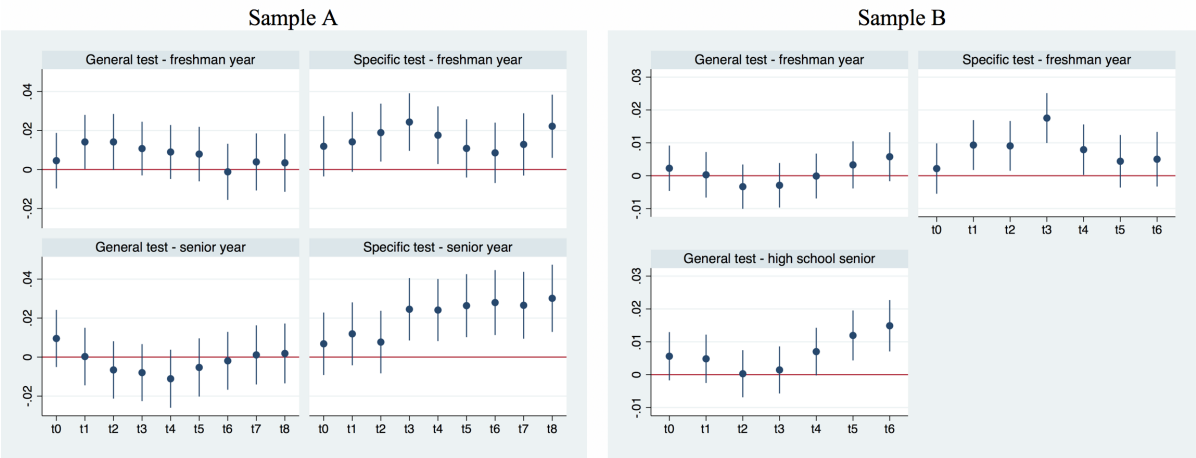
The returns to each group of college signals variables are presented in Figure 2.3 and Figure 2.4.

Considering our proposed signal measures related to previous cohort signals, the percentage of individuals of the previous cohort employed in the formal sector two years after their

[11] We also estimate the Equation 2.1 that depicts the wage formation restricting the sample for those who graduated in college, according to the information in *RAIS*. This subsample is about 30% smaller than the original one, but the results are not affected in general. Since the results do not change and we cannot observe the graduation information correctly, especially for those who are not in the formal sector, we choose to use the whole sample for both outcomes.

[12] Because $t7$ for the Third Cohort is not available, we present the results for Sample B up to $t6$ only. Tables display complete results in Appendix B.

Figure 2.2: Returns to individual skills on the probability of being employed



graduation (*Previous cohort - percentage in the formal sector*) presents a significant positive return on the outcome (Figure 4) of 0.23 in Sample A and 0.15 in Sample B (average in all years): an increase of 1 percentage point in the signal variable is related to an increase of 23% (15%) in Sample A (Sample B) in the probability of being employed in the following years after graduation. There might be a decreasing trend across the years, which may relate to other variables becoming more critical to determine the employability as the previous cohort signal reduces its importance. There is no evidence on the effects of the previous cohort's log hourly wage and the ENADE senior year specific score on the individual's probability of being employed.

The quality index for each major does not present significant coefficients (Figure 2.4), although this is the only college quality signal that could be entirely observed by the employers.

For the average *ENADE* senior year scores, which includes the student's own scores and her peers', there is no evidence of a positive relationship with the individual's employability, with some negative coefficients in Sample B estimations. The negative effects were not expected; therefore these variables might be related to unobservable characteristics.

Finally, the following cohort *ENADE* freshman year general test score does not present positive coefficients in most of the estimations. It is worthwhile to highlight the pattern of the dummy variable that indicates if the individual worked in the formal sector while in college (Figure 4): there is a clear decreasing trend from 0.4 in the year of graduation t0 to 0.2 in Sample A and 0.03 in Sample B at t6. That means that when the student is close to graduate in college, she has 40% more chance to be employed if she worked in prior years, but this effect decreases over time.

2.4.2 EARNINGS

The results for Equation 2.1 estimation of wage formation are presented graphically in Figures 6-8.

Figure 2.3: Returns to previous cohort's performance and individuals' experience on the probability of being employed

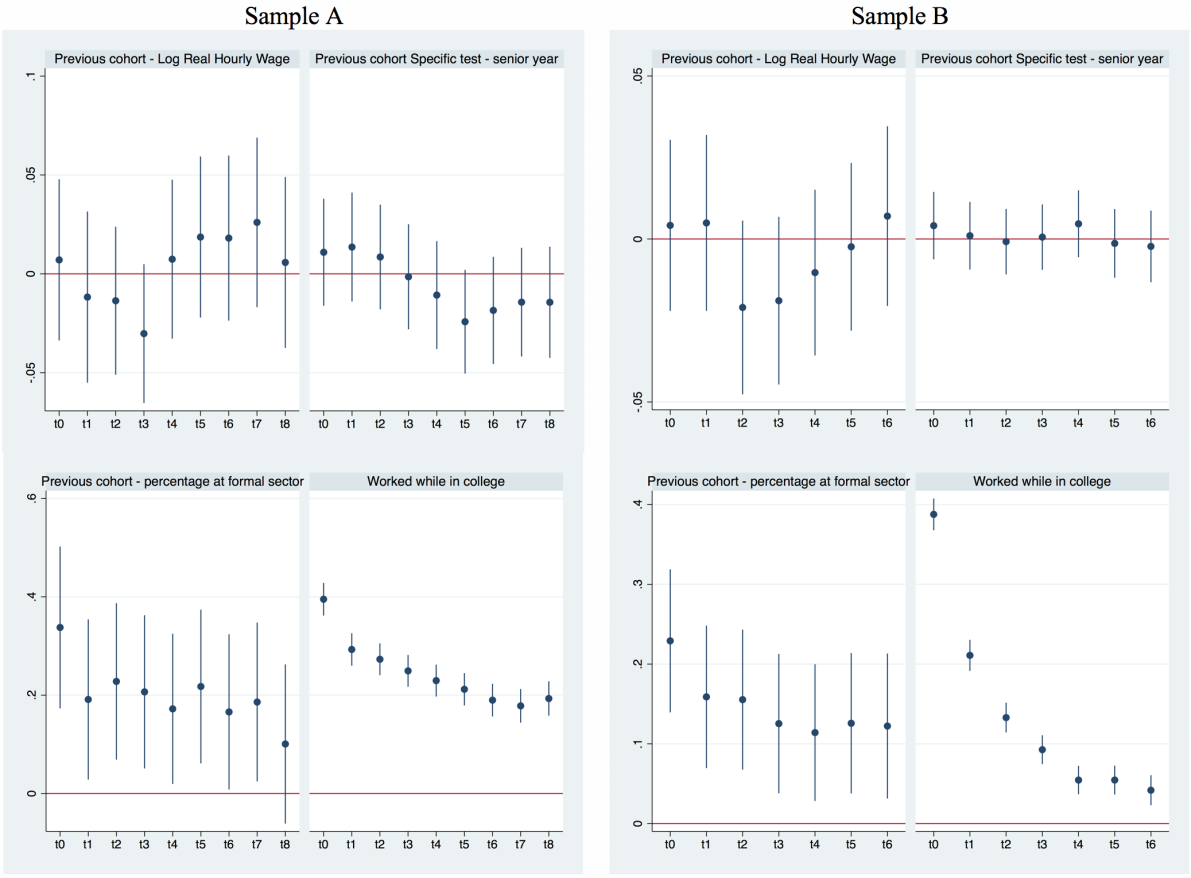
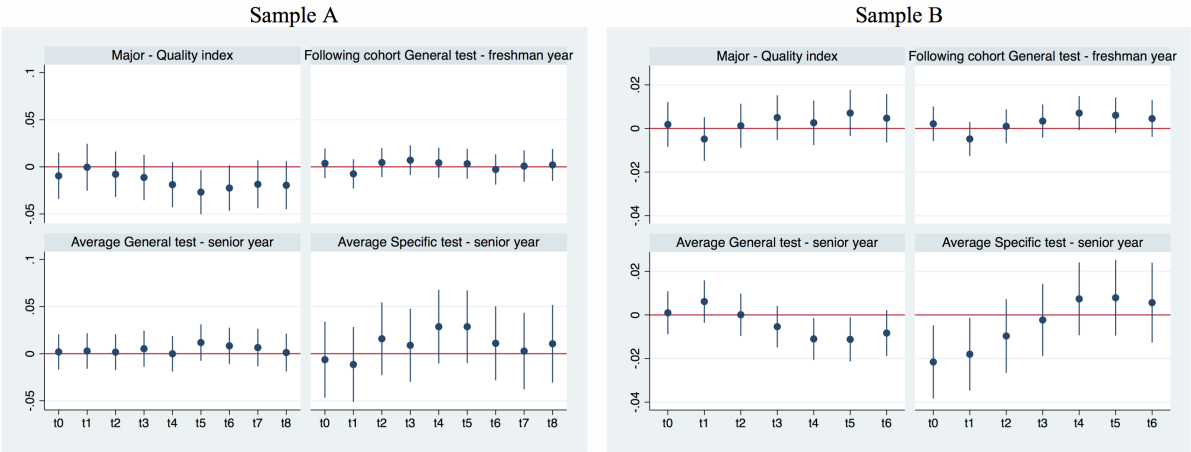


Figure 2.4: Returns to other college quality indicators on the probability of being employed

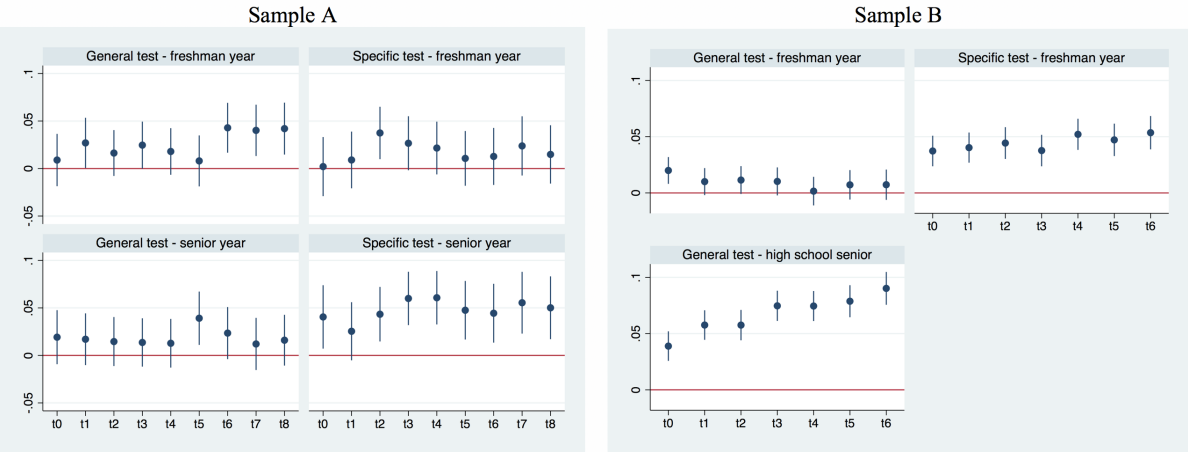


For the general skills measures, while there is little evidence of the importance of these measures in the probability of being employed, in wage formation the general skill measures present consistently positive coefficients. The *ENADE* freshman year general test score return is constant over time, around 0.04 and 0.03 (Sample A and B, respectively) on the log of hourly wage, i.e., if the general score increases by one standard deviation, we would expect the individual's hourly wage to increase by 4% and 3%, respectively. A similar result is observed in

the *ENADE* senior year general test score (variable only available for Sample A). Moreover, the return to the *ENEM* score (general test as high school senior, variable only available for Sample B) doubles from t0 to t6: six years after graduation, the return to one more standard deviation in the *ENEM* score is an hourly wage 8.5% greater. This result is consistent with the literature on wage formation, that states the increasing return on the individual's ability on her wage.

For the returns to specific skills, the main results are for the scores provided by *ENADE* senior year exam, that seems to be correlated to wage by 5% for each standard deviation. For the freshman year scores, returns are relatively constant around 0.03 or 0.05 (Sample A or Sample B), with little evidence of increasing returns over time.

Figure 2.5: Returns to individual skills on the log hourly wage



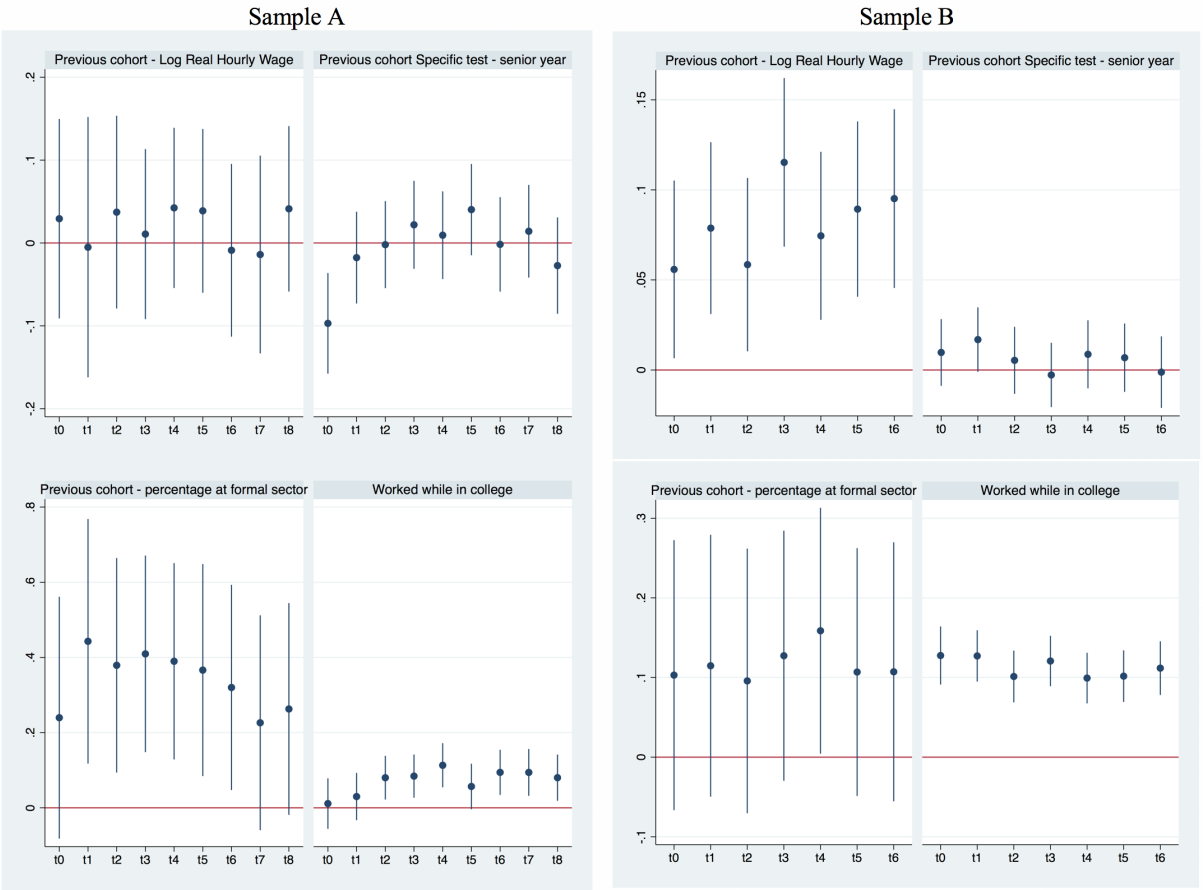
The returns to each group of college signals variables are presented in Figure 2.6 and Figure 2.7.

In the group of our proposed signal measures of previous cohort signals, the percentage of individuals of the previous cohort in the formal sector two years after their graduation (*Previous cohort - percentage in the formal sector*) behaves in a similar way to the return on employability: an increase of 1 percentage point in the signal variable is related to an increase of 33% and 16% (Sample A and Sample B, respectively) in the wage in the following years after graduation.

The previous cohort's log hourly wage, especially for Sample B, is significant around 0.1 for the whole period after expected graduation, meaning that a 10% higher wage of the previous cohort two years after their graduation reflects a 1% increase in the individual's wage. There is no evidence on the effects of the previous cohort's *ENADE* senior year specific score on the individual's wage.

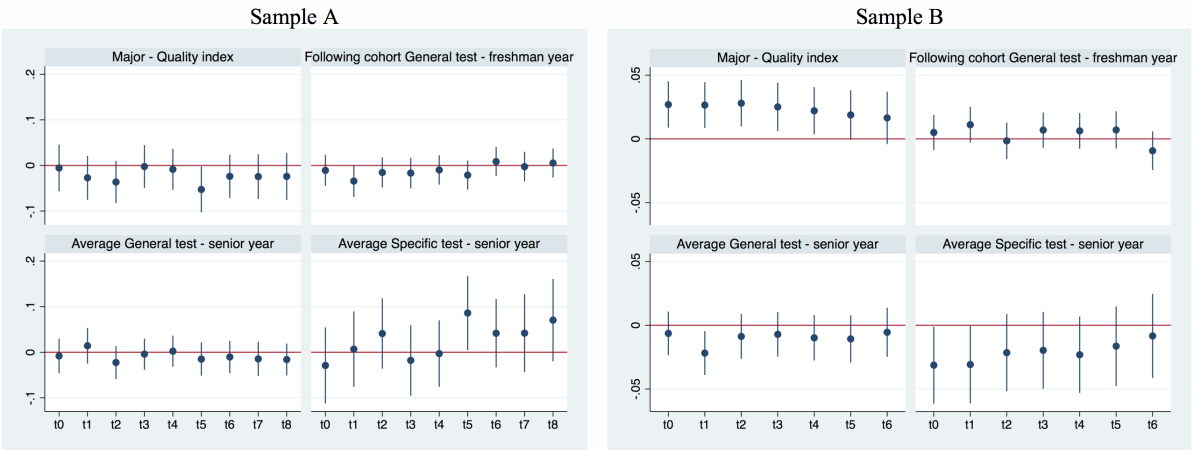
The quality index for each major presents coefficients around 0.025 for Sample B during the years after expected graduation: if the index value for the major in the college the student attended increases one standard deviation, it reflects in 2.5% higher wage.

Figure 2.6: Returns to previous cohort's performance and individuals' experience on the log hourly



For both current cohort and following cohort scores at *ENADE*, it is not found evidence on contribution in the wage formation.

Figure 2.7: Returns to other college quality indicators on the probability of being employed



Finally, we observe a constant coefficient over time for the dummy that indicates that the individual has worked while in college: if the individual has worked before, there is a 0.8%

(1%) in Sample A (Sample B) increase in her wage. It is interesting to note that the decreasing trend that we observe to employability result does not emerge to the wage formation.

2.4.3 HETEROGENEOUS RETURNS

To investigate if there are heterogeneous effects related to gender, previous experience in the formal sector and field of education, we estimate the Equation 2.2, Equation 2.3 and Equation 2.4, respectively. The groups of variables explored are the individual abilities and the previous cohort performance.

Table 2.4 and Table 2.5 present the heterogeneous returns across gender on the probability of being employed in the formal sector, for Samples A and B, respectively. A heterogeneous return similar across samples is found to the *ENADE* specific test score: this return is up to 3% greater for women compared to men. On the other hand, for Sample A, there is a 4% smaller return to the Previous cohort specific test score for women compared to men. These results analyzed together may indicate that while for women there is a greater return to the ability, the college quality signal might be more relevant for men in affecting the probability of being employed in the formal sector.

The gender heterogeneous returns on earnings present different pattern (Table 2.6 and Table 2.7). Sample A presents greater returns for men to the freshman year specific test. However, for Sample B, men acquire 3% smaller returns to general ability (high school senior measure) and 18% smaller returns to the *Previous cohort - percentage in the formal sector*.

We also investigate the existence of heterogeneous effects associated with previous experience in the formal sector. For this, we interact a binary variable that indicates if the student has worked while in college with the individual skills measures and college quality signals from the previous cohorts.

Table 2.8 and Table 2.9 present the results of heterogeneity across whether they have prior experience on the probability of being employed. Three years after graduation, those students who have worked while in college perceive a 3% smaller return to freshman specific skills than those students who have not worked. Yet, the returns to the general skills are greater (around 2%) for those with experience in their early careers. This result is consistent with the signaling theory: since they have worked before, their ability is more likely to correlate with the employability right after graduation. The students with prior experience also observe a smaller return to the *Previous cohort - percentage in the formal sector*, 20% less than the students who did not have experience (Sample A). Thus, the signaling from the previous cohort is less relevant to determine employability once the individual may signal her ability through her own work experience.

In respect of heterogeneity on earnings (Table 2.10 and Table 2.11), prior experience is related to 4% to 7% greater returns to freshman general skills in the early career. However,

Table 2.4: Probability of being employed in the formal sector, Sample A - Heterogeneity across Gender

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6	(8) t7	(9) t8
IndividualScores									
General test - freshman year	0.00304	0.01405*	0.01137	0.00978	0.00952	0.00854	0.00240	0.00033	0.00139
	[0.00861]	[0.00833]	[0.00858]	[0.00827]	[0.00836]	[0.00840]	[0.00859]	[0.00876]	[0.00894]
Specific test - freshman year	0.01636*	0.02013**	0.02560***	0.03606***	0.02255**	0.02096**	0.01320	0.01483	0.02489**
	[0.00933]	[0.00920]	[0.00899]	[0.00888]	[0.00895]	[0.00891]	[0.00926]	[0.00955]	[0.00980]
General test - senior year	0.01795**	0.00268	-0.00498	-0.01203	-0.00937	0.00145	0.00093	0.00689	0.00738
	[0.00880]	[0.00877]	[0.00878]	[0.00870]	[0.00884]	[0.00886]	[0.00864]	[0.00897]	[0.00910]
Specific test - senior year	0.00591	0.01027	0.00099	0.02222**	0.02035**	0.02408**	0.03010***	0.02338**	0.02222**
	[0.00970]	[0.00980]	[0.00963]	[0.00954]	[0.00964]	[0.00966]	[0.00995]	[0.01033]	[0.01040]
Signals									
PreviousCohort									
Previous cohort - percentage at formal sector	0.33293***	0.22187***	0.25595***	0.21160***	0.16465**	0.20035**	0.16837**	0.21099**	0.11154
	[0.08660]	[0.08580]	[0.08306]	[0.08156]	[0.08075]	[0.08281]	[0.08181]	[0.08448]	[0.08570]
Previous cohort - Log Real Hourly Wage	-0.00041	-0.01632	-0.02337	-0.03924**	0.00101	0.01060	0.00319	0.02219	0.01106
	[0.02239]	[0.02339]	[0.02018]	[0.01848]	[0.02229]	[0.02244]	[0.02266]	[0.02333]	[0.02412]
Previous cohort Specific test - senior year	0.00217	0.01287	0.00572	-0.00796	-0.02154	-0.03696***	-0.02860*	-0.01696	-0.02220
	[0.01513]	[0.01511]	[0.01437]	[0.01430]	[0.01505]	[0.01431]	[0.01469]	[0.01490]	[0.01526]
IndividualControls									
Men	-0.10050	0.03196	-0.04416	-0.08529	-0.06775	-0.12180	-0.16102	0.01486	0.12058
	[0.11087]	[0.11915]	[0.11552]	[0.11303]	[0.11520]	[0.11751]	[0.12552]	[0.12177]	[0.11689]
Interactions									
Men x General test - freshman year	0.00641	0.00036	0.01046	0.00366	-0.00168	-0.00075	-0.01324	0.01299	0.00779
	[0.01612]	[0.01597]	[0.01643]	[0.01562]	[0.01554]	[0.01592]	[0.01656]	[0.01683]	[0.01707]
Men x Specific test - freshman year	-0.01600	-0.01793	-0.02172	-0.03714**	-0.01677	-0.03406**	-0.01434	-0.00695	-0.00983
	[0.01614]	[0.01616]	[0.01557]	[0.01563]	[0.01540]	[0.01573]	[0.01617]	[0.01669]	[0.01663]
Men x General test - senior year	-0.03120*	-0.01055	-0.00943	0.01082	-0.00808	-0.02611	-0.01134	-0.02248	-0.02138
	[0.01664]	[0.01673]	[0.01658]	[0.01643]	[0.01668]	[0.01668]	[0.01723]	[0.01729]	[0.01744]
Men x Specific test - senior year	0.00464	0.00537	0.02042	0.00598	0.01093	0.00861	-0.00712	0.01069	0.02458
	[0.01638]	[0.01642]	[0.01625]	[0.01648]	[0.01584]	[0.01620]	[0.01682]	[0.01698]	[0.01718]
Men x Previous cohort - percentage at formal sector	0.01718	-0.12457	-0.10125	-0.00918	0.02397	0.06375	0.00202	-0.10601	-0.08147
	[0.07889]	[0.08430]	[0.08547]	[0.08310]	[0.08229]	[0.08350]	[0.08764]	[0.08846]	[0.08918]
Men x Previous cohort - Log Real Hourly Wage	0.03371	0.01744	0.03962	0.03675	0.02834	0.03683	0.06225	0.01600	-0.02003
	[0.03610]	[0.03868]	[0.03587]	[0.03454]	[0.03676]	[0.03786]	[0.04117]	[0.03848]	[0.03608]
Men x Previous cohort Specific test - senior year	0.03363*	0.00516	0.01363	0.02551	0.04090**	0.04849**	0.03934**	0.01184	0.02997
	[0.01929]	[0.02026]	[0.01952]	[0.01936]	[0.01906]	[0.01945]	[0.01990]	[0.02024]	[0.02038]
Constant	0.10528	0.04685	0.38548**	0.36230***	0.48458***	0.51268***	0.37809***	0.38939***	0.36704***
	[0.14667]	[0.15603]	[0.15061]	[0.13953]	[0.14211]	[0.14121]	[0.13562]	[0.13814]	[0.13723]
Observations	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925
Adjusted R-squared	0.29710	0.24699	0.23494	0.21925	0.20641	0.19013	0.17811	0.15276	0.13850
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.5: Probability of being employed in the formal sector, Sample B - Heterogeneity across Gender

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6
IndividualScores							
General test - freshman year	0.00647	0.00489	-0.00016	-0.00235	-0.00003	0.00247	0.00062
	[0.00447]	[0.00442]	[0.00425]	[0.00428]	[0.00434]	[0.00454]	[0.00476]
Specific test - freshman year	0.00067	0.01038**	0.00786*	0.01664***	0.00947**	0.00986**	0.01055**
	[0.00481]	[0.00474]	[0.00466]	[0.00466]	[0.00473]	[0.00487]	[0.00513]
General test - high school senior	0.00356	0.00199	-0.00598	-0.00014	0.00390	0.01076**	0.01693***
	[0.00486]	[0.00475]	[0.00462]	[0.00463]	[0.00463]	[0.00489]	[0.00514]
Signals							
PreviousCohort							
Previous cohort - percentage at formal sector	0.22161***	0.15908***	0.15688***	0.12643***	0.09650**	0.13146***	0.12929***
	[0.04871]	[0.04855]	[0.04823]	[0.04737]	[0.04705]	[0.04826]	[0.04991]
Previous cohort - Log Real Hourly Wage	0.00962	0.00766	-0.01871	-0.01499	-0.01132	-0.00959	0.00823
	[0.01450]	[0.01475]	[0.01484]	[0.01420]	[0.01434]	[0.01446]	[0.01558]
Previous cohort Specific test - senior year	0.00627	-0.00127	-0.00138	-0.00010	0.00445	-0.00043	-0.00687
	[0.00602]	[0.00608]	[0.00580]	[0.00580]	[0.00599]	[0.00613]	[0.00630]
IndividualControls							
Men	0.00961	0.00192	0.00333	0.01452	-0.05881	-0.05291	0.02344
	[0.05909]	[0.06122]	[0.05997]	[0.05924]	[0.05936]	[0.06037]	[0.06317]
Interactions							
Men X General test - freshman year	-0.01125	-0.01231*	-0.00842	-0.00152	-0.00019	0.00248	0.01383*
	[0.00721]	[0.00732]	[0.00719]	[0.00719]	[0.00722]	[0.00759]	[0.00785]
Men X Specific test - freshman year	0.00429	-0.00275	0.00372	0.00252	-0.00378	-0.01460*	-0.01523*
	[0.00748]	[0.00745]	[0.00751]	[0.00744]	[0.00757]	[0.00793]	[0.00817]
Men X General test - high school senior	0.00526	0.00736	0.01592**	0.00407	0.00777	0.00283	-0.00517
	[0.00748]	[0.00753]	[0.00739]	[0.00741]	[0.00748]	[0.00782]	[0.00798]
Men X Previous cohort - percentage at formal sector	0.02705	-0.00071	-0.00456	-0.00241	0.04967	-0.02118	-0.02731
	[0.04685]	[0.05008]	[0.04985]	[0.04984]	[0.04996]	[0.05059]	[0.05223]
Men X Previous cohort - Log Real Hourly Wage	-0.01352	-0.00761	-0.00563	-0.01063	0.00357	0.01935	-0.00529
	[0.01684]	[0.01718]	[0.01679]	[0.01627]	[0.01630]	[0.01665]	[0.01760]
Men X Previous cohort Specific test - senior year	-0.00579	0.00648	0.00157	0.00202	0.00030	-0.00232	0.01324
	[0.00760]	[0.00765]	[0.00759]	[0.00766]	[0.00776]	[0.00796]	[0.00831]
Constant	0.19998**	0.38989***	0.60342***	0.72827***	0.77142***	0.76434***	0.70987***
	[0.09935]	[0.09888]	[0.10268]	[0.08573]	[0.08594]	[0.07419]	[0.07907]
Observations	13,839	13,839	13,839	13,839	13,839	13,839	13,839
Adjusted R-squared	0.28437	0.12790	0.07076	0.04319	0.02917	0.02436	0.02727
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.6: Log Hourly Wage, Sample A - Heterogeneity across Gender

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6	(8) t7	(9) t8
IndividualScores									
General test - freshman year	0.00479	0.01205	0.00771	0.01476	-0.00215	-0.00892	0.02886*	0.03909**	0.03139*
	[0.01611]	[0.01534]	[0.01404]	[0.01429]	[0.01458]	[0.01611]	[0.01588]	[0.01594]	[0.01649]
Specific test - freshman year	-0.00273	-0.00146	0.02103	0.02113	0.01069	-0.00130	0.01926	0.03042*	0.00856
	[0.01810]	[0.01668]	[0.01521]	[0.01616]	[0.01585]	[0.01591]	[0.01703]	[0.01743]	[0.01794]
General test - senior year	0.02482	0.01745	0.02014	0.01764	0.01514	0.04434***	0.01536	0.01071	0.01871
	[0.01664]	[0.01608]	[0.01519]	[0.01447]	[0.01476]	[0.01622]	[0.01613]	[0.01594]	[0.01575]
Specific test - senior year	0.04402**	0.03508*	0.04575***	0.06135***	0.06128***	0.04584***	0.05704***	0.06471***	0.05761***
	[0.02049]	[0.01792]	[0.01692]	[0.01625]	[0.01646]	[0.01749]	[0.01795]	[0.01834]	[0.01943]
Signals									
PreviousCohort									
Previous cohort - percentage at formal sector	0.29014*	0.44306***	0.33968**	0.39348***	0.41801***	0.37293**	0.34538**	0.22918	0.27033*
	[0.17539]	[0.17157]	[0.15185]	[0.13647]	[0.13825]	[0.14682]	[0.14156]	[0.15341]	[0.15158]
Previous cohort - Log Real Hourly Wage	0.05292	0.00408	0.06454	0.02676	0.03670	0.04198	0.01655	-0.02648	0.04821
	[0.07625]	[0.09276]	[0.06787]	[0.05726]	[0.05353]	[0.05316]	[0.05588]	[0.06948]	[0.05552]
Previous cohort Specific test - senior year	-0.09605***	-0.00560	0.01132	0.04265	0.01242	0.04463	0.01671	0.02697	-0.03025
	[0.03217]	[0.02904]	[0.02813]	[0.02786]	[0.02816]	[0.02915]	[0.02954]	[0.02919]	[0.03039]
IndividualControls									
Men	0.50979**	0.28755	0.27739	0.27798	0.19050	0.22172	0.50012**	0.00464	0.22380
	[0.25772]	[0.29271]	[0.23862]	[0.24830]	[0.23104]	[0.26320]	[0.24954]	[0.26290]	[0.25932]
Interactions									
Men x General test - freshman year	0.01260	0.04756	0.02804	0.03332	0.06338**	0.05727*	0.04546	0.00555	0.03621
	[0.03292]	[0.03211]	[0.02916]	[0.02990]	[0.02849]	[0.03058]	[0.03002]	[0.03175]	[0.03141]
Men x Specific test - freshman year	0.01483	0.02789	0.04701	0.01496	0.02986	0.03454	-0.01883	-0.02025	0.01805
	[0.03416]	[0.03333]	[0.03039]	[0.03115]	[0.03081]	[0.03229]	[0.03306]	[0.03564]	[0.03385]
Men x General test - senior year	-0.01557	-0.00080	-0.01969	-0.01537	-0.01495	-0.02292	0.02568	0.00356	-0.01217
	[0.03214]	[0.03100]	[0.02818]	[0.02930]	[0.03009]	[0.03208]	[0.03063]	[0.03234]	[0.02998]
Men x Specific test - senior year	-0.00737	-0.02547	-0.00237	0.00149	0.00073	0.00746	-0.03450	-0.02488	-0.02006
	[0.03325]	[0.03229]	[0.02915]	[0.03024]	[0.02924]	[0.03345]	[0.03099]	[0.03336]	[0.03303]
Men x Previous cohort - percentage at formal sector	-0.27615	-0.09084	0.05551	0.03175	-0.10362	-0.08288	-0.17864	-0.01441	-0.04590
	[0.20301]	[0.19910]	[0.16653]	[0.16839]	[0.16317]	[0.17858]	[0.16816]	[0.18014]	[0.17235]
Men x Previous cohort - Log Real Hourly Wage	-0.08096	-0.06414	-0.10565	-0.07116	0.00354	-0.03910	-0.11580	0.03660	-0.03680
	[0.08204]	[0.10884]	[0.08619]	[0.08385]	[0.08388]	[0.08756]	[0.08198]	[0.08638]	[0.08344]
Men x Previous cohort Specific test - senior year	-0.00196	-0.04995	-0.05605	-0.07652*	-0.00587	-0.01377	-0.07143	-0.05019	0.00633
	[0.04685]	[0.04663]	[0.04131]	[0.04116]	[0.03764]	[0.04060]	[0.04427]	[0.04733]	[0.04495]
Constant	2.33704***	2.73082***	2.98608***	3.52176***	3.89015***	3.75491***	3.36213***	3.81493***	2.52957***
	[0.35179]	[0.48670]	[0.41192]	[0.32118]	[0.46099]	[0.58272]	[0.45057]	[0.82316]	[0.37073]
Observations	1,770	1,974	2,160	2,259	2,257	2,141	2,244	2,201	2,039
Adjusted R-squared	0.31508	0.30209	0.32265	0.30727	0.30803	0.28390	0.27587	0.27064	0.28790
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.7: Log Hourly Wage, Sample B - Heterogeneity across Gender

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6
IndividualScores							
General test - freshman year	0.02471***	0.00715	0.01233	0.01507*	0.00400	0.01189	0.00570
	[0.00759]	[0.00759]	[0.00777]	[0.00776]	[0.00787]	[0.00811]	[0.00854]
Specific test - freshman year	0.03514***	0.03862***	0.04302***	0.03607***	0.04972***	0.04772***	0.06257***
	[0.00847]	[0.00822]	[0.00855]	[0.00845]	[0.00839]	[0.00872]	[0.00900]
General test - high school senior	0.04505***	0.06378***	0.07053***	0.08575***	0.08532***	0.08940***	0.09662***
	[0.00842]	[0.00833]	[0.00843]	[0.00841]	[0.00830]	[0.00889]	[0.00914]
Signals							
PreviousCohort							
Previous cohort - percentage at formal sector	0.16904*	0.14615*	0.11840	0.17404**	0.15989*	0.12412	0.10915
	[0.09065]	[0.08827]	[0.08927]	[0.08390]	[0.08409]	[0.08427]	[0.08901]
Previous cohort - Log Real Hourly Wage	0.05060*	0.08823***	0.05619**	0.10661***	0.07625***	0.09817***	0.09320***
	[0.02773]	[0.02632]	[0.02607]	[0.02602]	[0.02574]	[0.02741]	[0.02818]
Previous cohort Specific test - senior year	0.01137	0.01958*	0.00456	-0.00046	0.01304	0.00715	-0.00019
	[0.01043]	[0.01024]	[0.01055]	[0.01015]	[0.01075]	[0.01084]	[0.01140]
IndividualControls							
Men	0.18893*	0.23109**	0.12419	0.13720	0.13505	0.23485**	0.11620
	[0.11024]	[0.10944]	[0.11101]	[0.10531]	[0.10712]	[0.10896]	[0.11253]
Interactions							
Men X General test - freshman year	-0.01180	0.00796	-0.00231	-0.01259	-0.00604	-0.01253	0.00480
	[0.01264]	[0.01286]	[0.01333]	[0.01335]	[0.01363]	[0.01405]	[0.01438]
Men X Specific test - freshman year	0.00482	0.00396	0.00168	0.00207	0.00505	-0.00309	-0.02596*
	[0.01329]	[0.01332]	[0.01391]	[0.01391]	[0.01371]	[0.01434]	[0.01495]
Men X General test - high school senior	-0.01510	-0.01560	-0.03287**	-0.02720**	-0.02761**	-0.02698*	-0.01642
	[0.01344]	[0.01349]	[0.01401]	[0.01366]	[0.01374]	[0.01465]	[0.01501]
Men X Previous cohort - percentage at formal sector	-0.18950**	-0.09011	-0.05481	-0.12675	0.00471	-0.04423	-0.01054
	[0.09241]	[0.09261]	[0.09195]	[0.08993]	[0.09160]	[0.09238]	[0.09673]
Men X Previous cohort - Log Real Hourly Wage	0.01207	-0.02765	0.00554	0.02161	-0.00494	-0.02447	0.00554
	[0.03134]	[0.03081]	[0.03218]	[0.02971]	[0.02998]	[0.03081]	[0.03170]
Men X Previous cohort Specific test - senior year	-0.00422	-0.00627	0.00207	-0.00626	-0.01206	0.00016	-0.00160
	[0.01354]	[0.01324]	[0.01402]	[0.01398]	[0.01426]	[0.01463]	[0.01540]
Constant	2.39510***	2.12881***	2.64748***	2.36118***	2.44786***	2.65263***	2.51971***
	[0.27359]	[0.14485]	[0.28255]	[0.14254]	[0.14061]	[0.14167]	[0.16327]
Observations	8,777	9,620	9,944	10,135	10,200	10,016	9,694
Adjusted R-squared	0.33346	0.32834	0.31995	0.33126	0.32346	0.30470	0.29420
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.8: Probability of being employed in the formal sector, Sample A - Heterogeneity across Prior experience

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6	(8) t7	(9) t8
IndividualScores									
General test - freshman year	-0.00681	0.01170	0.01387	0.00895	-0.00004	0.00262	-0.00788	0.00345	0.00679
	[0.00966]	[0.00997]	[0.01010]	[0.00991]	[0.00990]	[0.00984]	[0.01010]	[0.01022]	[0.01029]
Specific test - freshman year	0.01317	0.02120**	0.02372**	0.03544***	0.02828***	0.02013*	0.02171**	0.02538**	0.02968***
	[0.01041]	[0.01057]	[0.01054]	[0.01056]	[0.01063]	[0.01062]	[0.01076]	[0.01094]	[0.01103]
General test - senior year	0.01593	0.00790	0.00056	-0.00418	-0.01438	-0.01091	-0.01199	-0.00372	-0.00469
	[0.00976]	[0.01033]	[0.01034]	[0.01025]	[0.01034]	[0.01041]	[0.01025]	[0.01042]	[0.01054]
Specific test - senior year	0.02223**	0.01027	-0.00249	0.01360	0.02663**	0.03233***	0.03565***	0.02503**	0.02528**
	[0.01076]	[0.01121]	[0.01116]	[0.01107]	[0.01107]	[0.01107]	[0.01099]	[0.01127]	[0.01143]
Signals									
PreviousCohort									
Previous cohort - percentage at formal sector	0.40478***	0.28108***	0.32618***	0.27085***	0.23595***	0.29016***	0.21280**	0.21213**	0.17199*
	[0.08909]	[0.08897]	[0.08689]	[0.08499]	[0.08306]	[0.08483]	[0.08565]	[0.08751]	[0.08800]
Previous cohort - Log Real Hourly Wage	-0.00230	-0.01455	-0.01977	-0.03892**	0.01122	0.01694	0.01171	0.01647	-0.00430
	[0.02120]	[0.02203]	[0.01965]	[0.01925]	[0.02219]	[0.02249]	[0.02312]	[0.02359]	[0.02379]
Previous cohort Specific test - senior year	-0.00406	-0.00655	0.00914	-0.00557	-0.01248	-0.02773*	-0.02523	-0.02297	-0.01562
	[0.01580]	[0.01627]	[0.01605]	[0.01603]	[0.01600]	[0.01611]	[0.01649]	[0.01654]	[0.01675]
IndividualControls									
Worked while in college	0.43022***	0.47063***	0.41607***	0.31317***	0.41470***	0.35733***	0.24439**	0.16248	0.25423**
	[0.10886]	[0.11324]	[0.10509]	[0.10630]	[0.10678]	[0.10861]	[0.11230]	[0.11690]	[0.11770]
Interactions									
Prior experience x General test - freshman year	0.02721*	0.00615	0.00249	0.00578	0.02208	0.01273	0.01568	0.00105	-0.00763
	[0.01450]	[0.01390]	[0.01431]	[0.01364]	[0.01379]	[0.01406]	[0.01454]	[0.01474]	[0.01504]
Prior experience x Specific test - freshman year	-0.00368	-0.01639	-0.01174	-0.02539*	-0.02608*	-0.02256	-0.03077**	-0.02806*	-0.01728
	[0.01501]	[0.01466]	[0.01426]	[0.01411]	[0.01400]	[0.01419]	[0.01477]	[0.01536]	[0.01547]
Prior experience x General test - senior year	-0.01618	-0.01832	-0.01776	-0.00989	0.00712	0.01315	0.02373	0.01142	0.01579
	[0.01504]	[0.01473]	[0.01459]	[0.01434]	[0.01468]	[0.01469]	[0.01475]	[0.01508]	[0.01523]
Prior experience x Specific test - senior year	-0.03267**	0.00749	0.02696*	0.02817*	-0.00363	-0.01182	-0.01626	0.00473	0.01321
	[0.01546]	[0.01514]	[0.01487]	[0.01488]	[0.01474]	[0.01483]	[0.01529]	[0.01564]	[0.01591]
Prior experience x Previous cohort - percentage at formal sector	-0.22010***	-0.29821***	-0.31526***	-0.21827***	-0.21996***	-0.24975***	-0.17837**	-0.10660	-0.24569***
	[0.08127]	[0.08038]	[0.07868]	[0.07922]	[0.07997]	[0.08008]	[0.08201]	[0.08358]	[0.08391]
Prior experience x Previous cohort - Log Real Hourly Wage	0.04122	0.00509	0.01973	0.02758	-0.01778	0.00470	0.02297	0.03236	0.03506
	[0.03478]	[0.03818]	[0.03463]	[0.03413]	[0.03566]	[0.03760]	[0.03891]	[0.03966]	[0.04034]
Prior experience x Previous cohort Specific test - senior year	0.03164*	0.04282**	-0.00378	0.00865	0.00066	0.00547	0.01455	0.02064	0.00276
	[0.01826]	[0.01790]	[0.01686]	[0.01689]	[0.01761]	[0.01742]	[0.01764]	[0.01804]	[0.01862]
Constant	0.05718	0.01322	0.34238**	0.32551**	0.41514***	0.43280***	0.32064**	0.41231***	0.38048***
	[0.14426]	[0.15389]	[0.15064]	[0.14141]	[0.14185]	[0.14092]	[0.13582]	[0.13832]	[0.13494]
Observations	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925
Adjusted R-squared	0.30083	0.25319	0.23823	0.22104	0.20802	0.19070	0.17933	0.15362	0.14018
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.9: Probability of being employed in the formal sector, Sample B - Heterogeneity across Prior experience

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6
IndividualScores							
General test - freshman year	0.00611	-0.00567	-0.02054**	-0.01514*	-0.01001	0.00043	0.01037
	[0.00904]	[0.00920]	[0.00873]	[0.00840]	[0.00781]	[0.00833]	[0.00851]
Specific test - freshman year	0.00863	0.02172**	0.02563***	0.02290***	0.00060	-0.00505	0.00274
	[0.00928]	[0.00950]	[0.00904]	[0.00873]	[0.00858]	[0.00878]	[0.00895]
General test - high school senior	0.00012	0.01487	0.00052	0.00436	0.00713	0.01167	0.00842
	[0.00930]	[0.00952]	[0.00905]	[0.00873]	[0.00846]	[0.00861]	[0.00866]
Signals							
PreviousCohort							
Previous cohort - percentage at formal sector	0.41756***	0.30836***	0.25752***	0.19469***	0.12895**	0.11511*	0.08233
	[0.06067]	[0.06420]	[0.06207]	[0.06078]	[0.05880]	[0.06027]	[0.06143]
Previous cohort - Log Real Hourly Wage	-0.02300	0.00804	-0.02779	-0.01887	-0.01274	-0.00399	0.01741
	[0.02149]	[0.02208]	[0.02161]	[0.02072]	[0.02001]	[0.02010]	[0.02047]
Previous cohort Specific test - senior year	0.00586	-0.00013	0.00383	0.00756	0.02481***	0.00836	0.00309
	[0.00945]	[0.00966]	[0.00914]	[0.00871]	[0.00882]	[0.00894]	[0.00921]
IndividualControls							
Worked while in college	0.47874***	0.37465***	0.20877***	0.16191**	0.06059	0.03769	0.04239
	[0.07158]	[0.07225]	[0.07025]	[0.06815]	[0.06638]	[0.06747]	[0.06957]
Interactions							
Prior experience x General test - freshman year	-0.00501	0.00757	0.02241**	0.01593*	0.01301	0.00383	-0.00599
	[0.00975]	[0.00989]	[0.00944]	[0.00916]	[0.00871]	[0.00924]	[0.00949]
Prior experience x Specific test - freshman year	-0.00830	-0.01605	-0.02157**	-0.00686	0.00979	0.01248	0.00299
	[0.00990]	[0.01004]	[0.00963]	[0.00935]	[0.00930]	[0.00955]	[0.00976]
Prior experience x high school senior	0.00779	-0.01276	0.00020	-0.00355	-0.00004	0.00031	0.00836
	[0.00997]	[0.01016]	[0.00974]	[0.00948]	[0.00927]	[0.00949]	[0.00959]
Prior experience x Previous cohort - percentage at formal sector	-0.28875***	-0.22970***	-0.15973***	-0.10946*	-0.02960	0.01386	0.05662
	[0.05826]	[0.06060]	[0.05852]	[0.05729]	[0.05564]	[0.05679]	[0.05823]
Prior experience x Previous cohort - Log Real Hourly Wage	0.03957*	-0.00301	0.01199	0.00155	0.00488	0.00251	-0.01441
	[0.02074]	[0.02089]	[0.02051]	[0.01965]	[0.01920]	[0.01926]	[0.01974]
Prior experience x Previous cohort Specific test - senior year	-0.00224	0.00173	-0.00587	-0.00924	-0.02712***	-0.01318	-0.00717
	[0.00962]	[0.00966]	[0.00916]	[0.00877]	[0.00876]	[0.00897]	[0.00932]
Constant	0.15938	0.29589***	0.56943***	0.69697***	0.75181***	0.75906***	0.71668***
	[0.11036]	[0.11160]	[0.11428]	[0.09925]	[0.09761]	[0.08693]	[0.09059]
Observations	13,839	13,839	13,839	13,839	13,839	13,839	13,839
Adjusted R-squared	0.28654	0.12949	0.07216	0.04387	0.03015	0.02426	0.02695
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

for Sample B, high school senior measure of general skills presents 3% to 5% smaller wage premium to this group up to three years after graduation. In Sample B, the prior experience correlates positively to the signal from *Previous cohort - percentage in the formal sector*: the signaling for these students is from 22% to 27% more relevant than for those who have not worked before. So, even though the Previous cohort signal is less relevant to determine employability in the group with prior experience, they obtain a greater return on earnings.

Table 2.10: Log Hourly Wage, Sample A - Heterogeneity across Prior experience

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	t0	t1	t2	t3	t4	t5	t6	t7	t8
IndividualScores									
General test - freshman year	-0.01726	0.00078	0.00190	-0.00987	-0.00712	-0.01258	0.02799	0.02116	0.03107
	[0.02046]	[0.01940]	[0.01791]	[0.01808]	[0.01788]	[0.01858]	[0.01933]	[0.02088]	[0.02040]
Specific test - freshman year	-0.00754	0.02705	0.04216**	0.02301	0.02624	0.02167	0.00159	0.02022	0.03051
	[0.02239]	[0.02041]	[0.01964]	[0.02008]	[0.02022]	[0.01939]	[0.02034]	[0.02166]	[0.02151]
General test - senior year	0.01325	0.00842	0.00022	0.01985	0.01354	0.05259***	0.03321*	0.02348	0.03633*
	[0.02195]	[0.02185]	[0.01907]	[0.01820]	[0.01878]	[0.01954]	[0.01985]	[0.01978]	[0.01970]
Specific test - senior year	0.06360**	0.03951*	0.06930***	0.08619***	0.06944***	0.04813**	0.06146***	0.09057***	0.06795***
	[0.02734]	[0.02398]	[0.02166]	[0.01981]	[0.01993]	[0.02079]	[0.02112]	[0.02325]	[0.02343]
Signals									
PreviousCohort									
Previous cohort - percentage at formal sector	0.38517**	0.46785***	0.47924***	0.49605***	0.43439***	0.40014***	0.38732***	0.32823**	0.28765*
	[0.18100]	[0.17859]	[0.15419]	[0.14562]	[0.14632]	[0.15242]	[0.14879]	[0.15537]	[0.15324]
Previous cohort - Log Real Hourly Wage	0.08276	0.05054	0.02873	-0.01457	0.03970	0.06271	0.00501	-0.02001	0.04112
	[0.05911]	[0.07792]	[0.06973]	[0.06143]	[0.05548]	[0.05213]	[0.05890]	[0.07118]	[0.05873]
Previous cohort Specific test - senior year	-0.03993	0.00139	0.02985	0.08611***	0.04117	0.07299**	0.02790	0.05026	-0.00507
	[0.04047]	[0.03642]	[0.03237]	[0.03192]	[0.03318]	[0.03425]	[0.03555]	[0.03499]	[0.03559]
IndividualControls									
Worked while in college	0.44681**	0.29251	0.23177	0.03907	0.16487	0.32791	0.30526	0.21411	0.12047
	[0.22346]	[0.24350]	[0.20794]	[0.20947]	[0.19996]	[0.21394]	[0.20319]	[0.21854]	[0.20448]
Interactions									
Prior experience x General test - freshman year	0.04184	0.04658*	0.02593	0.06673***	0.05051**	0.04188	0.02801	0.03457	0.01908
	[0.02806]	[0.02770]	[0.02515]	[0.02518]	[0.02509]	[0.02730]	[0.02663]	[0.02755]	[0.02794]
Prior experience x Specific test - freshman year	0.01374	-0.03498	-0.01181	0.00066	-0.01222	-0.02541	0.01868	0.00469	-0.03194
	[0.02923]	[0.02867]	[0.02628]	[0.02715]	[0.02630]	[0.02743]	[0.02834]	[0.02956]	[0.02926]
Prior experience x General test - senior year	0.01043	0.01592	0.02740	-0.01132	-0.00247	-0.02583	-0.01740	-0.02045	-0.03923
	[0.02909]	[0.02876]	[0.02596]	[0.02502]	[0.02548]	[0.02798]	[0.02715]	[0.02745]	[0.02668]
Prior experience x Specific test - senior year	-0.03774	-0.02448	-0.04727*	-0.04772*	-0.01482	-0.00088	-0.03255	-0.06773**	-0.03546
	[0.03278]	[0.03081]	[0.02738]	[0.02687]	[0.02634]	[0.02877]	[0.02805]	[0.02956]	[0.03017]
Prior experience x Previous cohort - percentage at formal sector	-0.28433*	-0.02950	-0.27334*	-0.21503	-0.12247	-0.06518	-0.15725	-0.26931*	-0.04770
	[0.17179]	[0.17259]	[0.15220]	[0.14297]	[0.14710]	[0.14611]	[0.13971]	[0.15267]	[0.15014]
Prior experience x Previous cohort - Log Real Hourly Wage	-0.10121	-0.09484	0.00796	0.06539	0.00764	-0.09111	-0.04428	0.01855	-0.00375
	[0.07344]	[0.09361]	[0.07685]	[0.07323]	[0.07494]	[0.07582]	[0.07304]	[0.07593]	[0.07063]
Prior experience x Previous cohort Specific test - senior year	-0.08636**	-0.03297	-0.05584*	-0.11270***	-0.05640*	-0.06058*	-0.05679*	-0.06683*	-0.04030
	[0.03792]	[0.03683]	[0.03336]	[0.03207]	[0.03168]	[0.03327]	[0.03358]	[0.03575]	[0.03616]
Constant	2.27497***	2.64399***	3.03433***	3.54582***	3.93895***	3.75450***	3.46494***	3.66908***	2.62772***
	[0.32344]	[0.45403]	[0.38804]	[0.30892]	[0.47151]	[0.58891]	[0.38248]	[0.80560]	[0.37838]
Observations	1,770	1,974	2,160	2,259	2,257	2,141	2,244	2,201	2,039
Adjusted R-squared	0.31788	0.30265	0.32243	0.31196	0.30775	0.28470	0.27465	0.27355	0.29044
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.11: Log Hourly Wage, Sample B - Heterogeneity across Prior experience

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6
IndividualScores							
General test - freshman year	-0.03393*	-0.03175**	-0.02164	-0.00958	0.00822	0.00010	0.00099
	[0.01813]	[0.01474]	[0.01481]	[0.01414]	[0.01510]	[0.01479]	[0.01647]
Specific test - freshman year	0.01620	0.03233**	0.02332	0.02169	0.05730***	0.04311***	0.04181***
	[0.01814]	[0.01546]	[0.01569]	[0.01495]	[0.01491]	[0.01515]	[0.01576]
General test - high school senior	0.08210***	0.09413***	0.08493***	0.09846***	0.08198***	0.09050***	0.10089***
	[0.01809]	[0.01515]	[0.01524]	[0.01503]	[0.01491]	[0.01562]	[0.01610]
Signals							
PreviousCohort							
Previous cohort - percentage at formal sector	-0.09496	-0.00141	-0.01908	-0.02027	-0.03043	-0.06243	-0.06517
	[0.13914]	[0.11461]	[0.11385]	[0.10422]	[0.10775]	[0.10438]	[0.11218]
Previous cohort - Log Real Hourly Wage	0.03663	0.07987**	0.06450*	0.10864***	0.07094**	0.08882**	0.08604**
	[0.05029]	[0.03874]	[0.03722]	[0.03548]	[0.03461]	[0.03624]	[0.03599]
Previous cohort Specific test - senior year	0.05469***	0.05786***	0.04881***	0.00983	0.01068	0.01309	0.01278
	[0.02051]	[0.01635]	[0.01567]	[0.01480]	[0.01541]	[0.01586]	[0.01598]
IndividualControls							
Worked while in college	-0.10853	0.02440	0.00989	-0.05764	-0.09968	-0.07297	-0.09989
	[0.15615]	[0.12461]	[0.12195]	[0.11757]	[0.11739]	[0.11861]	[0.12208]
Interactions							
Prior experience x General test - freshman year	0.06128***	0.05029***	0.04090**	0.02526	-0.00836	0.00948	0.00845
	[0.01927]	[0.01620]	[0.01632]	[0.01578]	[0.01667]	[0.01656]	[0.01807]
Prior experience x Specific test - freshman year	0.02433	0.00984	0.02601	0.01998	-0.00700	0.00476	0.01469
	[0.01920]	[0.01672]	[0.01693]	[0.01640]	[0.01627]	[0.01652]	[0.01734]
Prior experience x high school senior	-0.04961***	-0.04424***	-0.03403**	-0.03030*	-0.00963	-0.01524	-0.01385
	[0.01919]	[0.01654]	[0.01674]	[0.01652]	[0.01642]	[0.01720]	[0.01769]
Prior experience x Previous cohort - percentage at formal sector	0.23320*	0.14690	0.15124	0.22004**	0.27498***	0.25382**	0.26117**
	[0.13226]	[0.10580]	[0.10348]	[0.10012]	[0.10279]	[0.10049]	[0.10782]
Prior experience x Previous cohort - Log Real Hourly Wage	0.02341	-0.00063	-0.00654	0.00880	0.00442	-0.00012	0.01148
	[0.04837]	[0.03725]	[0.03652]	[0.03425]	[0.03331]	[0.03490]	[0.03535]
Prior experience x Previous cohort Specific test - senior year	-0.05203***	-0.05031***	-0.05536***	-0.01678	-0.00243	-0.00817	-0.01878
	[0.02003]	[0.01613]	[0.01581]	[0.01488]	[0.01527]	[0.01562]	[0.01626]
Constant	2.61505***	2.24505***	2.70631***	2.48250***	2.58040***	2.79752***	2.65239***
	[0.29633]	[0.16685]	[0.29662]	[0.16147]	[0.15924]	[0.15989]	[0.17737]
Observations	8,777	9,620	9,944	10,135	10,200	10,016	9,694
Adjusted R-squared	0.33505	0.33009	0.32130	0.33151	0.32376	0.30475	0.29448
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Finally, we investigate whether there are heterogeneous returns across fields of education. For these analyses, since different majors are evaluated in each sample, the results must be explored cautiously. For Sample A, we interact the variables of skills and previous cohort signals with a binary variable of Field 7-*Health and Welfare*, so the comparison group is mainly the Field 6-*Agriculture*. For Sample B, the interaction is with the Field 3- Social sciences, business and law and Field 4-*Science*, so Field 1-Education and Field 5-*Engineering, manufacturing and construction* are the comparison group.

Table 2.12 and Table 2.13 present the results in respect to the probability of being employed as an outcome. In the Sample A comparison, Field 7-*Health and Welfare* is associated to a greater return (40%) to *Previous cohort - percentage in the formal sector* compared to Field 6-*Agriculture*. Eight years after graduation, the returns to freshman year general skills are also greater (5%) to Field 7-*Health and Welfare* graduates.

For the groups in Sample B, individuals in Field 4-*Science* present smaller returns to high school senior measure of general skills (3%) and also smaller returns to *Previous cohort - Log hourly wage* (6%), compared to Field 3-*Social sciences, business and law*, Field 1-*Education* and Field 5-*Engineering, manufacturing and construction*.

The returns on earnings are heterogeneous across fields as well (Table 2.14 and Table 2.15). In Sample A, Field 7-*Health and Welfare* present smaller returns to freshman year specific skills (10%) and also smaller returns to the *Previous cohort - Specific test* (18%), compared to Field 6-*Agriculture*. In Sample B, the returns to general skills are mixed: Field 3-*Social sciences, business and law* and Field 4-*Science* present smaller returns to freshman year general test scores, but greater returns to the high school senior measure of general skills, compared to Field 1-*Education* and Field 5-*Engineering, manufacturing and construction*. On the other hand, Fields 3 and 4 present smaller returns to *Previous cohort - percentage in the formal sector*, but greater return to *Previous cohort - Log hourly wage*.

Table 2.12: Probability of being employed in the formal sector, Sample A - Heterogeneity across Field of Education

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6	(8) t7	(9) t8
IndividualScores									
General test - freshman year	-0.01312	0.02000	0.02176	-0.00107	0.00655	-0.00390	-0.00168	-0.00514	-0.03764*
	[0.02004]	[0.01903]	[0.02046]	[0.01988]	[0.01932]	[0.01927]	[0.01940]	[0.01937]	[0.02020]
Specific test - freshman year	0.02189	0.03161	0.05382**	0.03543*	0.02168	0.00946	0.00206	0.00915	0.03670*
	[0.02181]	[0.02195]	[0.02109]	[0.02128]	[0.02037]	[0.01998]	[0.02085]	[0.02082]	[0.02092]
General test - senior year	-0.00808	0.01842	0.00341	0.00926	0.02350	0.01477	0.00897	0.03069	0.00592
	[0.01990]	[0.02018]	[0.02047]	[0.02063]	[0.02003]	[0.02037]	[0.02004]	[0.02014]	[0.02051]
Specific test - senior year	0.02547	0.02793	0.01226	0.03273	0.00357	0.01489	0.02886	0.03702*	0.04429**
	[0.02012]	[0.02001]	[0.02017]	[0.02060]	[0.02022]	[0.02050]	[0.02091]	[0.02049]	[0.02079]
Signals									
PreviousCohort									
Previous cohort - percentage at formal sector	-0.00751	-0.07761	0.22214	0.10774	0.02560	0.13686	-0.07451	-0.08582	-0.25189
	[0.19657]	[0.18648]	[0.19130]	[0.19372]	[0.20066]	[0.20317]	[0.19975]	[0.19237]	[0.19164]
Previous cohort - Log Real Hourly Wage	0.09846*	0.04208	-0.04246	-0.02879	0.04467	0.04283	0.09216	0.09388*	0.07998
	[0.05735]	[0.05575]	[0.05569]	[0.05651]	[0.05820]	[0.05886]	[0.05759]	[0.05639]	[0.05710]
Previous cohort Specific test - senior year	-0.02331	-0.01832	0.01106	0.02987	0.00400	-0.03212	0.00239	0.00085	-0.01830
	[0.03595]	[0.03522]	[0.03655]	[0.03491]	[0.03591]	[0.03744]	[0.03743]	[0.03584]	[0.03703]
Interactions									
Field 7 x General test - freshman year	0.02105	-0.00618	-0.00896	0.01430	0.00316	0.01393	0.00123	0.01148	0.04866**
	[0.02148]	[0.02053]	[0.02193]	[0.02127]	[0.02074]	[0.02073]	[0.02099]	[0.02102]	[0.02181]
Field 7 x Specific test - freshman year	-0.01145	-0.02173	-0.04223*	-0.01315	-0.00519	0.00184	0.00806	0.00418	-0.01618
	[0.02346]	[0.02361]	[0.02262]	[0.02277]	[0.02199]	[0.02166]	[0.02253]	[0.02267]	[0.02279]
Field 7 x General test - senior year	0.02033	-0.02178	-0.01215	-0.02026	-0.04065*	-0.02364	-0.01269	-0.03470	-0.00505
	[0.02148]	[0.02174]	[0.02191]	[0.02206]	[0.02157]	[0.02187]	[0.02163]	[0.02181]	[0.02218]
Field 7 x Specific test - senior year	-0.02282	-0.02039	-0.00672	-0.01098	0.02441	0.01385	-0.00127	-0.01350	-0.01800
	[0.02195]	[0.02184]	[0.02192]	[0.02234]	[0.02193]	[0.02225]	[0.02266]	[0.02240]	[0.02276]
Field 7 x Previous cohort - percentage at formal sector	0.39893*	0.30081	-0.00617	0.10878	0.16706	0.09229	0.28120	0.31368	0.40334**
	[0.20421]	[0.19463]	[0.20021]	[0.20242]	[0.20931]	[0.21183]	[0.20951]	[0.20325]	[0.20224]
Field 7 x Previous cohort - Log Real Hourly Wage	-0.09488*	-0.05525	0.02910	-0.00429	-0.04023	-0.02520	-0.07911	-0.07230	-0.07958
	[0.05506]	[0.05312]	[0.05375]	[0.05465]	[0.05630]	d	[0.05547]	[0.05380]	[0.05442]
Field 7 x Previous cohort Specific test - senior year	0.03972	0.03829	-0.00182	-0.03520	-0.01551	0.00975	-0.02382	-0.01616	0.00540
	[0.03819]	[0.03765]	[0.03827]	[0.03695]	[0.03784]	[0.03913]	[0.03879]	[0.03775]	[0.03911]
Constant	-0.07644	-0.03608	0.45534**	0.37656**	0.38936**	0.41043**	0.21862	0.30021*	0.30845*
	[0.17054]	[0.17606]	[0.17861]	[0.17457]	[0.17373]	[0.17105]	[0.17069]	[0.17227]	[0.17060]
Observations	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925
Adjusted R-squared	0.29680	0.24751	0.23483	0.21839	0.20590	0.18729	0.17646	0.15292	0.13890
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.13: Probability of being employed in the formal sector, Sample B - Heterogeneity across Field of Education

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6
IndividualScores							
General test - freshman year	0.00089	0.00161	-0.00708	-0.00603	-0.00942	-0.00012	-0.00520
	[0.00666]	[0.00632]	[0.00611]	[0.00605]	[0.00602]	[0.00633]	[0.00639]
Specific test - freshman year	0.00376	0.00170	0.00394	0.02183***	0.01533**	0.00072	0.00433
	[0.00702]	[0.00686]	[0.00680]	[0.00660]	[0.00672]	[0.00689]	[0.00693]
General test - high school senior	0.00809	0.01199*	0.00877	0.00767	0.01784***	0.01981***	0.02268***
	[0.00678]	[0.00655]	[0.00637]	[0.00636]	[0.00644]	[0.00675]	[0.00681]
Signals							
PreviousCohort							
Previous cohort - percentage at formal sector	0.24762***	0.14896**	0.15584***	0.06286	0.03018	0.07448	0.05856
	[0.06236]	[0.06124]	[0.05887]	[0.05753]	[0.05750]	[0.05747]	[0.05908]
Previous cohort - Log Real Hourly Wage	-0.00333	0.01433	-0.02362	-0.00526	0.00290	0.00528	0.00418
	[0.01821]	[0.01807]	[0.01761]	[0.01662]	[0.01703]	[0.01643]	[0.01760]
Previous cohort Specific test - senior year	0.02296**	-0.01198	-0.00233	0.01201	0.00583	-0.00480	-0.01019
	[0.01015]	[0.00968]	[0.00952]	[0.00928]	[0.00977]	[0.00957]	[0.00954]
Interactions							
Field 3 x General test - freshman year	0.00106	-0.00472	0.00472	0.00422	0.01454*	0.00651	0.01763**
	[0.00800]	[0.00785]	[0.00762]	[0.00765]	[0.00766]	[0.00804]	[0.00824]
Field 4 x General test - freshman year	0.00585	0.00838	0.00702	0.00283	0.00791	-0.00356	0.00456
	[0.01281]	[0.01237]	[0.01199]	[0.01144]	[0.01159]	[0.01194]	[0.01228]
Field 3 x Specific test - freshman year	-0.00505	0.01211	0.00899	-0.00589	-0.01129	0.00483	-0.00076
	[0.00860]	[0.00845]	[0.00845]	[0.00837]	[0.00851]	[0.00882]	[0.00907]
Field 4 x Specific test - freshman year	0.01016	0.00191	-0.00932	-0.01946	-0.01451	0.00837	0.01094
	[0.01556]	[0.01481]	[0.01436]	[0.01395]	[0.01380]	[0.01420]	[0.01460]
Field 3 x General test - senior year	-0.00215	-0.00806	-0.00876	-0.00438	-0.01151	-0.00689	-0.00604
	[0.00832]	[0.00818]	[0.00799]	[0.00802]	[0.00817]	[0.00854]	[0.00874]
Field 4 x General test - senior year	-0.00827	-0.01925	-0.03092**	-0.03017***	-0.03404***	-0.03433***	-0.03788***
	[0.01269]	[0.01264]	[0.01240]	[0.01158]	[0.01157]	[0.01218]	[0.01208]
Field 3 x Previous cohort - percentage at formal sector	-0.11726	-0.06482	-0.04465	0.06845	0.11271	0.08826	0.13384*
	[0.07172]	[0.07045]	[0.06888]	[0.06804]	[0.06884]	[0.07169]	[0.07432]
Field 4 x Previous cohort - percentage at formal sector	0.07045	0.12087	0.06036	0.11767	0.09941	0.03549	-0.03836
	[0.08855]	[0.09014]	[0.09080]	[0.08755]	[0.08388]	[0.08539]	[0.08606]
Field 3 x Previous cohort - Log Real Hourly Wage	0.02798	0.00764	0.01854	-0.00621	-0.01340	-0.01317	0.00390
	[0.02201]	[0.02163]	[0.02164]	[0.02020]	[0.02097]	[0.02130]	[0.02283]
Field 4 x Previous cohort - Log Real Hourly Wage	-0.05828**	-0.05345**	-0.03469	-0.06234**	-0.05597**	-0.00758	0.01287
	[0.02480]	[0.02544]	[0.02564]	[0.02479]	[0.02425]	[0.02427]	[0.02439]
Field 3 x Previous cohort Specific test - senior year	-0.02131*	0.01972*	0.00688	-0.01055	0.00300	0.01048	0.01309
	[0.01209]	[0.01174]	[0.01151]	[0.01130]	[0.01191]	[0.01193]	[0.01220]
Field 4 x Previous cohort Specific test - senior year	-0.04245**	0.01551	-0.01647	-0.03375**	-0.01662	-0.01991	-0.00158
	[0.01730]	[0.01673]	[0.01633]	[0.01582]	[0.01632]	[0.01676]	[0.01700]
Constant	0.25210**	0.39722***	0.61129***	0.73169***	0.74915***	0.73648***	0.67659***
	[0.10153]	[0.10064]	[0.10447]	[0.08975]	[0.08964]	[0.07960]	[0.08376]
Observations	13,792	13,792	13,792	13,792	13,792	13,792	13,792
Adjusted R-squared	0.28429	0.12933	0.07128	0.04444	0.03029	0.02470	0.02759
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.14: Log Hourly Wage, Sample A - Heterogeneity across Field of Education

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6	(8) t7	(9) t8
IndividualScores									
General test - freshman year	0.01285	0.03502	0.04108	0.04881	0.04259	0.02320	0.06811	0.07870*	0.06486
	[0.04298]	[0.04168]	[0.03839]	[0.03742]	[0.03942]	[0.03996]	[0.04176]	[0.04302]	[0.04753]
Specific test - freshman year	0.02543	0.09615**	0.04210	0.03440	0.06952	0.05798	0.08759*	0.05745	0.04947
	[0.05621]	[0.04595]	[0.04823]	[0.04601]	[0.04422]	[0.04414]	[0.04546]	[0.05030]	[0.05135]
General test - senior year	0.00633	-0.00147	-0.02937	0.02528	-0.03223	0.01043	-0.01037	-0.06390	0.03686
	[0.04890]	[0.04787]	[0.04299]	[0.03561]	[0.03892]	[0.04201]	[0.04115]	[0.04603]	[0.04551]
Specific test - senior year	0.03322	-0.00712	0.07173	0.03533	0.07657*	0.04803	0.01609	0.00195	-0.01155
	[0.05276]	[0.04049]	[0.04523]	[0.03915]	[0.04019]	[0.04190]	[0.04177]	[0.04550]	[0.04694]
Signals									
PreviousCohort									
Previous cohort - percentage at formal sector	0.08534	0.87115*	0.67036	0.20052	0.43241	0.16154	0.53677	0.01679	0.13207
	[0.47352]	[0.44675]	[0.45176]	[0.33080]	[0.35896]	[0.34241]	[0.34723]	[0.40320]	[0.40853]
Previous cohort - Log Real Hourly Wage	0.15543	-0.06003	0.02877	0.09250	0.08101	0.11336	0.01596	0.15546	0.10428
	[0.13311]	[0.13044]	[0.13744]	[0.09856]	[0.11534]	[0.11114]	[0.11107]	[0.12178]	[0.12953]
Previous cohort Specific test - senior year	0.05619	0.05317	0.05665	-0.03756	0.00839	0.02717	0.05927	0.05047	-0.08952
	[0.09446]	[0.08661]	[0.09826]	[0.07846]	[0.08986]	[0.09695]	[0.08875]	[0.07927]	[0.10764]
Interactions									
Field 7 x General test - freshman year	-0.00558	-0.01184	-0.02995	-0.02824	-0.03068	-0.01943	-0.03170	-0.04527	-0.02773
	[0.04558]	[0.04410]	[0.04034]	[0.03971]	[0.04158]	[0.04230]	[0.04408]	[0.04556]	[0.04981]
Field 7 x Specific test - freshman year	-0.02753	-0.10439**	-0.00883	-0.01109	-0.05729	-0.05802	-0.09090*	-0.04026	-0.04262
	[0.05878]	[0.04829]	[0.05009]	[0.04824]	[0.04641]	[0.04691]	[0.04809]	[0.05297]	[0.05378]
Field 7 x General test - senior year	0.01454	0.02044	0.05128	-0.01410	0.05106	0.03252	0.03843	0.08722*	-0.02598
	[0.05113]	[0.05002]	[0.04487]	[0.03789]	[0.04122]	[0.04479]	[0.04357]	[0.04829]	[0.04775]
Field 7 x Specific test - senior year	0.00730	0.03855	-0.03531	0.03031	-0.02055	-0.00142	0.03241	0.06567	0.07525
	[0.05520]	[0.04380]	[0.04771]	[0.04177]	[0.04293]	[0.04496]	[0.04503]	[0.04845]	[0.05010]
Field 7 x Previous cohort - percentage at formal sector	0.23106	-0.46242	-0.30503	0.23946	-0.04048	0.23924	-0.20437	0.29614	0.12180
	[0.48139]	[0.46759]	[0.46081]	[0.35162]	[0.38003]	[0.36299]	[0.36566]	[0.41776]	[0.41788]
Field 7 x Previous cohort - Log Real Hourly Wage	-0.13937	0.06519	0.01488	-0.08408	-0.04058	-0.08346	-0.02846	-0.18117	-0.06573
	[0.12830]	[0.12391]	[0.13647]	[0.09245]	[0.11121]	[0.10649]	[0.10274]	[0.11205]	[0.12488]
Field 7 x Previous cohort Specific test - senior year	-0.17749*	-0.07650	-0.06429	0.06897	0.00326	0.01585	-0.06696	-0.04064	0.07162
	[0.09770]	[0.08926]	[0.10098]	[0.08152]	[0.09561]	[0.10209]	[0.09213]	[0.08657]	[0.11472]
Constant	2.30322***	2.78863***	2.96242***	3.37363***	3.80079***	3.64806***	3.30187***	3.44610***	2.38618***
	[0.41398]	[0.49742]	[0.40717]	[0.34077]	[0.45046]	[0.57984]	[0.39122]	[0.78387]	[0.40694]
Observations	1,770	1,974	2,160	2,259	2,257	2,141	2,244	2,201	2,039
Adjusted R-squared	0.31613	0.30514	0.32270	0.30588	0.30809	0.28271	0.27757	0.27629	0.28920
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 2.15: Log Hourly Wage, Sample B - Heterogeneity across Field of Education

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6
IndividualScores							
General test - freshman year	0.04422***	0.02516**	0.04375***	0.02713**	0.01826	0.02534**	0.03068***
	[0.01165]	[0.01157]	[0.01184]	[0.01161]	[0.01119]	[0.01175]	[0.01156]
Specific test - freshman year	0.02577*	0.04619***	0.04104***	0.02128*	0.04729***	0.03989***	0.05298***
	[0.01338]	[0.01273]	[0.01267]	[0.01236]	[0.01191]	[0.01225]	[0.01257]
General test - high school senior	0.02657**	0.03023**	0.01666	0.04971***	0.03432***	0.03425***	0.03657***
	[0.01245]	[0.01187]	[0.01215]	[0.01201]	[0.01128]	[0.01208]	[0.01232]
Signals							
PreviousCohort							
Previous cohort - percentage at formal sector	0.24119**	0.18131*	0.19406*	0.23572**	0.27267***	0.24900**	0.32616***
	[0.11578]	[0.10898]	[0.11299]	[0.10701]	[0.10347]	[0.10433]	[0.10801]
Previous cohort - Log Real Hourly Wage	-0.01498	0.01627	0.03227	0.07514**	0.00304	0.02165	0.01502
	[0.03427]	[0.03280]	[0.03328]	[0.03307]	[0.03146]	[0.03311]	[0.03267]
Previous cohort Specific test - senior year	-0.00415	0.00972	0.01238	-0.01364	0.02407	0.01289	0.01248
	[0.01774]	[0.01629]	[0.01785]	[0.01613]	[0.01724]	[0.01633]	[0.01703]
Interactions							
Field 3 x General test - freshman year	-0.03651***	-0.02631*	-0.05253***	-0.02682*	-0.03327**	-0.03487**	-0.04170***
	[0.01401]	[0.01402]	[0.01434]	[0.01419]	[0.01410]	[0.01476]	[0.01476]
Field 4 x General test - freshman year	-0.02360	-0.00013	-0.01528	-0.01005	0.01373	0.01096	-0.00729
	[0.02043]	[0.02148]	[0.02147]	[0.02260]	[0.02282]	[0.02132]	[0.02417]
Field 3 x Specific test - freshman year	0.01001	-0.01215	-0.00231	0.02019	0.00942	0.01211	0.00406
	[0.01576]	[0.01537]	[0.01563]	[0.01558]	[0.01516]	[0.01584]	[0.01612]
Field 4 x Specific test - freshman year	0.03564	0.01368	0.02979	0.03417	-0.01808	-0.01287	-0.03309
	[0.02543]	[0.02564]	[0.02762]	[0.02648]	[0.02634]	[0.02533]	[0.02789]
Field 3 x General test - senior year	0.02210	0.03556**	0.05923***	0.03886***	0.05954***	0.06720***	0.08184***
	[0.01507]	[0.01469]	[0.01490]	[0.01488]	[0.01443]	[0.01556]	[0.01571]
Field 4 x General test - senior year	-0.00654	0.05514**	0.06368***	0.01099	0.03444	0.03738	0.04924**
	[0.02275]	[0.02267]	[0.02397]	[0.02243]	[0.02169]	[0.02276]	[0.02362]
Field 3 x Previous cohort - percentage at formal sector	-0.13978	-0.03587	-0.04615	-0.00110	-0.00988	-0.10081	-0.26781**
	[0.12905]	[0.12100]	[0.12836]	[0.12782]	[0.12635]	[0.12889]	[0.13148]
Field 4 x Previous cohort - percentage at formal sector	-0.54805***	-0.39569**	-0.50741***	-0.54768***	-0.64393***	-0.55277***	-0.59329***
	[0.16309]	[0.16521]	[0.16594]	[0.15510]	[0.15894]	[0.15637]	[0.16496]
Field 3 x Previous cohort - Log Real Hourly Wage	0.10042**	0.10316***	0.04122	0.04805	0.11868***	0.12087***	0.13327***
	[0.04008]	[0.03801]	[0.04022]	[0.04263]	[0.03894]	[0.04133]	[0.04113]
Field 4 x Previous cohort - Log Real Hourly Wage	0.16610***	0.11059**	0.08297*	0.15702***	0.14156***	0.12886***	0.16388***
	[0.04721]	[0.04697]	[0.04734]	[0.04414]	[0.04556]	[0.04404]	[0.04660]
Field 3 x Previous cohort Specific test - senior year	0.01603	0.00947	-0.01383	0.01365	-0.02344	-0.01336	-0.02318
	[0.02137]	[0.02003]	[0.02147]	[0.02021]	[0.02136]	[0.02085]	[0.02179]
Field 4 x Previous cohort Specific test - senior year	0.02631	-0.00069	0.00129	0.00570	-0.01812	0.00210	-0.00865
	[0.27785]	[0.14960]	[0.28590]	[0.14934]	[0.14559]	[0.14940]	[0.16543]
Constant	2.33619***	2.06665***	2.56150***	2.25144***	2.25685***	2.51720***	2.41092***
	8,761	9,597	9,915	10,106	10,173	9,985	9,668
Observations	0.33475	0.32972	0.32307	0.33252	0.32616	0.30659	0.29784
Adjusted R-squared	YES	YES	YES	YES	YES	YES	YES
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

2.5 FINAL REMARKS

In this paper we investigate the labor market returns to college quality of Brazilian HEIs, considering individual measures of general and major-specific skills. We explore the returns on the probability of being employed in the formal sector and the log of hourly wages, conditional on being employed, up to eight years after the expected graduation in college. As college quality measure, besides using indicators based on published index, proxies for peers' performance and selectivity, we propose a new measure of quality college signal: the performance of the previous cohort that has graduated three years before the individual in the same institution and major. The previous cohort's performance may contribute to building the institution reputation, being consequently predictive of its new graduates' future employment and earnings.

For the probability of being employed, the main results of the college quality measures relate to the percentage of individuals of the previous cohort in the formal sector: an increase of 1 percentage point in the signal variable is related to an increase of 23%-15% in the probability of being employed in the following years after graduation. There might be a decreasing trend across the years, which may relate to other variables becoming more critical to determine the employability as the previous cohort signal reduces its importance, consistent with the signaling literature. The individual specific skills measured in the college senior year present increasing returns on the probability of being employed: an increase of 1 percentage point in the major-specific test score is related to an increase of 3% in the probability of being employed eight years after graduation. The high school senior measure of general skills (*ENEM*) brings positive returns a few years after expected graduation, up to 1.5% in the sixth year. The increasing trend is not unexpected: as the employee gets experience in the job market, her probability to be employed is more related to her own skills.

An extensive literature has explored the selectivity and college quality returns on earnings. Measuring college quality as the Previous cohort - percentage in the formal sector, we find that an increase of 1 percentage point in the signal variable is related to an increase up to 44% (Sample A) in the early career wage; after seven years, this return is of 26%. The return to the previous cohort's log of hourly wage, for one sample in the analyses, is also positive in the period, up to 10%, but there is no evidence of decreasing returns for this variable, as it would be expected if it served as a mere signal for the individual's ability. Thus, other reasons may explain the returns to the college identity measured through previous cohort's achievement. The wage premium to individual skills differs across sort of skill. While the returns to general skills, measured by high school senior measure of general skills (*ENEM*), are increasing over time (six years after graduation, the return to one standard deviation in the score is an hourly wage 8.5% greater), the returns to the major-specific skills present a positive constant behavior (5% wage increase for each standard deviation). Therefore, while signaling theory might explain the

general skills' trend, the major-specific skills could be related not only to signaling but also to human capital accumulation, for instance.

A relevant covariate that affects, in a consistent decreasing trend, the probability of being employed is whether the individual has worked in the formal sector while a college student. In the year the individual graduates in college, she is 40% more likely to be employed if she has prior working experience. However, this relationship decreases over time, as the individual gains potential experience after graduation time. It is interesting to note that the decreasing trend does not arise in the wage formation, presenting a constant return of 1% on wage if the individual has worked before. These results lead to heterogeneity analysis according to the prior working experience status. If the individual has worked while a college student, her return to the *Previous cohort - Percentage at formal sector* measure of college quality is 20% smaller on the probability of being employed, but 20% greater on earnings.

Labor market heterogeneous returns could also emerge according to gender. In our study, we find evidence that while for women there is a greater return to the ability, the college quality signal might be more relevant for men in affecting the probability of being employed in the formal sector. However, men acquire 3% smaller returns on earnings to general ability (high school senior measure) and 18% smaller returns to the Previous cohort - percentage in the formal sector.

Taking into account our results, we contribute to the literature of college quality returns to labor market outcomes in developing countries, introducing a measure based on the performance of the cohort that has graduated before in the same college-major pair. Although we include measures of individuals' ability, they are not observable by the employers, and it may not account for all the selectivity in the sample. However, this is the first work to investigate the returns of college quality considering selectivity in Brazil. We provide evidence that the previous cohort participation in the formal sector two years after their graduation is a good predictive variable of the individuals' employability and earnings. Thus, it may signal for the individuals' ability, at least in the early career. As future work, we intend to investigate whether the previous cohort may be the individuals' employers, which would lead to high correlation with the labor market outcomes. Furthermore, it would be relevant to take into account the heterogeneity of preferences, which could lead to college choices not based only on reputation and expected economic returns.

Part III
Cost-Effectiveness Analysis of Brazilian Higher Education Systems

3 COST-EFFECTIVENESS ANALYSIS OF BRAZILIAN HIGHER EDUCATION SYSTEMS

Abstract

This study aims to explore the cost-effectiveness of public investment in the tertiary level of education, regarding future private earnings, using Brazil as a case study. The private benefits of attaining a post-secondary education have been proven in existing literature. However, the existence of externalities and other market failures, such as liquidity constraints and information asymmetries, may cause the private market not to achieve the optimum social investment, highlighting the need for public intervention. These investments may be made either directly through the provision of public institutions or indirectly through subsidies, fiscal incentives and scholarships to attend private institutions. We perform a cost-effectiveness regression analysis of public higher education institutions versus private ones in Brazil. Considering the primary input for human capital accumulation in the tertiary level comes from the instruction provided by the professors, we use the total faculty wage bill as the cost of the investment in each institution. Our results indicate that an increase of 1% in the public faculty wage expenditure per pupil may increase total individual earnings by 2.3%.

Keywords: cost-effectiveness, public provision, higher education

3.1 INTRODUCTION

Higher education is a relevant mechanism for improving the skilled labor force in the economy. Through knowledge generation and acquisition of specific skills, a person who attains a tertiary education degree may raise her productivity and future earnings. Although the evidence for non-monetary private benefit is scarce, the individual benefits of college attendance may include: broader employment opportunities, promising career development, and increased motivation. Moreover, the benefits of higher education are not restricted to the private level. A more educated population leads to economic growth (HANUSHEK; WOESSMANN, 2008), intergenerational benefits, and social improvements (CARNOY, 1995). The existence of externalities and other market failures, such as liquidity constraints and information asymmetries, highlights the need for policy intervention. Public funding may be allocated to either the direct provision of higher education or to subsidizing the private providers.

This study aims to explore the cost-effectiveness of public investment in the tertiary level of human capital accumulation, regarding future private earnings, using Brazil as a case study. To accomplish this objective, we compare the total faculty wage bill in public versus private higher education institutions (HEIs) and how this specific cost relates to formal labor market returns for the students in each education system. We observe the costs of faculty salaries for four years, starting with the individual's college entrance year and then observing her in the formal job market sector up to ten years after her college entrance year. Our results indicate that an increase of 1% of the faculty wage bill in public HEIs is positively associated with a 2% variation in the student's early career earnings.

The private benefits of attaining a post-secondary education have been proven in existing literature. In Latin America, the wage premium for tertiary education graduates can grow to 104% more than the wage premium for high school graduates, conditional to worker characteristics (FERREYRA et al., 2017), although this gap has been declining in the past two decades (FERREIRA; FIRPO; MESSINA, 2016; LUSTIG; LOPEZ-CALVA; ORTIZ-JUAREZ, 2013). Nevertheless, for the policy maker, the social benefits associated with higher education provision must also be considered in the public funding allocation. Private and social returns may differ significantly (SCHüNDELN; PLAYFORTH, 2014). Besides the returns concerning increased earnings, productivity, and economic growth, the social benefits may include poverty alleviation, social cohesion, better health conditions, and improved sanitation conditions, among other benefits (JIMENEZ; PATRINOS, 2008). For the US, Moretti (2004) estimates the spillovers from college education and shows that one percentage point increase in the supply of college graduates is associated to increases in the wages for all groups: 1.9% for high school dropouts, 1.6% for high school graduates and 0.4% for college graduates. However, these results are not sustained for more recent cohorts (SAND, 2013).

Public investments in higher education arise in this context of positive externalities and others market failures, once the market could not achieve the social optimum of meeting the

economy's skill needs (JIMENEZ; PATRINOS, 2008). Since these investments are made based on tax burden, including tax income of low-skilled workers who do not benefit from higher education investments, the net social benefit is questionable. Viaene e Zilcha (2013) examine the theoretical premises under which this type of public investment is efficient. The authors describe the existence of conditions under which society would benefit more from no public funding in higher education. So, although in general government funding in higher education will lead to human capital generation and economic growth, this may not always be the case. On the other hand, empirically with data for Latin America, Ferreyra et al. (2017) show that current higher education spending is progressive, due to the increasing number of low and middle-income students.

To perform cost analyses of the education provision, several methods have been used in the past decades. The method of internal rate of returns is broadly applied, considering various natures of private and social costs and benefits (HECKMAN; LOCHNER; TODD, 2008; THIAS; CARNOY, 1972). Cost-benefit analyses, which compares expected benefits to the inputs of a project, was originally developed to guide investments. It has been implemented in many educational studies (BELFIELD et al., 2006; MORETTI, 2004; PSACHAROPOULOS; PATRINOS, 2004; TEMPLE; REYNOLDS, 2007; TSANG, 1988)[1], especially through cost-benefit ratios. Among the levels of education, the tertiary exhibits the lowest returns, which could be explained by the comparatively higher cost of university provision (FISZBEIN; PSACHAROPOULOS, 1993). Jimenez e Patrinos (2008) argue that cost-benefit analyses should be used more frequently to guide public investments in education, once the costs and benefits description of a project helps the policy maker. According to the authors, the decision of implementing a project should rely on its viability compared to competing projects. However, a cost-benefit analysis limitation is the lack of evidence in attributing outcomes to then investments. The parameters to perform the analysis, such as the discount rate, could affect the conclusions, emerging the need for sensitivity analyses to account for uncertainty (HUMMEL-ROSSI; ASHDOWN, 2002).

Similar to the cost-benefit method, the cost-effectiveness analysis is usually chosen when an outcome is not measurable in monetary terms or when it is not possible to measure all the intervention benefits. Then, cost-effectiveness analyses are a useful approach when comparing projects with similar goals and when the project benefits are difficult to monetize (BOARDMAN et al., 2011; ROTH, 2016), such as social benefits in the education case (HARBISON; HANUSHEK, 1992).

Costs analyses are extensively used in health studies to compare medical treatments. In this context, the cost-effectiveness ratio is a common measure calculated, since benefits are

[1] Martin e Pindyck (2015) proposes a new framework for cost-benefit analyses when the projects evaluated are interdependent. In their model, when the costs and benefits can affect the overall economy, the projects' costs and benefits should not be performed marginally, i.e., in isolation. This framework has not yet been applied in education context.

not easily obtained in monetary terms. However, due to the dependency of costs and outcomes on certain characteristics of the patient, the use of covariates in the cost-effectiveness analyses have become relevant (VAZQUEZ-POLO; HERNáNDEZ; LóPEZ-VALCáRCEL, 2005). To cover this need, a regression framework for cost-effectiveness analysis has been developed, overcoming limitations of the cost-effectiveness ratio. The regression approach may take as the outcome the net benefit associated with the project, including covariates and its interaction terms with the treatment variable (HOCH; BRIGGS; WILLAN, 2002; HOCH, 2009; HOUNTON; NEWLANDS, 2012; WILLAN; BRIGGS; HOCH, 2004). Indurkhya, Mitra e Schrag (2006) proposes a further improvement for nonrandomized studies: apply the method of inverse probability weighting (RUBIN, 1979). adjusting the regressions for the propensity score of being treated to obtain valid and unbiased treatment estimates.

We adapt the net-benefit regression framework to perform a cost-effectiveness analysis of public higher education institutions compared to private ones in Brazil. Since the cost structure differs significantly between the two systems, we include only the faculty wage bill in the analysis, assuming this is the primary type of cost to explain human capital accumulation. An inverse-probability-weight adjustment is also implemented in order to account for selection of students between public and private HEIs.

This article is divided as follows: section 3.2 brings a description about the databases and the differences between the public and private systems; section 3.3 provides the empirical strategy; main results are reported in section 3.4; and, in conclusion, section 3.5 brings final remarks.

3.2 DATA

In this section, we describe the data sets used in the study, our definition of costs and benefits of higher education. In our analyses, we consider the individuals who entered college in the years 2004, 2005 and 2006.

3.2.1 COSTS

From the individual point of view, several kinds of direct and indirect costs are involved in attending college. Fees, tuition, material, and transportation are examples of direct costs, while opportunity costs regarding foregone income are indirect costs. In the Brazilian public HEIs, in which there is no charge of tuition, the direct costs for the individuals are certainly lower, although the cost of access could be larger, due to the competitive admissions process.

On the other hand, the social costs of providing higher education include the society's spending, the fiscal cost and the deadweight of mobilizing public resources (JIMENEZ; PATRINOS, 2008). The fiscal costs, although in different proportions are related to both public and private education systems: in the public since the government entirely defrays it, and in the private system through subsidies and tax incentives.

The complexity of HEI's cost structure follows the multiplicity of roles an institution may assume, e.g., undergraduate teaching, production, and dissemination of research, graduation programs, and extension programs towards the community (FERREYRA et al., 2017). However, the HEIs do not offer all the possible services to the same extent. It is reasonable to suppose that public HEIs provide research and extension programs in higher proportion than private ones in Brazil.

In this study, we assume that the main input for human capital accumulation in the tertiary level comes from the instruction provided by the professors. Moreover, universities in Brazil and Latin America spend a larger share of the budget in personnel salaries, unlike developed countries (FERREYRA et al., 2017). Thus, we take the total faculty wage bill as the cost for the HEI. This measure has the advantage of being comparable between public and private institutions. Furthermore, since personnel expenses correspond to the most part of the institution budget, accounting for the faculty wages covers the desired human capital accumulation.

We calculate the present value of the total faculty wage bill for four consecutive years, CPV_j, for each financial control institution[2] j, starting from the first-year of each cohort, as demonstrated by Equation 3.1:

[2] The financial control institution is responsible for controlling the HEI budget and possess tax identifier. For private schools, the financial control institution might be a for-profit or non-profit firm, depending on the purpose of the HEI. The same financial control institution may control multiples HEIs.

$$CPV_j = W_t + \frac{W_{t+1}}{(1+r_{t+1})} + \frac{W_{t+2}}{(1+r_{t+2})} + \frac{W_{t+3}}{(1+r_{t+3})} \tag{3.1}$$

where W_t is the total faculty wage bill in year t and r is nominal interest rate of the economy, *SELIC* rate, acting as the discount rate[3]. We establish t as the college entrance year. Since our estimations are at the individual level, we consider the cost per pupil enrolled in the institution in year t.

We identify the HEI's faculty wage bills through the taxpayer identification number *CNPJ* (*Cadastro Nacional de Pessoas Jurídicas*) of the financial control institutions at *RAIS* database (*Relação Anual de Informações Sociais* - Annual Reports of Social Information). In this database, the companies report on an annual basis the salaries paid to each employee in December.

For each HEI, we include in our estimations variables controlling for various characteristics, such as faculty attributes, average college exit exams test scores, quality indicators, and student body attributes. The source of this data is the Higher Education Census and the higher education evaluation system, both provided by *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* (INEP/MEC), an autarchy related to the Brazilian Ministry of Education.

Table 3.1 provides descriptive statistics for the CPV_j and HEI characteristics for the period in the study. The total faculty wage bill is higher in public institutions: R$ 1.281 million compared to R$ 1.054 million, although these numbers are not significantly different. The systems also differ in most of HEI and student body characteristics.

3.2.2 BENEFITS

Through the direct monetary benefits that higher education provides to the students, the indirect benefits are enjoyed by society and derived from the human capital generated (VIAENE; ZILCHA, 2013). We use as benefits from the provision of higher education the present value of the total gross earnings in the formal sector the students experience after the expected graduation. There is available data for seven years after graduation for the individuals who entered college in 2004, 2005 and 2006 and took the *ENADE (Exame Nacional de Desempenho de Estudantes* - National Exam of Student Performance)[4] in those years. Other indirect social benefits are not included in this study, due to sparse data.

[3] We consider 2004 as the year-base for all the prices. So, the i_{t+n} is the accumulated interest rate to bring to 2004 prices.

[4] *ENADE* is developed and provided by *Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira* (INEP/MEC), an autarchy related to the Brazilian Ministry of Education.

Equation 3.2 provides present value for those benefits generated to the first-years students in each cohort:

$$BPV_i = \frac{E_{t+4}}{(1+r_{t+4})} + \frac{E_{t+5}}{(1+r_{t+5})} + \frac{E_{t+6}}{(1+r_{t+6})} + \frac{E_{t+7}}{(1+r_{t+7})} + \frac{E_{t+8}}{(1+r_{t+8})} + \frac{E_{t+9}}{(1+r_{t+9})} + \frac{E_{t+10}}{(1+r_{t+10})} \tag{3.2}$$

where E_t is the total earnings[5] for individual i in year t and r is nominal interest rate of the economy, *SELIC* rate, serving as the discount rate. We establish t as the college entrance year (2004, 2005 and 2006 for each entrance cohort, respectively). Thus, we consider the discounted total earnings in the formal sector after the college investment were made during seven years, conditional on being in the formal sector at least once during this period.

Besides the present value of the total benefit, the average earnings per year worked in the formal sector is also used as an outcome. While the total earnings of an individual who is in the formal sector during the seven years of the analysis are likely greater than those earned by someone who has worked for only one year, this difference is not expected to arise when the outcome is the average earnings. Thus, through the average earning, we expect to clean for possible effects of attending a public institution - and its costs with faculty salaries - on the frequency the individual appears in the formal sector.

For each student, observable characteristics are included to control for selection, such as the first-year college exam test scores, socioeconomic variables and whether the individual worked in the formal sector during college years. The statistics for individuals' characteristics are summarized in Table 3.2.

In all analyzed variables, the students differ significantly between the two systems. In order to estimate the cost-effectiveness accounting for this sorting into institutions, we estimate the probability to an individual be a student in public HEI, conditional on socioeconomic characteristics and first-year test scores, through the propensity score matching methodology. Figure 3.1 shows the improvement in the similarities between the densities of the estimated propensity scores.

[5] The earnings are extracted from *RAIS* database and correspond to the individual's wages in December of each year.

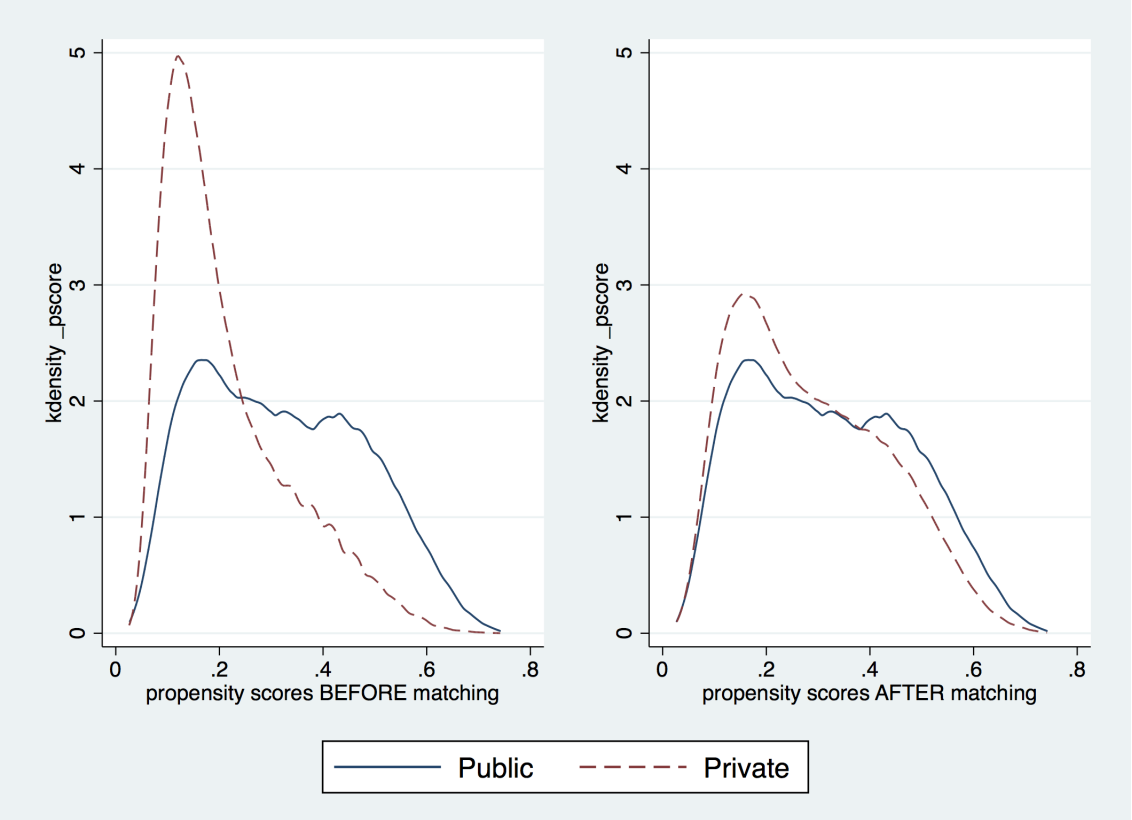
Table 3.1: HEI characteristics

VARIABLES	Total		Private HEI		Public HEI		Diff Pub-Priv
	mean	*sd*	mean	*sd*	mean	*sd*	
Higher Education Institutions							
Number of HEIs	*1050*		*911*		*141*		
HEI quality index	221.2	55.94	212.4	46.71	275.1	74.38	62.74***
Average General test score	48.02	*7.155*	47.28	*6.751*	52.50	*7.884*	5.22***
Average Specific test score	41.13	*8.808*	40.45	*8.405*	45.26	*10.01*	4.81***
Students enrolled - HEI	7,644	*15,093*	6,322	*14,606*	15,960	*15,473*	9,637.11***
Average Grade - evaluation	2.691	*0.794*	2.600	*0.752*	3.239	*0.820*	0.64***
Infrastracture - evaluation	3.389	*1.042*	3.551	*0.939*	2.397	*1.092*	-1.15***
Pedagogical methods - evaluation	2.815	*0.973*	2.930	*0.948*	2.113	*0.815*	-0.82***
Faculty size	254.6	*457.8*	186.5	*356.8*	684.3	*718.3*	497.80***
Student body - proportion of day class	0.288	*0.356*	0.242	*0.330*	0.580	*0.378*	0.34***
Student body - proportion of females	0.580	*0.216*	0.587	*0.222*	0.536	*0.165*	-0.05***
Student body - proportion of scholarships	0.0582	*0.0649*	0.0659	*0.0655*	0.00987	*0.0310*	-0.06***
General test score	44.38	*13.85*	43.88	*13.81*	47.59	*13.64*	3.71***
Specific test score	29.74	*7.797*	29.57	*7.509*	30.85	*9.368*	1.28***
Faculty - proportion of PhD	0.111		0.0876		0.259		0.17***
Faculty - proportion of males	0.538		0.535		0.558		0.02***
Faculty - proportion of full time	0.181		0.113		0.611		0.50***
Employed at formal sector	0.898		0.900		0.887		-0.01**
Financial control institution							
Total benefit - (R$ 1.000.000)	1.137	*2.403*	0.946	*2.188*	2.155	*3.139*	1.21***
Faculty wage bill - (R$ 1.000.000)	1.090	*2.818*	1.054	*2.861*	1.281	*2.576*	0.23
Students enrolled	11,077	*23,067*	9,670	*23,255*	18,634	*20,476*	8,964.25***
Faculty proportion in staff	0.445		0.472		0.271		-0.20***
For-profit institution	0.366		0.433		0		-0.43***
Non-profit institution	0.474		0.557		0.0290		-0.53***

Table 3.2: Students characteristics

VARIABLES	Total mean	*sd*	Private HEI mean	*sd*	Public HEI mean	*sd*	Diff Pub-Priv
Total number of students	*370,930*		*276,039*		*94,891*		
Total earnings (R$)	5,424	*5,875*	5,242	*5,701*	5,953	*6,325*	710.4***
General test score	44.72	*29.48*	42.79	*28.26*	50.40	*32.16*	7.605***
Specific test score	29.71	*20.12*	29.21	*19.36*	31.28	*22.26*	2.071***
Age	24.01	*6.745*	24.31	*6.917*	23.12	*6.129*	-1.190***
Men	0.448		0.436		0.483		0.0470***
Night classes	0.653		0.726		0.443		-0.283***
Children	0.182		0.196		0.136		-0.0604***
Black	0.310		0.294		0.360		0.0656***
Public high school	0.678		0.710		0.579		-0.131***
Low income	0.332		0.330		0.338		0.00828***
Mother - high school	0.520		0.493		0.603		0.109***
Scholarship	0.305		0.370		0.103		-0.267***
Worked while in college	0.736		0.785		0.595		-0.190***
Graduate	0.703		0.685		0.752		0.0667***

Figure 3.1: Propensity scores - density



Source: Elaborated by the authors.

3.3 EMPIRICAL STRATEGY

To investigate the effectiveness of the investment on faculty salary made in the public HEIs, we estimate the following model:

$$Y_i = \alpha_i + \beta_i C_j + \theta_i P_j + \gamma_i P_j \times C_j + \sigma_i H_j + \eta_i X_i + \varepsilon_i \tag{3.3}$$

where Y_i is the earning outcome variable in log terms, which can be either the total earnings as defined by Equation 3.2 or the average wage in the period per year worked in the formal sector, C_j is log of total faculty wage per enrolled student, derived from Equation 3.1, P_j is a binary variable in which $P_j = 1$ for public HEIs and $P_j = 0$ for private HEIs, H_j is a vector of control variables related to the HEI (see Table 3.1 for the list of variables, besides year and city dummies), X_i is a vector of individual controls (see Table 3.2 for the list of variables, besides major group dummies), and ε_i is an error term.

In this case, the parameter if interest is γ_i related to the interaction between P_j and C_j. Since the costs and earnings are represented in the equation in log terms, γ_i is interpreted as the percentage variation in the individual earnings related to one percentage variation in faculty wage bill for students of public institutions. Thus, γ_i represents the effectiveness of public expenses with professors' salaries.

Considering the college admission processes, students differ related to their background across the two education systems. In order to account for these differences, we estimate a propensity score of the probability of a student be in the public system conditional to her observable characteristics:

$$\lambda_i(X_i) = Pr[P_j = 1|X_i]$$

Therefore, we identify the students in private HEIs who are more similar to the ones in public HEIs. Equation 3.3 is re-estimated including an inverse-probability-weighted regression adjustment, using the following weights for each student i:

$$w_i(P_j, X_i) = \frac{P_j}{\hat{\lambda}_i(X_i)} + \frac{1 - P_j}{1 - \hat{\lambda}_i(X_i)} \tag{3.4}$$

Additionally, we present three robustness tests. The first one considers a sub-sample restricted to individuals whose employers have informed at *RAIS* that the students have graduated from college. This analysis restricted to graduates differs from the main results since the results for the entire sample, which includes college dropout students, might be underestimated: if a student drops out, it is less likely that the college costs will affect her lifetime earnings.

Secondly, we consider a sub-sample restricted to individuals who remained employed during the seven years after expected graduation. Assuming the frequency with which an indi-

vidual appears in the formal sector may also be an effect of the investment in human capital accumulation through college, the results may differ for those students who persisted in the formal sector during the whole period.

Finally, a sensitivity analysis for the discount rate is presented. In this exercise, the benefits and costs related to higher education are discounted using only the inflation rate (*IPCA - Índice Nacional de Preços ao Consumidor*).

In all estimations, standard errors are calculated considering clusters of financial control institution. Students of the same HEI perceive the same cost per pupil enrolled. Thus they have the same value in the explanatory variable. Moreover, since the same financial control institution may financially manage multiple HEIs, the costs are shared among these institutions under the same administration. The robust standard errors take into account this lack of variability in the explanatory variable.

3.4 COST-EFFECTIVENESS ANALYSIS

In this section, we discuss the results of the cost-effectiveness estimations related to two earnings outcomes: log of total earnings and log of the average earnings per year in the formal sector. For each outcome, the results are presented in the standard model expressed in Equation 3.3, followed the estimation adjusted by weights as in Equation 3.4. The first subsection presents the overall results, while the following subsection presents robustness tests and sensitivity analysis.

3.4.1 OVERALL RESULTS

Using the present value of the log total earnings as the outcome, the first part of Table 3.3 shows the results associated with the education cost burdened by the institution, represented by the log of faculty wage bill per student enrolled, and, specifically, in the public institutions (Equation 3.3 without weights). Column (1) indicates a nonsignificant correlation between student earnings and faculty wages, unconditional to any other covariates. Column (2) shows a positive and significant unconditional correlation between student earnings and public institution: having attended a public HEI is associated with 11.9% greater total earnings for next seven years after expected graduation. Controlling for the expenses with faculty salary (Column (3)), the latter correlation rises to almost 15%. In Column (4) it is included an interaction term between the institution system and its respective faculty wage cost per pupil enrolled: for each percentage increase in the public expenditure per student, total individual earnings increase by 2.3%. Columns (5) to (10) include gradually several kinds of controls in the model. Although the estimated coefficient of the interaction term is not significant with the introduction of controls, it is always positive. Including all controls for observable variables, such as student's socioeconomic characteristics and *ENADE* first-year test scores, the point estimate for the interaction coefficient is 1.0%.

Following the same model structure, the second part of Table 3.3 presents the inverse-probability-weight adjusted regressions. The results are more precise than those without the adjustment, not changing the direction. Conditional to the faculty cost per pupil enrolled, having attended a public institution is related to 12.6% higher total earnings (Column (3)). When all observable characteristics are taken into account, the effectiveness of the public expenditure is a 1.8% increase in the individual total earnings.

Additionally, we may compare Column (9) to Column (10), in which the individual test scores were added. It is relevant to note the parameter of interest does not change, but the coefficient associated with public HEI loses significance and magnitude. This change points out to the ability selection into public HEIs, considering these tests scores are a proxy for abilities.

Table 3.3: HEI cost-effectiveness: Log Total earnings

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Unweighted										
Log Faculty wage bill per capita	-0.00204		0.00481	-0.00512	-0.00185	-0.00008	0.00309	0.00160	0.00463	0.00426
	[0.00626]		[0.00847]	[0.00802]	[0.00793]	[0.00392]	[0.00345]	[0.00324]	[0.00374]	[0.00425]
Public HEI		0.11188***	0.14974***	0.07164	0.05513	0.24820***	0.26597***	0.06685	0.09694*	0.06855
		[0.03453]	[0.03631]	[0.05104]	[0.05320]	[0.02943]	[0.02424]	[0.05243]	[0.05608]	[0.05861]
Public x Log Faculty wage bill per capita				0.02338*	0.01881	0.00968	0.00129	0.00831	0.00782	0.01028
				[0.01202]	[0.01221]	[0.00869]	[0.00628]	[0.00566]	[0.00651]	[0.00698]
Observations	278,821	349,122	278,821	278,821	278,821	278,213	278,213	209,501	124,893	106,680
Adjusted R-squared	0.00002	0.00240	0.00423	0.00489	0.01793	0.06375	0.12680	0.12872	0.17070	0.15724
Weighted										
Log Faculty wage bill per capita	-0.00011		0.00580	-0.00081	-0.00183	0.00334	0.00685	0.00227	0.00458	0.00473
	[0.00422]		[0.00546]	[0.00624]	[0.00634]	[0.00496]	[0.00511]	[0.00419]	[0.00449]	[0.00466]
Public HEI		0.10217***	0.12557***	0.09255**	0.09649**	0.26949***	0.28535***	0.13766**	0.11678*	0.06255
		[0.02719]	[0.02897]	[0.03824]	[0.03910]	[0.03136]	[0.03169]	[0.06913]	[0.06999]	[0.06571]
Public x Log Faculty wage bill per capita				0.00881	0.00944	0.01271	0.00800	0.02155***	0.01829**	0.01787**
				[0.00855]	[0.00906]	[0.01061]	[0.00904]	[0.00799]	[0.00788]	[0.00802]
Observations	151,011	189,717	151,011	151,011	151,011	150,759	150,759	112,988	111,969	106,680
Adjusted R-squared	-0.00001	0.00292	0.00406	0.00417	0.00610	0.05165	0.09856	0.10250	0.15003	0.16514
Year dummies	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
City dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Group dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
HEI controls	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
SES individual controls	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Individual 1st-year test scores	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 3.4 continues the cost-effectiveness analysis, presenting as an outcome the log of average individual earnings in the seven years following the expected graduation. Differences between these results and the ones previously presented might indicate that the education investment, measured by the cost of faculty salary per student, is also related to the frequency with which the individual is found in the formal sector. The results for this set of estimations follow the same pattern found for the total earnings: a percent increase of the faculty wage bill per capita in public HEIs is related to an increase of 1.7% in the individual average earnings (1.0% if the observations are not weighted by the inverse of the probability of being a student in a public HEI). Again, the coefficient for the public HEI binary variable is also always positive, i.e., individuals who have attended public HEIs earn more than those who have attended private ones, even when controlling for observable characteristics.

Hence, the overall results point to effective public expenditure in higher education, considering only the costs for the faculty wage bill per student enrolled. Weighting the individuals according to their probability of being a student in a public HEI, an increase in the faculty expenses is related to almost a 2% increase in the earnings of the public HEI's students. In average, this corresponds to over R$ 110.00, in prices of 2004, discounted by the interest rate.

Table 3.4: HEI cost-effectiveness: Log Average earnings - per year in the formal sector

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Unweighted										
Log Faculty wage bill per capita	-0.00212		0.00703	-0.00048	0.00163	0.00462	0.00564	0.00321	0.00339	0.00262
	[0.00565]		[0.00852]	[0.00788]	[0.00757]	[0.00456]	[0.00366]	[0.00332]	[0.00318]	[0.00372]
Public HEI		0.15955***	0.19958***	0.14059**	0.12896**	0.29939***	0.30084***	0.13070**	0.12348***	0.10062*
		[0.03572]	[0.03736]	[0.05655]	[0.05650]	[0.03051]	[0.02408]	[0.05527]	[0.04737]	[0.05526]
Public x Log Faculty wage bill per capita				0.01766	0.01519	0.00651	0.00001	0.00605	0.00737	0.01010*
				[0.01343]	[0.01329]	[0.00856]	[0.00602]	[0.00529]	[0.00547]	[0.00591]
Observations	278,821	349,122	278,821	278,821	278,821	278,213	278,213	209,501	124,893	106,680
Adjusted R-squared	0.00003	0.00759	0.01166	0.01224	0.01714	0.08748	0.17989	0.18249	0.22290	0.19977
Weighted										
Log Faculty wage bill per capita	0.00284		0.00818	0.00327	0.00131	0.00791	0.00794	0.00335	0.00281	0.00293
	[0.00575]		[0.00702]	[0.00581]	[0.00598]	[0.00499]	[0.00506]	[0.00393]	[0.00388]	[0.00408]
Public HEI		0.08867***	0.11346***	0.08891**	0.10094**	0.28173***	0.28715***	0.12878**	0.10161*	0.06884
		[0.02932]	[0.03061]	[0.04348]	[0.04321]	[0.03000]	[0.03052]	[0.05744]	[0.05423]	[0.05806]
Public x Log Faculty wage bill per capita				0.00655	0.00835	0.00775	0.00590	0.01745**	0.01647**	0.01748**
				[0.01006]	[0.01022]	[0.00916]	[0.00818]	[0.00739]	[0.00710]	[0.00717]
Observations	151,011	189,717	151,011	151,011	151,011	150,759	150,759	112,988	111,969	106,680
Adjusted R-squared	0.00010	0.00345	0.00531	0.00540	0.01265	0.08526	0.15493	0.15909	0.19570	0.21359
Year dummies	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
City dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Group dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
HEI controls	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
SES individual controls	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Individual 1st-year test scores	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

3.4.2 ROBUSTNESS TESTS

3.4.2.1 Effects on Graduates

The same set of regressions that were presented in the previous section are estimated, thus restricting the sample for those students who have graduated, according to their employers in the formal sector. The first part of Table 3.5 presents the results for the individuals' total earnings outcome, without and with weighting. Similar to results presented in Table 3.3, the unweighted regression with all controls shows a non-significant coefficient for the interaction of public institution and log faculty wage bill per capita of 1.0% (Column (10) in Table 3.5). Without controlling for institution and individual characteristics, the effect on the graduates' total earnings is of 2.4% for a 1% variation of public expenditure.

The weighted models are more precise than the unweighted ones. In the complete model, including all control variables, graduates from public institutions earn 2.1% more for a 1% increase in faculty salaries, compared to the students from private institutions.

Considering the average earnings per year worked in the formal sector, graduates from public institutions earn per year worked 1.5% more for a 1% percent increase in faculty salaries (Column (10) in Table 3.6). Although also positive, the unweighted models do not present a significant coefficient for the interaction of interest.

Comparing to the overall results, the cost-effectiveness for graduates are no more than 0.3 percentage points larger than for the whole sample. This indicates that the public expense for faculty salaries may be effective regarding early career earnings even if the individuals have not graduated.

Table 3.5: HEI cost-effectiveness: Log Total earnings only for Graduates

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Unweighted										
Log Faculty wage bill per capita	0.00019		0.00894	-0.00250	-0.00077	0.00262	0.00284	-0.00067	0.00423	0.00391
	[0.00697]		[0.00868]	[0.00825]	[0.00794]	[0.00530]	[0.00309]	[0.00381]	[0.00447]	[0.00518]
Public HEI		0.11108***	0.15330***	0.07258	0.06458	0.24170***	0.20159***	-0.08345	0.05231	0.03661
		[0.03539]	[0.03451]	[0.05012]	[0.05157]	[0.03714]	[0.02431]	[0.09904]	[0.09134]	[0.08450]
Public x Log Faculty wage bill per capita				0.02361**	0.02063*	0.00800	0.00183	0.01137*	0.00696	0.01014
				[0.01184]	[0.01215]	[0.01177]	[0.00671]	[0.00678]	[0.00757]	[0.00810]
Observations	102,042	125,449	102,042	102,042	102,042	101,870	101,870	79,395	52,548	45,072
Adjusted R-squared	-0.00001	0.00257	0.00468	0.00535	0.01830	0.06185	0.15341	0.15642	0.18691	0.17460
Weighted										
Log Faculty wage bill per capita	0.00329		0.00925	-0.00097	-0.00212	0.00504	0.00646	0.00383	0.00608	0.00502
	[0.00474]		[0.00566]	[0.00699]	[0.00710]	[0.00646]	[0.00512]	[0.00477]	[0.00506]	[0.00529]
Public HEI		0.08367***	0.11417***	0.06177	0.07035*	0.23344***	0.22130***	0.07643	0.04264	-0.02679
		[0.02845]	[0.02795]	[0.03856]	[0.03969]	[0.03946]	[0.03402]	[0.11301]	[0.10759]	[0.08965]
Public x Log Faculty wage bill per capita				0.01389	0.01382	0.01136	0.00907	0.02207**	0.01891**	0.02083**
				[0.00877]	[0.00908]	[0.01430]	[0.01036]	[0.00950]	[0.00937]	[0.00935]
Observations	62,078	76,407	62,078	62,078	62,078	61,999	61,999	47,963	47,604	45,072
Adjusted R-squared	0.00007	0.00188	0.00327	0.00353	0.00701	0.04600	0.11937	0.12514	0.16495	0.17950
Year dummies	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
City dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Group dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
HEI controls	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
SES individual controls	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Individual 1st-year test scores	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$
Filter: Graduates

Table 3.6: HEI cost-effectiveness: Log Average earnings - per year in the formal sector only for Graduates

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Unweighted										
Log Faculty wage bill per capita	-0.00170		0.01177	0.00285	0.00346	0.00895	0.00548*	0.00152	0.00350	0.00303
	[0.00668]		[0.00928]	[0.00759]	[0.00765]	[0.00608]	[0.00284]	[0.00309]	[0.00338]	[0.00404]
Public HEI		0.19414***	0.23588***	0.17296***	0.17040***	0.31640***	0.24492***	0.03153	0.10730*	0.10099*
		[0.03609]	[0.03395]	[0.05518]	[0.05659]	[0.03832]	[0.02224]	[0.05975]	[0.05846]	[0.05809]
Public x Log Faculty wage bill per capita				0.01841	0.01729	0.00098	-0.00087	0.00584	0.00255	0.00611
				[0.01372]	[0.01410]	[0.01146]	[0.00584]	[0.00557]	[0.00609]	[0.00648]
Observations	102,042	125,449	102,042	102,042	102,042	101,870	101,870	79,395	52,548	45,072
Adjusted R-squared	0.00002	0.01306	0.01843	0.01911	0.02221	0.09348	0.23687	0.23913	0.26651	0.23717
Weighted										
Log Faculty wage bill per capita	0.00549		0.01162	0.00489	0.00272	0.01208**	0.00815*	0.00459	0.00452	0.00373
	[0.00706]		[0.00813]	[0.00647]	[0.00675]	[0.00608]	[0.00417]	[0.00384]	[0.00401]	[0.00420]
Public HEI		0.08638***	0.11750***	0.08302*	0.10041**	0.27624***	0.24194***	0.12080*	0.09034	0.05696
		[0.03100]	[0.02894]	[0.04720]	[0.04706]	[0.03412]	[0.02733]	[0.07222]	[0.07190]	[0.06296]
Public x Log Faculty wage bill per capita				0.00914	0.01024	0.00027	0.00194	0.01226	0.01124	0.01481*
				[0.01135]	[0.01135]	[0.01122]	[0.00802]	[0.00824]	[0.00813]	[0.00785]
Observations	62,078	76,407	62,078	62,078	62,078	61,999	61,999	47,963	47,604	45,072
Adjusted R-squared	0.00038	0.00335	0.00604	0.00622	0.02127	0.08752	0.19954	0.20182	0.22843	0.24677
Year dummies	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
City dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Group dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
HEI controls	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
SES individual controls	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Individual 1st-year test scores	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$
Filter: Graduates

3.4.2.2 Effects on Employed during the whole period

The estimates for the sub-sample of individuals who were employed in all seven years of the analysis are presented in Table 3.7, using the log of discounted total earnings as the outcome[6].

Unlike the overall results and the graduates sample, previously presented, the results for the sample of individuals who were employed during the whole period indicate that the public expenditure is effective even before taking into account the probability of being a public HEI student. An increase of one percent in the cost of faculty salaries per pupil in the public institutions raises their students' earnings by 1.4%, conditional on observables. This effect is larger when weighting the model by the estimated propensity score: 2.3%.

The results for this sub-sample confirm the existence of a positive cost-effectiveness of public HEIs compared to private ones. It is not possible to indicate the existence of effects on the frequency of a former student working in the formal sector.

[6] Since the average earning is obtained as a simple mean of the total earnings divided by the total years the individual remained employed, and for this sample there is no variation in the total years in the formal sector, the coefficients do not vary across outcomes. Therefore, we present the results for only one of them, namely, the total earnings.

Table 3.7: HEI cost-effectiveness: Log Total earnings only for Employed during the whole period

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Unweighted										
Log Faculty wage bill per capita	0.00175		0.00585	-0.00392	-0.00290	0.00067	0.00222	-0.00030	-0.00131	-0.00110
	[0.00762]		[0.00936]	[0.00874]	[0.00878]	[0.00544]	[0.00347]	[0.00417]	[0.00335]	[0.00392]
Public HEI		0.06653*	0.10404**	0.02348	0.01875	0.17190***	0.23825***	0.10730	0.14462***	0.12684**
		[0.03799]	[0.04066]	[0.06028]	[0.06180]	[0.03245]	[0.02318]	[0.07980]	[0.05426]	[0.06067]
Public x Log Faculty wage bill per capita				0.02423*	0.02290	0.01411*	0.00350	0.01091*	0.01434**	0.01362**
				[0.01389]	[0.01400]	[0.00856]	[0.00627]	[0.00627]	[0.00608]	[0.00664]
Observations	139,786	176,738	139,786	139,786	139,786	139,415	139,415	101,927	60,757	52,635
Adjusted R-squared	0.00003	0.00159	0.00390	0.00533	0.00819	0.11688	0.21800	0.21573	0.26940	0.23977
Weighted										
Log Faculty wage bill per capita	0.00812		0.01017	0.00115	-0.00126	0.00204	0.00152	-0.00098	-0.00228	-0.00142
	[0.00626]		[0.00695]	[0.00582]	[0.00598]	[0.00418]	[0.00492]	[0.00475]	[0.00435]	[0.00438]
Public HEI		0.01547	0.04640	0.00263	0.01030	0.16429***	0.20320***	0.13154**	0.10705*	0.07123
		[0.03153]	[0.03164]	[0.04064]	[0.04159]	[0.02771]	[0.03094]	[0.06288]	[0.06365]	[0.06352]
Public x Log Faculty wage bill per capita				0.01173	0.01412	0.01869**	0.01549*	0.02444***	0.02409***	0.02286***
				[0.00939]	[0.00983]	[0.00824]	[0.00872]	[0.00869]	[0.00785]	[0.00790]
Observations	76,080	96,581	76,080	76,080	76,080	75,921	75,921	55,400	54,898	52,635
Adjusted R-squared	0.00123	0.00013	0.00240	0.00282	0.01250	0.12340	0.18363	0.18917	0.24887	0.26723
Year dummies	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
City dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Group dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
HEI controls	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
SES individual controls	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Individual 1st-year test scores	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$
Filter: Employed during the whole period

3.4.2.3 Sensitivity analysis

This subsection presents the overall results re-estimated in order to test the sensitivity for the chosen discount rate. We calculate the cost and benefit present values using as our discount rate the annual inflation rate (*IPCA*) instead of the interest rate in the economy (*SELIC*).

The results for the log of total earnings are presented in Table 3.8. The estimations indicate that, controlling for all available information, an increase of 1% in public expenditure is related to 1.7% higher total earnings (weighted model, Column (10) in Table 3.8). The unweighted models do not present significant coefficient for the interaction of interest in the complete model, although also positive. The results for the average earnings per year worked in the formal sector are very similar to the total earnings (see Table 3.9).

Therefore, comparing to results discussed in the previous sections, the estimated cost-effectiveness does not show sensitivity to the discount rate chosen.

Table 3.8: HEI cost-effectiveness: Log Real Total earnings

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Unweighted										
Log Faculty real wage bill per capita	-0.00125		0.00593	-0.00338	-0.00137	0.00063	0.00348	0.00178	0.00497	0.00462
	[0.00593]		[0.00818]	[0.00788]	[0.00787]	[0.00400]	[0.00353]	[0.00325]	[0.00375]	[0.00426]
Public HEI		0.11790***	0.15747***	0.07947	0.06366	0.26032***	0.27677***	0.06612	0.09235	0.06314
		[0.03462]	[0.03614]	[0.05232]	[0.05546]	[0.03118]	[0.02557]	[0.05357]	[0.05636]	[0.05941]
Public x Log Faculty real wage bill per capita				0.02173*	0.01784	0.00858	0.00100	0.00807	0.00696	0.00951
				[0.01178]	[0.01222]	[0.00870]	[0.00631]	[0.00564]	[0.00647]	[0.00698]
Observations	278,821	349,122	278,821	278,821	278,821	278,213	278,213	209,501	124,893	106,680
Adjusted R-squared	0.00000	0.00263	0.00460	0.00517	0.02008	0.06521	0.12758	0.13028	0.16930	0.15590
Weighted										
Log Faculty real wage bill per capita	0.00041		0.00649	0.00092	-0.00135	0.00412	0.00735	0.00229	0.00476	0.00501
	[0.00385]		[0.00510]	[0.00640]	[0.00639]	[0.00509]	[0.00520]	[0.00418]	[0.00448]	[0.00466]
Public HEI		0.10605***	0.13095***	0.10141**	0.10167**	0.27708***	0.29236***	0.12598*	0.10841	0.05656
		[0.02749]	[0.02932]	[0.03951]	[0.04081]	[0.03265]	[0.03314]	[0.06956]	[0.07090]	[0.06663]
Public x Log Faculty real wage bill per capita				0.00740	0.00881	0.01186	0.00756	0.02135***	0.01776**	0.01722**
				[0.00847]	[0.00913]	[0.01062]	[0.00904]	[0.00790]	[0.00781]	[0.00798]
Observations	151,011	189,717	151,011	151,011	151,011	150,759	150,759	112,988	111,969	106,680
Adjusted R-squared	-0.00001	0.00310	0.00436	0.00443	0.00866	0.05381	0.09995	0.10419	0.14864	0.16406
Year dummies	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
City dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Group dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
HEI controls	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
SES individual controls	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Individual 1st-year test scores	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table 3.9: HEI cost-effectiveness: Log Real Average earnings - per year in the formal sector

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Unweighted										
Log Faculty real wage bill per capita	-0.00200		0.00711	-0.00029	0.00185	0.00497	0.00566	0.00322	0.00359	0.00282
	[0.00561]		[0.00848]	[0.00790]	[0.00758]	[0.00464]	[0.00366]	[0.00333]	[0.00318]	[0.00373]
Public HEI		0.15955***	0.19969***	0.13773**	0.12680**	0.30085***	0.30069***	0.12970**	0.12430***	0.10076*
		[0.03572]	[0.03733]	[0.05889]	[0.05865]	[0.03225]	[0.02487]	[0.05541]	[0.04757]	[0.05550]
Public x Log Faculty real wage bill per capita				0.01726	0.01476	0.00560	0.00005	0.00595	0.00680	0.00950
				[0.01334]	[0.01317]	[0.00855]	[0.00596]	[0.00527]	[0.00539]	[0.00587]
Observations	278,821	349,122	278,821	278,821	278,821	278,213	278,213	209,501	124,893	106,680
Adjusted R-squared	0.00003	0.00759	0.01167	0.01223	0.01714	0.08747	0.17989	0.18249	0.22290	0.19976
Weighted										
Log Faculty real wage bill per capita	0.00291		0.00817	0.00321	0.00156	0.00823	0.00798	0.00329	0.00294	0.00312
	[0.00564]		[0.00692]	[0.00590]	[0.00607]	[0.00503]	[0.00507]	[0.00394]	[0.00388]	[0.00409]
Public HEI		0.08867***	0.11344***	0.08714*	0.09986**	0.28189***	0.28564***	0.12472**	0.09933*	0.06692
		[0.02932]	[0.03063]	[0.04503]	[0.04453]	[0.03147]	[0.03172]	[0.05793]	[0.05458]	[0.05862]
Public x Log Faculty real wage bill per capita				0.00659	0.00814	0.00716	0.00590	0.01744**	0.01616**	0.01700**
				[0.00997]	[0.01008]	[0.00914]	[0.00812]	[0.00731]	[0.00701]	[0.00713]
Observations	151,011	189,717	151,011	151,011	151,011	150,759	150,759	112,988	111,969	106,680
Adjusted R-squared	0.00011	0.00345	0.00532	0.00541	0.01268	0.08526	0.15494	0.15910	0.19570	0.21359
Year dummies	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
City dummies	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Group dummies	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
HEI controls	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
SES individual controls	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Individual 1st-year test scores	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

3.5 FINAL REMARKS

In this paper, we analyze the cost-effectiveness of the faculty wage bill in Brazilian colleges. We consider as the outcome the total of salaries the students earn in the formal sector, up to seven years after the investments were made. Positive externalities emerge from an increase in the supply of high-skilled workers, justifying the need for public investments on this level of education. However, these investments may be made either directly with the provision through public institutions or indirectly through subsidies, fiscal incentives and scholarships to attend private institutions. We contribute to the existing body of literature by providing evidence of the cost-effectiveness of increased government expenditure in public HEIs.

Our results indicate that a positive variation of 1% in the public faculty wage expenditure per pupil may increase total individual earnings by 2.3%. This value is equivalent to R$ 137 (R$ 588 in prices of 2017) in the total earnings of the individuals who attended a public institution. Thus, considering the faculty wage bill, expenditure in public HEIs is effective compared to private ones. This result might be related to the nature of the service provided by each institution. For example, unobservable faculty characteristics, research centers, and graduate programs in the public institutions could affect how the investment in faculty predicts students' future wages.

This analysis could be extended to include other types of costs and benefits involved in the higher education provision. On the cost side, it is important to account for the differences in the cost structure of public and private HEIs. We include in this study only the total faculty wage bill, assuming this represents the investment on skills acquirement. Considering other costs related to, for example, research, extension programs, and the tax burden involved, the institutions would present expressively variation in the costs and roles taken in society. Further investigation on how to consider other costs is needed. On the benefit side, measuring economic and non-monetary returns to public higher education investments are possible next steps for future studies. Additionally, heterogeneous cost-effectiveness may emerge across fields of education.

BIBLIOGRAPHY

ALTONJI, J. G.; PIERRET, C. R. Employer learning and statistical discrimination. *The Quarterly Journal of Economics*, Oxford University Press, v. 116, n. 1, p. 313–350, 2001. ISSN 00335533, 15314650. Available from Internet: <http://www.jstor.org/stable/2696451>. Cited on page 44.

ANDREWS, R. J.; LI, J.; LOVENHEIM, M. F. Quantile treatment effects of college quality on earnings. *Journal of Human Resources*, v. 51, n. 1, p. 200–238, 2016. Available from Internet: <http://jhr.uwpress.org/content/51/1/200.abstract>. Cited on page 45.

ARCIDIACONO, P.; BAYER, P.; HIZMO, A. Beyond signaling and human capital: Education and the revelation of ability. *American Economic Journal: Applied Economics*, v. 2, n. 4, p. 76–104, October 2010. Available from Internet: <http://www.aeaweb.org/articles?id=10.1257-/app.2.4.76>. Cited on page 44.

ARTEAGA, C. The effect of human capital on earnings: Evidence from a reform at colombia's top university. *Journal of Public Economics*, v. 157, p. 212 – 225, 2018. ISSN 0047-2727. Available from Internet: <http://www.sciencedirect.com/science/article/pii-/S0047272717301809>. Cited on page 44.

ATTANASIO, O.; GOLDBERG, P.; PAVCNIK, N. Trade reforms and wage inequality in colombia. *Journal of Development Economics*, v. 74, n. 2, p. 331–366, 2004. Available from Internet: <https://EconPapers.repec.org/RePEc:eee:deveco:v:74:y:2004:i:2:p:331-366>. Cited on page 43.

AVERY, C. The effects of college counseling on high-achieving, low-income students. *NBER Working Paper*, n. 16359, 2012. Available from Internet: <http://www.nber.org/papers-/w16359>. Cited on page 19.

AVERY, C. Evaluation of the college possible program: Results from a randomized controlled trial. *NBER Working Paper*, n. 19562, 2013. Available from Internet: <http://www.nber.org-/papers/w19562>. Cited on page 19.

AVITABILE, C.; HOYOS, R. The heterogeneous effect of information on student performance : Evidence from a randomized control trial in mexico. *Policy Research Working Paper*, n. 7422, 2015. Available from Internet: <https://openknowledge.worldbank.org/handle/10986/22845>. Cited on page 18.

BARBOSA-FILHO, F. d. H.; PESSôA, S. Retorno da educação no brasil. *Pesquisa e Planejamento Econômico*, n. v.38, n.1, p. 97–125, 2008. Available from Internet: <http://ppe.ipea.gov.br/index.php/ppe/article/viewFile/130/1024>. Cited on page 16.

BARROS, R. P. e. a. Políticas públicas para redução do abandono e evasão escolar de jovens. 2017. Available from Internet: <http://gesta.org.br/wp-content/uploads/2017/09/Politicas-Publicas-para-reducao-do-abandono-e-evasao-escolar-de-jovens.pdf>. Cited 2 times on pages 16 and 17.

BARROW, L.; MALAMUD, O. Is college a worthwhile investment? *Annual Review of Economics*, v. 7, n. 1, p. 519–555, 2015. Available from Internet: <https://doi.org/10.1146-/annurev-economics-080614-115510>. Cited on page 16.

BECKER, G. S. Investment in human capital: A theoretical analysis. *Journal of Political Economy*, University of Chicago Press, v. 70, n. 5, p. 9–49, 1962. ISSN 00223808, 1537534X. Available from Internet: <http://www.jstor.org/stable/1829103>. Cited on page 43.

BEHRMAN, J.; ROSENZWEIG, M.; TAUBMAN, P. College choice and wages: Estimates using data on female twins. *The Review of Economics and Statistics*, v. 78, n. 4, p. 672–85, 1996. Available from Internet: <https://EconPapers.repec.org-/RePEc:tpr:restat:v:78:y:1996:i:4:p:672-85>. Cited on page 45.

BELFIELD, C. R. et al. The high/scope perry preschool program: Cost-benefit analysis using data from the age-40 followup. *The Journal of Human Resources*, [University of Wisconsin Press, Board of Regents of the University of Wisconsin System], v. 41, n. 1, p. 162–190, 2006. ISSN 0022166X. Available from Internet: <http://www.jstor.org/stable/40057261>. Cited on page 88.

BETTINGER, E. P. et al. The role of application assistance and information in college decisions: Results from the h&r block fafsa experiment. *The Quarterly Journal of Economics*, v. 127, n. 3, p. 1205–1242, 2012. Available from Internet: <http://dx.doi.org/10.1093/qje-/qjs017>. Cited 3 times on pages 17, 18, and 19.

BIRCH, E. R.; LI, I.; MILLER, P. W. The influences of institution attended and field of study on graduates' starting salaries. *Australian Economic Review*, v. 42, n. 1, p. 42–63, 2009. Available from Internet: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-8462.2009.00524.x>. Cited on page 45.

BIRD, K. et al. *Nudging at a National scale: experimental evidence from a FAFSA completion campaign*. [S.l.], 2017. Cited on page 19.

BLACK, D.; SMITH, J. Estimating the returns to college quality with multiple proxies for quality. *Journal of Labor Economics*, [The University of Chicago Press, Society of Labor Economists, NORC at the University of Chicago], v. 24, n. 3, p. 701–728, 2006. ISSN 0734306X, 15375307. Available from Internet: <http://www.jstor.org/stable/10.1086-/505067>. Cited on page 45.

BOARDMAN, A. E. et al. *Cost-Benefit Analysis: Concepts and Practice.* [S.l.]: Pearson; 4 edition (August 27, 2010), 2011. 560 p. ISBN 0137002696. Cited on page 88.

BOCCANFUSO, D.; LAROUCHE, A.; TRANDAFIR, M. Quality of higher education and the labor market in developing countries: Evidence from an education reform in senegal. *World Development*, v. 74, n. C, p. 412–424, 2015. Available from Internet: <https://EconPapers.repec.org/RePEc:eee:wdevel:v:74:y:2015:i:c:p:412-424>. Cited on page 45.

BOS, J. M. et al. The impacts of source: A program to support college enrollment through near-peer, low-cost student advising. *Association of Public Policy Analysis and Management Annual Conference*, 2012. Cited on page 19.

BOWEN, W. G. et al. *The Shape of the River: Long-Term Consequences of Considering Race in College and University Admissions*. Rev - revised. Princeton University Press, 1998. ISBN 9780691050195. Available from Internet: <http://www.jstor.org/stable/j.ctt1b4cwrk>. Cited on page 45.

BOWEN, W. G.; CHINGOS, M. M.; MCPHERSON, M. S. *Crossing the Finish Line: Completing College at America's Public Universities*. Princeton University Press, 2009. ISBN 0691149909. Available from Internet: <http://www.jstor.org/stable/j.ctt7rp39>. Cited on page 45.

BREWER, D. J.; EIDE, E. R.; EHRENBERG, R. G. Does it pay to attend an elite private college? cross-cohort evidence on the effects of college type on earnings. *The Journal of Human Resources*, [University of Wisconsin Press, Board of Regents of the University of Wisconsin System], v. 34, n. 1, p. 104–123, 1999. ISSN 0022166X. Available from Internet: <http://www.jstor.org/stable/146304>. Cited on page 45.

BULMAN, G. et al. *Parental Resources and College Attendance: Evidence from Lottery Wins*. [S.l.], 2016. (Working Paper Series, 22679). Available from Internet: <http://www.nber.org-/papers/w22679>. Cited on page 19.

BUSSO, M. et al. The effects of financial aid and returns information in selective and less selective schools: Experimental evidence from chile. *Labour Economics*, v. 45, p. 79 – 91, 2017. ISSN 0927-5371. Field experiments in labor economics and social policies. Available from Internet: <http://www.sciencedirect.com/science/article/pii/S0927537116303074>. Cited 2 times on pages 17 and 18.

CARD, D. Estimating the return to schooling: Progress on some persistent econometric problems. *Econometrica*, [Wiley, Econometric Society], v. 69, n. 5, p. 1127–1160, 2001. ISSN 00129682, 14680262. Available from Internet: <http://www.jstor.org/stable/2692217>. Cited 2 times on pages 43 and 46.

CARNOY, M. *International encyclopedia of economics of education.* [S.l.]: Oxford : Pergamon, 1995., 1995. (Resources in education). ISBN 0080423035. Cited on page 87.

CARRELL, S.; SACERDOTE, B. Late interventions matter too: The case of college coaching new hampshire. n. 19031, 05 2013. Cited on page 19.

CARRELL, S.; SACERDOTE, B. Why do college-going interventions work? *American Economic Journal: Applied Economics*, v. 9, n. 3, p. 124–51, July 2017. Available from Internet: <http://www.aeaweb.org/articles?id=10.1257/app.20150530>. Cited on page 19.

CASTLEMAN, B.; GOODMAN, J. *Intensive College Counseling and the College Enrollment Choices of Low Income Students*. [S.l.], 2014. Available from Internet: <https://ideas.repec-.org/p/ecl/harjfk/rwp14-031.html>. Cited on page 19.

CHEN, S. Education and transition to work: Evidence from vietnam, cambodia and nepal. *International Journal of Educational Development*, v. 61, p. 92 – 105, 2018. ISSN 0738-0593. Available from Internet: <http://www.sciencedirect.com/science/article/pii-/S0738059317301839>. Cited on page 16.

CHEVALIER, A. Does higher education quality matter in the uk? In: ____. *Factors Affecting Worker Well-being: The Impact of Change in the Labor Market*. [s.n.], 2014. cap. 7, p.

257–292. Available from Internet: <https://www.emeraldinsight.com/doi/abs/10.1108/S0147-912120140000040010>. Cited 2 times on pages 44 and 45.

CUNHA, J. M.; MILLER, T. Measuring value-added in higher education: Possibilities and limitations in the use of administrative data. *Economics of Education Review*, v. 42, p. 64 – 77, 2014. ISSN 0272-7757. Available from Internet: <http://www.sciencedirect.com/science-/article/pii/S0272775714000582>. Cited on page 45.

DALE, S. B.; KRUEGER, A. B. Estimating the payoff to attending a more selective college: An application of selection on observables and unobservables*. *The Quarterly Journal of Economics*, v. 117, n. 4, p. 1491–1527, 2002. Available from Internet: <http://dx.doi.org/10.1162/003355302320935089>. Cited on page 45.

DALE, S. B.; KRUEGER, A. B. Estimating the effects of college characteristics over the career using administrative earnings data. *Journal of Human Resources*, v. 49, n. 2, p. 323–358, 2014. Available from Internet: <http://jhr.uwpress.org/content/49/2/323.abstract>. Cited 2 times on pages 44 and 45.

DICKSON, M.; HARMON, C. Economic returns to education: What we know, what we don't know, and where we are going—some brief pointers. *Economics of Education Review*, v. 30, n. 6, p. 1118 – 1122, 2011. ISSN 0272-7757. Special Issue: Economic Returns to Education. Available from Internet: <http://www.sciencedirect.com/science/article/pii-/S0272775711001361>. Cited on page 43.

DILLON, E. W.; SMITH, J. A. Determinants of the match between student ability and college quality. *Journal of Labor Economics*, v. 35, n. 1, p. 45–66, 2017. Available from Internet: <https://doi.org/10.1086/687523>. Cited on page 18.

DINKELMAN, T.; MARTíNEZ, C. Investing in schooling in chile: The role of information about financial aid for higher education. *The Review of Economics and Statistics*, v. 96, n. 2, p. 244–257, 2014. Available from Internet: <https://doi.org/10.1162/REST_a_00384>. Cited 3 times on pages 17, 18, and 19.

FARBER, H. S.; GIBBONS, R. Learning and wage dynamics*. *The Quarterly Journal of Economics*, v. 111, n. 4, p. 1007–1047, 1996. Available from Internet: <http://dx.doi.org/10-.2307/2946706>. Cited on page 44.

FERREIRA, F.; FIRPO, S. P.; MESSINA, J. Understanding recent dynamics of earnings inequality in Brazil. *New Order and Progress: Development and Democracy in Brazil*, Oxford University Press New York, NY, v. 187, 2016. Cited 2 times on pages 44 and 87.

FERREYRA, M. et al. *At a Crossroads: Higher Education in Latin America and the Caribbean*. World Bank Publications, 2017. (Directions in Development Series). ISBN 9781464810145. Available from Internet: <https://books.google.com.br/books?id=wMROnQAACAAJ>. Cited 3 times on pages 87, 88, and 90.

FISZBEIN, A.; PSACHAROPOULOS, G. A cost-benefit analysis of educational investment in venezuela: 1989 update. *Economics of Education Review*, v. 12, n. 4, p. 293 – 298, 1993. ISSN 0272-7757. Available from Internet: <http://www.sciencedirect.com/science/article/pii-/027277579390063M>. Cited on page 88.

FRENCH, R.; OREOPOULOS, P. Behavioral barriers transitioning to college. *Labour Economics*, v. 47, p. 48 – 63, 2017. ISSN 0927-5371. EALE conference issue 2016. Available from Internet: <http://www.sciencedirect.com/science/article/pii/S0927537117300556>. Cited on page 17.

FRYER, R. G. Information, non-financial incentives, and student achievement: Evidence from a text messaging experiment. *Journal of Public Economics*, v. 144, p. 109 – 121, 2016. ISSN 0047-2727. Available from Internet: <http://www.sciencedirect.com/science/article/pii-/S0047272716301566>. Cited 2 times on pages 17 and 18.

GROGGER, J.; EIDE, E. Changes in college skills and the rise in the college wage premium. *The Journal of Human Resources*, [University of Wisconsin Press, Board of Regents of the University of Wisconsin System], v. 30, n. 2, p. 280–310, 1995. ISSN 0022166X. Available from Internet: <http://www.jstor.org/stable/146120>. Cited on page 46.

GUARCELLO, L. et al. School to work transitions: Regional overview. p. 107–148, 01 2008. Cited on page 44.

HANUSHEK, E. A.; WOESSMANN, L. The role of cognitive skills in economic development. *Journal of Economic Literature*, v. 46, n. 3, p. 607–68, September 2008. Available from Internet: <http://www.aeaweb.org/articles?id=10.1257/jel.46.3.607>. Cited 2 times on pages 44 and 87.

HARBISON, R. W.; HANUSHEK, E. *Educational Performance of the Poor: Lessons from Rural Northeast Brazil*. [S.l.]: The World Bank, 1992. Cited on page 88.

HASTINGS, J.; NEILSON, C.; ZIMMERMAN, S. D. *The Effects of Earnings Disclosure on College Enrollment Decisions*. [S.l.], 2015. Available from Internet: <https://EconPapers-.repec.org/RePEc:nbr:nberwo:21300>. Cited 2 times on pages 17 and 18.

HECKMAN, J. J.; LOCHNER, L. J.; TODD, P. E. *Earnings functions, rates of return and treatment effects: the Mincer equation and beyond*. Bonn: Institute for the Study of Labor (IZA), 2005. (IZA Discussion Papers, 1700). Available from Internet: <http://hdl.handle.net-/10419/33472>. Cited on page 43.

HECKMAN, J. J.; LOCHNER, L. J.; TODD, P. E. Earnings functions and rates of return. *Journal of Human Capital*, v. 2, n. 1, p. 1–31, 2008. Available from Internet: <https://doi.org/10.1086/587037>. Cited on page 88.

HERSHBEIN, B. Worker signals among new college graduates: The role of selectivity and gpa. 01 2013. Cited on page 44.

HOCH, J. S. Improving efficiency and value in palliative care with net benefit regression: An introduction to a simple method for cost-effectiveness analysis with person-level data. *Journal of Pain and Symptom Management*, v. 38, n. 1, p. 54 – 61, 2009. ISSN 0885-3924. Available from Internet: <http://www.sciencedirect.com/science/article/pii/S0885392409004990>. Cited on page 89.

HOCH, J. S.; BRIGGS, A. H.; WILLAN, A. R. Something old, something new, something borrowed, something blue: a framework for the marriage of health econometrics and cost-effectiveness analysis. *Health Economics*, v. 11, n. 5, p. 415–430, 2002. Available from Internet: <https://onlinelibrary.wiley.com/doi/abs/10.1002/hec.678>. Cited on page 89.

HOEKSTRA, M. The effect of attending the flagship state university on earnings: A discontinuity-based approach. *The Review of Economics and Statistics*, v. 91, n. 4, p. 717–724, 2009. Available from Internet: <https://doi.org/10.1162/rest.91.4.717>. Cited 2 times on pages 45 and 46.

HOUNTON, S.; NEWLANDS, D. Applying the net-benefit framework for analyzing and presenting cost-effectiveness analysis of a maternal and newborn health intervention. *PLOS ONE*, Public Library of Science, v. 7, n. 7, p. 1–8, 07 2012. Available from Internet: <https://doi.org/10.1371/journal.pone.0040995>. Cited on page 89.

HOUT, M. Social and economic returns to college education in the united states. *Annual Review of Sociology*, v. 38, n. 1, p. 379–400, 2012. Available from Internet: <https://doi.org/10.1146/annurev.soc.012809.102503>. Cited on page 44.

HOXBY, C.; TURNER, S. *Expanding College Opportunities for High-Achieving, Low Income Students*. [S.l.], 2013. Available from Internet: <https://ideas.repec.org/p/sip/dpaper/12-014-.html>. Cited 3 times on pages 17, 18, and 19.

HOXBY, C. M. The changing selectivity of american colleges. *Journal of Economic Perspectives*, v. 23, n. 4, p. 95–118, December 2009. Available from Internet: <http://www-.aeaweb.org/articles?id=10.1257/jep.23.4.95>. Cited on page 45.

HOXBY, C. M.; AVERY, C. The missing "one-offs": The hidden supply of high-achieving, low-income students. v. 1, p. 1–65, 2013. Cited on page 18.

HOYOS, R. D.; ROGERS, H.; SZéKELY, M. *Out of School and Out of Work: Risk and Opportunities for Latin America's Ninis*. [S.l.], 2016. Cited 3 times on pages 15, 17, and 18.

HUMMEL-ROSSI, B.; ASHDOWN, J. The state of cost-benefit and cost-effectiveness analyses in education. *Review of Educational Research*, [Sage Publications, Inc., American Educational Research Association], v. 72, n. 1, p. 1–30, 2002. ISSN 00346543, 19351046. Available from Internet: <http://www.jstor.org/stable/3516072>. Cited on page 88.

IBGE. *Síntese de indicadores sociais: uma análise das condições de vida da população brasileira*. [S.l.], 2016. Cited on page 15.

INDURKHYA, A.; MITRA, N.; SCHRAG, D. Using propensity scores to estimate the cost–effectiveness of medical therapies. *Statistics in Medicine*, v. 25, n. 9, p. 1561–1576, 2006. Available from Internet: <https://onlinelibrary.wiley.com/doi/abs/10.1002/sim.2267>. Cited on page 89.

INEP. *Estimativas de fluxo escolar a partir do acompanhamento longitudinal dos registros de aluno do Censo Escolar do período 2007-2016*. [S.l.], 2017. (Nota Técnica, 8). Cited on page 16.

JENSEN, R. The (perceived) returns to education and the demand for schooling*. *The Quarterly Journal of Economics*, v. 125, n. 2, p. 515–548, 2010. Available from Internet: <http://dx.doi.org/10.1162/qjec.2010.125.2.515>. Cited 2 times on pages 17 and 18.

JIMENEZ, E.; PATRINOS, H. *Can cost-benefit analysis guide education policy in developing countries?* [S.l.], 2008. (Policy Research Working Paper, 4568). Cited 3 times on pages 87, 88, and 90.

KAUFMANN, K.; MESSNER, M.; SOLIS, A. *Returns to Elite Higher Education in the Marriage Market: Evidence from Chile*. [S.l.], 2013. Available from Internet: <https://EconPapers.repec.org/RePEc:igi:igierp:489>. Cited on page 45.

KERR, P. S. et al. *Post-secondary education and information on labor market prospects: a randomized field experiment*. [S.l.], 2015. 53 p. (Discussion Paper Series, 9372). Cited on page 17.

LEMIEUX, T. The "mincer equation" thirty years after schooling, experience, and earnings. In: ____. *Jacob Mincer A Pioneer of Modern Labor Economics*. Boston, MA: Springer US, 2006. p. 127–145. ISBN 978-0-387-29175-8. Available from Internet: <https://doi.org/10.1007/0-387-29175-X_11>. Cited on page 43.

LIU, V. Y.; BELFIELD, C. R.; TRIMBLE, M. J. The medium-term labor market returns to community college awards: Evidence from north carolina. *Economics of Education Review*, v. 44, n. C, p. 42–55, 2015. Available from Internet: <https://EconPapers.repec.org-/RePEc:eee:ecoedu:v:44:y:2015:i:c:p:42-55>. Cited on page 43.

LONG, M. C. Changes in the returns to education and college quality. *Economics of Education Review*, v. 29, n. 3, p. 338 – 347, 2010. ISSN 0272-7757. Available from Internet: <http://www.sciencedirect.com/science/article/pii/S0272775709001150>. Cited 2 times on pages 44 and 45.

LOURY, L.; GARMAN, D. College selectivity and earnings. *Journal of Labor Economics*, v. 13, n. 2, p. 289–308, 1995. Available from Internet: <https://EconPapers.repec.org-/RePEc:ucp:jlabec:v:13:y:1995:i:2:p:289-308>. Cited on page 45.

LUNA, X. de; LUNDIN, M. Sensitivity analysis of the unconfoundedness assumption with an application to an evaluation of college choice effects on earnings. *Journal of Applied Statistics*, Taylor & Francis, v. 41, n. 8, p. 1767–1784, 2014. Available from Internet: <https://doi.org/10.1080/02664763.2014.890178>. Cited on page 45.

LUSTIG, N.; LOPEZ-CALVA, L. F.; ORTIZ-JUAREZ, E. Declining inequality in Latin America in the 2000s: the cases of Argentina, Brazil, and Mexico. *World Development*, Elsevier, v. 44, p. 129–141, 2013. Cited 2 times on pages 44 and 87.

MACLEOD, W. B. et al. The big sort: College reputation and labor market outcomes. *American Economic Journal: Applied Economics*, v. 9, n. 3, p. 223–61, July 2017. Available from Internet: <http://www.aeaweb.org/articles?id=10.1257/app.20160126>. Cited 2 times on pages 45 and 55.

MACLEOD, W. B.; URQUIOLA, M. Reputation and school competition. *American Economic Review*, v. 105, n. 11, p. 3471–88, November 2015. Available from Internet: <http://www.aeaweb.org/articles?id=10.1257/aer.20130332>. Cited 3 times on pages 44, 45, and 46.

MANSKI, C. F. Adolescent econometricians: How do youth infer the returns to schooling? In: ____. *Studies of Supply and Demand in Higher Education*. University of Chicago Press, 1993. p. 43–60. Available from Internet: <http://www.nber.org/chapters/c6097>. Cited on page 16.

MARTIN, I. W. R.; PINDYCK, R. S. Averting catastrophes: The strange economics of scylla and charybdis. *American Economic Review*, v. 105, n. 10, p. 2947–85, October 2015. Available

from Internet: <http://www.aeaweb.org/articles?id=10.1257/aer.20140806>. Cited on page 88.

MCGUIGAN, M.; MCNALLY, S.; WYNESS, G. Student awareness of costs and benefits of educational decisions: Effects of an information campaign. *Journal of Human Capital*, v. 10, n. 4, p. 482–519, 2016. Available from Internet: <https://doi.org/10.1086/689551>. Cited 2 times on pages 17 and 18.

MINCER, J. Investment in human capital and personal income distribution. *Journal of Political Economy*, University of Chicago Press, v. 66, n. 4, p. 281–302, 1958. ISSN 00223808, 1537534X. Available from Internet: <http://www.jstor.org/stable/1827422>. Cited on page 43.

MINCER, J. *Schooling, Experience, and Earnings*. National Bureau of Economic Research, Inc, 1974. Available from Internet: <https://EconPapers.repec.org/RePEc:nbr:nberbk:minc74-1>. Cited on page 43.

MONTENEGRO, C. E.; PATRINOS, H. A. *Comparable estimates of returns to schooling around the world*. [S.l.], 2014. Available from Internet: <https://ideas.repec.org/p/wbk-/wbrwps/7020.html>. Cited on page 16.

MORETTI, E. Estimating the social return to higher education: evidence from longitudinal and repeated cross-sectional data. *Journal of Econometrics*, v. 121, n. 1, p. 175 – 212, 2004. ISSN 0304-4076. Higher education (Annals issue). Available from Internet: <http://www-.sciencedirect.com/science/article/pii/S0304407603002653>. Cited 2 times on pages 87 and 88.

NAKAMURO, M.; INUI, T.; YAMAGATA, S. Returns to education using a sample of twins: Evidence from japan*. *Asian Economic Journal*, v. 31, n. 1, p. 61–81, 2017. Available from Internet: <https://onlinelibrary.wiley.com/doi/abs/10.1111/asej.12113>. Cited on page 45.

NASTARI, R. B. *Três Ensaios em Economia da Educação*. Thesis (PhD in Economics) — Escola de Economia de São Paulo, 2015. Cited on page 16.

NGUYEN, T. Information, role models and perceived returns to education: Experimental evidence from madagascar. mimeo. 2008. Cited on page 17.

OECD. *Education at a Glance 2017*. [s.n.], 2017. 456 p. Available from Internet: <https://www.un-ilibrary.org/content/publication/eag-2017-en>. Cited on page 16.

OPPEDISANO, V. Higher education expansion and unskilled labour market outcomes. *Economics of Education Review*, v. 40, p. 205 – 220, 2014. ISSN 0272-7757. Available from Internet: <http://www.sciencedirect.com/science/article/pii/S0272775714000351>. Cited on page 44.

OREOPOULOS, P.; DUNN, R. Information and college access: Evidence from a randomized field experiment. *The Scandinavian Journal of Economics*, v. 115, n. 1, p. 3–26, 2013. Available from Internet: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-9442.2012.01742.x>. Cited 2 times on pages 17 and 18.

OREOPOULOS, P.; FORD, R. *Keeping College Options Open: A Field Experiment to Help All High School Seniors Through the College Application Process*. [S.l.], 2016. (Working Paper Series, 22320). Available from Internet: <http://www.nber.org/papers/w22320>. Cited on page 19.

OREOPOULOS, P.; PETRONIJEVIC, U. Making college worth it: A review of the returns to higher education. v. 23, 05 2013. Cited 3 times on pages 16, 44, and 45.

PAUW, K.; OOSTHUIZEN, M.; WESTHUIZEN, C. V. D. Graduate unemployment in the face of skills shortages: A labour market paradox1. *South African Journal of Economics*, v. 76, n. 1, p. 45–57, 2008. Available from Internet: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j-.1813-6982.2008.00152.x>. Cited on page 44.

PSACHAROPOULOS, G.; PATRINOS, H. A. Returns to investment in education: a further update. *Education Economics*, Routledge, v. 12, n. 2, p. 111–134, 2004. Available from Internet: <https://doi.org/10.1080/0964529042000239140>. Cited on page 88.

RODERICK, M. et al. *From High School to the Future: making Hard Work Pay Off*. [S.l.], 2009. Cited on page 18.

ROSENBAUM, P. R.; RUBIN, D. B. Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician*, [American Statistical Association, Taylor & Francis, Ltd.], v. 39, n. 1, p. 33–38, 1985. ISSN 00031305. Available from Internet: <http://www.jstor.org/stable/2683903>. Cited on page 32.

ROSS, C. E.; MIROWSKY, J. Refining the association between education and health: The effects of quantity, credential, and selectivity. *Demography*, v. 36, n. 4, p. 445–460, Nov 1999. ISSN 1533-7790. Available from Internet: <https://doi.org/10.2307/2648083>. Cited on page 45.

ROTH, W. I. *Understanding the Use of Cost Benefit and Cost Effectiveness Analysis in World Bank Education Proposals*. Thesis (PhD) — Department of Leadership, Higher and Adult Education - University of Toronto, 2016. Cited on page 88.

RUBIN, D. B. Using multivariate matched sampling and regression adjustment to control bias in observational studies. *Journal of the American Statistical Association*, Taylor & Francis, v. 74, n. 366a, p. 318–328, 1979. Available from Internet: <https://doi.org/10.1080/01621459-.1979.10482513>. Cited on page 89.

SAAVEDRA, A. R.; SAAVEDRA, J. E. Do colleges cultivate critical thinking, problem solving, writing and interpersonal skills? *Economics of Education Review*, v. 30, n. 6, p. 1516 – 1526, 2011. ISSN 0272-7757. Special Issue: Economic Returns to Education. Available from Internet: <http://www.sciencedirect.com/science/article/pii/S0272775711001397>. Cited on page 44.

SAAVEDRA, J. E. The learning and early labor market effects of college quality: A regression discontinuity analysis. 09 2009. Cited 2 times on pages 45 and 46.

SAND, B. M. A re-examination of the social returns to education: Evidence from u.s. cities. *Labour Economics*, v. 24, p. 97 – 106, 2013. ISSN 0927-5371. Available from Internet: <http://www.sciencedirect.com/science/article/pii/S0927537113000791>. Cited on page 87.

SCHNEIDER, S. L. The international standard classification of education 2011. In: ____. *Class and Stratification Analysis*. [s.n.], 2013. p. 365–379. Available from Internet: <https://www.emeraldinsight.com/doi/abs/10.1108/S0195-6310%282013%290000030017>. Cited on page 50.

SCHüNDELN, M.; PLAYFORTH, J. Private versus social returns to human capital: Education and economic growth in india. *European Economic Review*, v. 66, p. 266 – 283, 2014. ISSN 0014-2921. Available from Internet: <http://www.sciencedirect.com/science/article/pii-/S0014292113001347>. Cited on page 87.

SMITH, J.; PENDER, M.; HOWELL, J. The full extent of student-college academic undermatch. *Economics of Education Review*, v. 32, p. 247 – 261, 2013. ISSN 0272-7757. Available from Internet: <http://www.sciencedirect.com/science/article/pii-/S0272775712001446>. Cited on page 18.

SPENCE, M. Job market signaling. *The Quarterly Journal of Economics*, Oxford University Press, v. 87, n. 3, p. 355–374, 1973. ISSN 00335533, 15314650. Available from Internet: <http://www.jstor.org/stable/1882010>. Cited on page 44.

SUHONEN, T. Quality of higher education and earnings: evidence from finland using field-of-study-level quality measures. *International Review of Applied Economics*, Routledge, v. 28, n. 1, p. 22–44, 2014. Available from Internet: <https://doi.org/10.1080/02692171.2013-.826635>. Cited on page 45.

TEIXEIRA, W. M.; MENEZES-FILHO, N. A. Estimando o retorno à educação do brasil considerando a legislação educacional brasileira como um instrumento. *Revista de Economia Política*, v. 32, p. 479–496, 2012. Cited on page 16.

TEMPLE, J. A.; REYNOLDS, A. J. Benefits and costs of investments in preschool education: Evidence from the child–parent centers and related programs. *Economics of Education Review*, v. 26, n. 1, p. 126 – 144, 2007. ISSN 0272-7757. The Economics of Early Childhood Education. Available from Internet: <http://www.sciencedirect.com/science/article/pii-/S0272775706000409>. Cited on page 88.

THIAS, H.; CARNOY, M. *Cost-benefit analysis in education: a case study of Kenya*. International Bank for Reconstruction and Development]; distributed by the Johns Hopkins Press, Baltimore, 1972. (Staff occasional papers). ISBN 9780801813351. Available from Internet: <https://books.google.com.br/books?id=1dAjAAAAMAAJ>. Cited on page 88.

THOMAS, S. L.; ZHANG, L. Post-baccalaureate wage growth within four years of graduation: The effects of college quality and college major. *Research in Higher Education*, v. 46, n. 4, p. 437–459, Jun 2005. ISSN 1573-188X. Available from Internet: <https://doi.org/10.1007-/s11162-005-2969-y>. Cited on page 44.

TSANG, M. C. Cost analysis for educational policymaking: A review of cost studies in education in developing countries. *Review of Educational Research*, [Sage Publications, Inc., American Educational Research Association], v. 58, n. 2, p. 181–230, 1988. ISSN 00346543, 19351046. Available from Internet: <http://www.jstor.org/stable/1170334>. Cited on page 88.

VAZQUEZ-POLO, F. J.; HERNáNDEZ, M. A. N.; LóPEZ-VALCáRCEL, B. G. Using covariates to reduce uncertainty in the economic evaluation of clinical trial data. *Health Economics*, v. 14, n. 6, p. 545–557, 2005. Available from Internet: <https://onlinelibrary-.wiley.com/doi/abs/10.1002/hec.947>. Cited on page 89.

VIAENE, J.-M.; ZILCHA, I. Public funding of higher education. *Journal of Public Economics*, v. 108, p. 78 – 89, 2013. ISSN 0047-2727. Available from Internet: <http://www-.sciencedirect.com/science/article/pii/S0047272713001898>. Cited 2 times on pages 88 and 91.

WILLAN, A. R.; BRIGGS, A. H.; HOCH, J. S. Regression methods for covariate adjustment and subgroup analysis for non-censored cost-effectiveness data. *Health Economics*, v. 13, n. 5, p. 461–475, 2004. Available from Internet: <https://onlinelibrary.wiley.com/doi/abs/10.1002-/hec.843>. Cited on page 89.

ZIMMERMAN, S. D. *Making the One Percent: The Role of Elite Universities and Elite Peers*. [S.l.], 2016. (Working Paper Series, 22900). Available from Internet: <http://www.nber.org-/papers/w22900>. Cited on page 45.

Appendix

APPENDIX A – DESCRIPTION OF VARIABLES

Table A.1: Description of variables

Variable Section and Name	Variable description	Data source
Labor Market outcomes		
Employed at formal sector	Binary variable indicatesif individual works in the formal sector each year	RAIS
Log Real Hourly Wage	Natural logarithm of the real hourly wage each year	RAIS
Individual Scores*		
General test - freshman year	ENADE freshman year general test score	ENADE
Specific test - freshman year	ENADE freshman year specific test score	ENADE
General test - senior year	ENADE freshman year general test score	ENADE
Specific test - senior year	ENADE senior year specific test score	ENADE
General test - high school senior	ENEM high school general test score	ENEM
Signals		
Previous Cohort		
Previous cohort - percentage at formal sector	Percentage of previous cohort that was working in the formal sector two years after their graduation	RAIS
Previous cohort - Log Real Hourly Wage	Log of hourly wage of the previous cohort in the formal sector two years after their graduation, conditional on being employed	RAIS
Previous cohort Specific test - senior year*	Average of the previous cohort's ENADE senior year specific test scores	ENADE
*Quality Index**		
Major - Quality index	CPC quality index	INEP
*Current Cohort**		
Average General test - senior year	Average of the current cohort's ENADE senior year general test scores	ENADE
Average Specific test - senior year	Average of the current cohort's ENADE senior year specific test scores	ENADE
*Following Cohort**		
Following cohort General test - freshman year	Average of the following cohort's ENADE freshman year general test scores	ENADE

Source: Elaborated by authors.

(*) Variables are standardized by normal distribution, using mean and standard deviation of the students in the same HEI.

APPENDIX B – EFFECTS ON AFTER GRADUATION OUTCOMES

Table B.1: Probability of being employed in the formal sector, Sample A (1)

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6	(8) t7	(9) t8
IndividualScores									
General test - freshman year	-0.01072	-0.00088	-0.00055	-0.00330	-0.00652	-0.00706	-0.01351**	-0.00975	-0.00650
	[0.00680]	[0.00659]	[0.00656]	[0.00641]	[0.00646]	[0.00648]	[0.00661]	[0.00670]	[0.00680]
Specific test - freshman year	0.00972	0.01597**	0.02661***	0.03439***	0.02843***	0.02159***	0.02113***	0.02259***	0.02594***
	[0.00690]	[0.00669]	[0.00654]	[0.00647]	[0.00643]	[0.00653]	[0.00664]	[0.00677]	[0.00687]
General test - senior year	0.00313	-0.00162	-0.00443	-0.00633	-0.00741	-0.00356	-0.00259	0.00146	0.00220
	[0.00711]	[0.00692]	[0.00681]	[0.00672]	[0.00680]	[0.00690]	[0.00689]	[0.00696]	[0.00705]
Specific test - senior year	0.02264***	0.02564***	0.01774**	0.02741***	0.02432***	0.02651***	0.02582***	0.02493***	0.02828***
	[0.00772]	[0.00755]	[0.00751]	[0.00734]	[0.00738]	[0.00737]	[0.00744]	[0.00762]	[0.00779]
Signals									
QualityIndex									
Major - Quality index	-0.00814	0.01308	0.02698***	0.01942**	0.01868**	0.01220	0.01644**	0.02444***	0.02513***
	[0.00813]	[0.00820]	[0.00802]	[0.00817]	[0.00804]	[0.00805]	[0.00819]	[0.00848]	[0.00856]
PreviousCohort									
Previous cohort - percentage at formal sector	0.74041***	0.66932***	0.64304***	0.61894***	0.56917***	0.53247***	0.50151***	0.45319***	0.39741***
	[0.03303]	[0.03408]	[0.03400]	[0.03377]	[0.03373]	[0.03391]	[0.03450]	[0.03508]	[0.03561]
Previous cohort - Log Real Hourly Wage	-0.02493	-0.03688**	-0.03219**	-0.03585***	-0.00483	0.00248	0.01319	0.01114	0.01407
	[0.01562]	[0.01533]	[0.01373]	[0.01285]	[0.01415]	[0.01449]	[0.01503]	[0.01504]	[0.01528]
Previous cohort Specific test - senior year	-0.04211***	-0.03592***	-0.02009**	-0.02096***	-0.02621***	-0.02979***	-0.02419***	-0.02516***	-0.02570***
	[0.00848]	[0.00822]	[0.00785]	[0.00790]	[0.00783]	[0.00790]	[0.00798]	[0.00812]	[0.00834]
CurrentCohort									
Average General test - senior year	0.00831	0.00356	-0.00573	-0.00245	-0.00865	-0.00526	-0.01248	-0.01443*	-0.01253
	[0.00820]	[0.00808]	[0.00791]	[0.00800]	[0.00795]	[0.00794]	[0.00801]	[0.00823]	[0.00834]
Average Specific test - senior year	0.00940	-0.01885**	-0.02657***	-0.03101***	-0.02470***	-0.02340***	-0.03184***	-0.03333***	-0.04173***
	[0.00957]	[0.00936]	[0.00913]	[0.00911]	[0.00901]	[0.00903]	[0.00922]	[0.00950]	[0.00968]
FollowingCohort									
Following cohort General test - freshman year	-0.01329*	-0.01895***	-0.01154*	-0.00506	-0.00891	-0.00953	-0.01065	-0.00826	-0.00840
	[0.00711]	[0.00702]	[0.00687]	[0.00693]	[0.00694]	[0.00698]	[0.00698]	[0.00714]	[0.00732]
Constant	0.17080***	0.32716***	0.36489***	0.40517***	0.36448***	0.36829***	0.35214***	0.37231***	0.37772***
	[0.04787]	[0.04745]	[0.04405]	[0.04227]	[0.04441]	[0.04487]	[0.04595]	[0.04644]	[0.04719]
Observations	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010
Adjusted R-squared	0.15515	0.15078	0.14010	0.13670	0.12302	0.11018	0.10362	0.08765	0.07497
HEI dummies	NO	NO	NO	NO	NO	NO	NO	NO	NO
Group dummies	NO	NO	NO	NO	NO	NO	NO	NO	NO
Controls	NO	NO	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Probability of being employed in the formal sector, Sample A (2)

VARIABLES	(10) t0	(11) t1	(12) t2	(13) t3	(14) t4	(15) t5	(16) t6	(17) t7	(18) t8
IndividualScores									
General test - freshman year	-0.00661	0.00302	0.00258	-0.00041	-0.00448	-0.00518	-0.01141*	-0.00765	-0.00532
	[0.00682]	[0.00656]	[0.00660]	[0.00637]	[0.00641]	[0.00640]	[0.00653]	[0.00664]	[0.00674]
Specific test - freshman year	0.01176	0.00822	0.01631**	0.02271***	0.01707**	0.00741	0.00741	0.01213*	0.01924***
	[0.00746]	[0.00723]	[0.00705]	[0.00697]	[0.00692]	[0.00697]	[0.00703]	[0.00723]	[0.00742]
General test - senior year	0.00394	0.00098	-0.00141	-0.00294	-0.00374	0.00074	0.00187	0.00629	0.00528
	[0.00713]	[0.00691]	[0.00688]	[0.00678]	[0.00684]	[0.00689]	[0.00684]	[0.00696]	[0.00707]
Specific test - senior year	0.01614**	0.02198***	0.01806**	0.03066***	0.02734***	0.03115***	0.02957***	0.02722***	0.03055***
	[0.00791]	[0.00766]	[0.00767]	[0.00750]	[0.00747]	[0.00746]	[0.00755]	[0.00776]	[0.00795]
Signals									
QualityIndex									
Major - Quality index	-0.00546	0.00421	0.00242	-0.01097	-0.01593	-0.02623***	-0.02272**	-0.01365	-0.00820
	[0.01071]	[0.01071]	[0.01037]	[0.01034]	[0.01015]	[0.00999]	[0.01026]	[0.01060]	[0.01074]
PreviousCohort									
Previous cohort - percentage at formal sector	0.40175***	0.27754***	0.32628***	0.26447***	0.22380***	0.22314***	0.17127**	0.20005***	0.14643**
	[0.07662]	[0.07375]	[0.07341]	[0.07219]	[0.06984]	[0.07051]	[0.07133]	[0.07357]	[0.07415]
Previous cohort - Log Real Hourly Wage	0.00316	-0.01208	-0.01276	-0.01534	0.00927	0.02639	0.02309	0.02329	0.00704
	[0.02054]	[0.02087]	[0.01827]	[0.01680]	[0.01868]	[0.01911]	[0.01959]	[0.01990]	[0.01990]
Previous cohort Specific test - senior year	-0.00030	-0.00274	-0.00008	-0.00652	-0.00985	-0.02854**	-0.02757**	-0.02059*	-0.01667
	[0.01382]	[0.01279]	[0.01212]	[0.01206]	[0.01213]	[0.01187]	[0.01221]	[0.01236]	[0.01304]
CurrentCohort									
Average General test - senior year	0.01045	0.01193	0.00755	0.01131	0.00750	0.01773**	0.01169	0.00862	0.00225
	[0.00902]	[0.00884]	[0.00887]	[0.00885]	[0.00874]	[0.00878]	[0.00875]	[0.00905]	[0.00922]
Average Specific test - senior year	-0.02099	-0.03589**	-0.00953	0.00272	0.00880	0.01040	0.00256	-0.00720	-0.01010
	[0.01683]	[0.01619]	[0.01594]	[0.01579]	[0.01551]	[0.01524]	[0.01561]	[0.01621]	[0.01641]
FollowingCohort									
Following cohort General test - freshman year	-0.01072	-0.01439*	-0.01171	-0.00462	-0.00677	-0.00497	-0.00867	-0.00138	-0.00123
	[0.00777]	[0.00756]	[0.00748]	[0.00760]	[0.00761]	[0.00755]	[0.00761]	[0.00785]	[0.00804]
Constant	0.07402	0.41797***	0.31902**	0.31320**	0.44352***	0.46630***	0.34752***	0.38886***	0.51180***
	[0.13343]	[0.12468]	[0.13404]	[0.12445]	[0.12017]	[0.11712]	[0.11848]	[0.12646]	[0.12332]
Observations	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010	5,010
Adjusted R-squared	0.18076	0.17614	0.15336	0.15498	0.14590	0.13871	0.13787	0.11395	0.09729
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	NO	NO	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Probability of being employed in the formal sector, Sample A (3)

VARIABLES	(19) t0	(20) t1	(21) t2	(22) t3	(23) t4	(24) t5	(25) t6	(26) t7	(27) t8
IndividualScores									
General test - freshman year	0.00453	0.01415**	0.01415*	0.01074	0.00898	0.00791	-0.00119	0.00388	0.00345
	[0.00726]	[0.00707]	[0.00731]	[0.00702]	[0.00705]	[0.00712]	[0.00733]	[0.00746]	[0.00758]
Specific test - freshman year	0.01191	0.01418*	0.01893**	0.02434***	0.01760**	0.01083	0.00856	0.01288	0.02219***
	[0.00788]	[0.00783]	[0.00758]	[0.00753]	[0.00754]	[0.00762]	[0.00790]	[0.00815]	[0.00827]
General test - senior year	0.00955	0.00028	-0.00658	-0.00797	-0.01111	-0.00532	-0.00192	0.00112	0.00187
	[0.00747]	[0.00753]	[0.00750]	[0.00746]	[0.00759]	[0.00761]	[0.00757]	[0.00773]	[0.00783]
Specific test - senior year	0.00682	0.01193	0.00770	0.02454***	0.02413***	0.02638***	0.02798***	0.02657***	0.03015***
	[0.00817]	[0.00823]	[0.00818]	[0.00816]	[0.00812]	[0.00824]	[0.00849]	[0.00874]	[0.00879]
Signals									
QualityIndex									
Major - Quality index	-0.00954	-0.00042	-0.00781	-0.01128	-0.01889	-0.02682**	-0.02249*	-0.01850	-0.01952
	[0.01252]	[0.01274]	[0.01231]	[0.01232]	[0.01221]	[0.01195]	[0.01231]	[0.01294]	[0.01299]
PreviousCohort									
Previous cohort - percentage at formal sector	0.33772***	0.19121**	0.22796***	0.20667***	0.17212**	0.21759***	0.16584**	0.18601**	0.10065
	[0.08392]	[0.08310]	[0.08119]	[0.07947]	[0.07791]	[0.07971]	[0.08052]	[0.08240]	[0.08259]
Previous cohort - Log Real Hourly Wage	0.00704	-0.01176	-0.01361	-0.03022*	0.00739	0.01860	0.01808	0.02602	0.00577
	[0.02079]	[0.02207]	[0.01908]	[0.01790]	[0.02051]	[0.02078]	[0.02127]	[0.02187]	[0.02204]
Previous cohort Specific test - senior year	0.01091	0.01354	0.00852	-0.00149	-0.01074	-0.02422*	-0.01849	-0.01432	-0.01438
	[0.01380]	[0.01406]	[0.01352]	[0.01355]	[0.01392]	[0.01338]	[0.01382]	[0.01403]	[0.01433]
CurrentCohort									
Average General test - senior year	0.00189	0.00287	0.00163	0.00532	-0.00005	0.01185	0.00835	0.00654	0.00123
	[0.00960]	[0.00965]	[0.00968]	[0.00977]	[0.00966]	[0.00987]	[0.00983]	[0.01017]	[0.01026]
Average Specific test - senior year	-0.00634	-0.01147	0.01586	0.00890	0.02870	0.02868	0.01108	0.00278	0.01056
	[0.02061]	[0.02030]	[0.01969]	[0.01982]	[0.01993]	[0.01965]	[0.02008]	[0.02073]	[0.02104]
FollowingCohort									
Following cohort General test - freshman year	0.00376	-0.00747	0.00456	0.00708	0.00425	0.00329	-0.00281	0.00085	0.00205
	[0.00806]	[0.00790]	[0.00787]	[0.00802]	[0.00815]	[0.00811]	[0.00821]	[0.00850]	[0.00871]
Constant	0.07247	0.05298	0.37356**	0.33015**	0.45169***	0.46235***	0.32447**	0.39695***	0.38945***
	[0.14315]	[0.15329]	[0.14853]	[0.13895]	[0.13955]	[0.13787]	[0.13360]	[0.13749]	[0.13468]
Observations	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925
Adjusted R-squared	0.29674	0.24717	0.23440	0.21853	0.20635	0.18853	0.17711	0.15299	0.13809
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table B.2: Probability of being employed in the formal sector, Sample B (1)

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6
IndividualScores							
General test - freshman year	0.00218	0.00077	-0.00016	0.00121	0.00132	0.00364	0.00662**
	[0.00317]	[0.00293]	[0.00281]	[0.00276]	[0.00277]	[0.00287]	[0.00298]
Specific test - freshman year	0.00956***	0.01076***	0.00978***	0.01179***	0.00538*	0.00638**	0.00576*
	[0.00327]	[0.00300]	[0.00291]	[0.00284]	[0.00288]	[0.00297]	[0.00308]
General test - high school senior	-0.00602*	-0.00301	-0.00618**	-0.00474*	0.00142	0.00244	0.00662**
	[0.00322]	[0.00299]	[0.00285]	[0.00280]	[0.00282]	[0.00288]	[0.00297]
Signals							
QualityIndex							
Major - Quality index	0.00508	0.00126	0.00598*	0.00864***	0.00895***	0.01004***	0.01049***
	[0.00357]	[0.00330]	[0.00319]	[0.00316]	[0.00324]	[0.00331]	[0.00343]
PreviousCohort							
Previous cohort - percentage at formal sector	0.80801***	0.57698***	0.45618***	0.39855***	0.36011***	0.29807***	0.30219***
	[0.02040]	[0.01989]	[0.01928]	[0.01874]	[0.01886]	[0.01876]	[0.01940]
Previous cohort - Log Real Hourly Wage	-0.02839***	-0.01792***	-0.01856***	-0.01323**	-0.00322	-0.00496	-0.00923
	[0.00730]	[0.00677]	[0.00647]	[0.00625]	[0.00626]	[0.00631]	[0.00660]
Previous cohort Specific test - senior year	-0.00091	0.00474	0.00795**	0.00347	0.00304	0.00195	0.00157
	[0.00354]	[0.00327]	[0.00311]	[0.00304]	[0.00305]	[0.00312]	[0.00324]
CurrentCohort							
Average General test - senior year	0.00040	0.00185	-0.00243	-0.00602*	-0.00946***	-0.00925***	-0.00942**
	[0.00388]	[0.00355]	[0.00344]	[0.00334]	[0.00341]	[0.00354]	[0.00366]
Average Specific test - senior year	-0.02388***	-0.01973***	-0.01508***	-0.00841**	-0.00315	-0.00238	-0.00097
	[0.00395]	[0.00362]	[0.00348]	[0.00338]	[0.00343]	[0.00348]	[0.00364]
FollowingCohort							
Following cohort General test - freshman year	-0.00453	-0.00605*	-0.00391	-0.00166	-0.00015	0.00210	0.00311
	[0.00336]	[0.00310]	[0.00300]	[0.00290]	[0.00296]	[0.00306]	[0.00316]
Constant	0.22968***	0.43321***	0.54360***	0.57923***	0.57777***	0.61610***	0.60454***
	[0.02592]	[0.02458]	[0.02347]	[0.02282]	[0.02299]	[0.02306]	[0.02401]
Observations	21,555	21,555	21,555	21,555	21,555	21,555	21,555
Adjusted R-squared	0.09241	0.05753	0.03975	0.03084	0.02321	0.01548	0.01504
HEI dummies	NO	NO	NO	NO	NO	NO	NO
Group dummies	NO	NO	NO	NO	NO	NO	NO
Controls	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Probability of being employed in the formal sector, Sample B (2)

VARIABLES	(8) t0	(9) t1	(10) t2	(11) t3	(12) t4	(13) t5	(14) t6
IndividualScores							
General test - freshman year	0.00098	0.00047	-0.00021	0.00068	0.00043	0.00288	0.00576*
	[0.00311]	[0.00293]	[0.00283]	[0.00281]	[0.00282]	[0.00292]	[0.00301]
Specific test - freshman year	0.00220	0.00593*	0.00710**	0.01299***	0.00661**	0.00571*	0.00736**
	[0.00345]	[0.00323]	[0.00318]	[0.00313]	[0.00317]	[0.00326]	[0.00339]
General test - high school senior	-0.00075	-0.00038	-0.00475	-0.00365	0.00291	0.00538*	0.00927***
	[0.00324]	[0.00306]	[0.00293]	[0.00289]	[0.00290]	[0.00299]	[0.00308]
Signals							
QualityIndex							
Major - Quality index	0.00152	0.00018	0.00570	0.00602	0.00587	0.00733*	0.00697*
	[0.00421]	[0.00395]	[0.00383]	[0.00384]	[0.00389]	[0.00397]	[0.00413]
PreviousCohort							
Previous cohort - percentage at formal sector	0.27308***	0.21762***	0.20276***	0.19209***	0.17114***	0.13663***	0.14524***
	[0.03801]	[0.03641]	[0.03527]	[0.03458]	[0.03416]	[0.03428]	[0.03500]
Previous cohort - Log Real Hourly Wage	0.00998	-0.00499	-0.02101*	-0.01778*	-0.00276	0.00440	-0.00085
	[0.01190]	[0.01141]	[0.01100]	[0.01066]	[0.01054]	[0.01064]	[0.01112]
Previous cohort Specific test - senior year	0.00634	0.00244	0.00231	0.00351	0.00381	0.00182	0.00094
	[0.00454]	[0.00431]	[0.00413]	[0.00409]	[0.00415]	[0.00417]	[0.00432]
CurrentCohort							
Average General test - senior year	-0.00013	0.00388	-0.00053	-0.00280	-0.00889**	-0.00542	-0.00422
	[0.00434]	[0.00408]	[0.00394]	[0.00387]	[0.00390]	[0.00407]	[0.00417]
Average Specific test - senior year	-0.01778**	-0.02040***	-0.01669**	-0.00741	0.00205	0.00128	-0.00049
	[0.00706]	[0.00678]	[0.00652]	[0.00642]	[0.00644]	[0.00653]	[0.00678]
FollowingCohort							
Following cohort General test - freshman year	-0.00538	-0.00788**	-0.00554*	-0.00159	0.00025	0.00030	0.00175
	[0.00345]	[0.00327]	[0.00319]	[0.00310]	[0.00317]	[0.00327]	[0.00337]
Constant	0.50997***	0.66486***	0.75553***	0.77750***	0.69531***	0.71014***	0.77009***
	[0.06227]	[0.06022]	[0.05636]	[0.05476]	[0.05635]	[0.05462]	[0.05085]
Observations	21,555	21,555	21,555	21,555	21,555	21,555	21,555
Adjusted R-squared	0.15636	0.09032	0.05750	0.03753	0.02931	0.02140	0.02541
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Probability of being employed in the formal sector, Sample B (3)

VARIABLES	(15) t0	(16) t1	(17) t2	(18) t3	(19) t4	(20) t5	(21) t6
IndividualScores							
General test - freshman year	0.00227	0.00028	-0.00333	-0.00291	-0.00009	0.00330	0.00578
	[0.00352]	[0.00354]	[0.00344]	[0.00346]	[0.00348]	[0.00366]	[0.00380]
Specific test - freshman year	0.00218	0.00933**	0.00908**	0.01754***	0.00793**	0.00440	0.00503
	[0.00391]	[0.00387]	[0.00386]	[0.00387]	[0.00392]	[0.00408]	[0.00424]
General test - high school senior	0.00561	0.00483	0.00028	0.00144	0.00701*	0.01194***	0.01489***
	[0.00374]	[0.00375]	[0.00366]	[0.00365]	[0.00370]	[0.00388]	[0.00399]
Signals							
QualityIndex							
Major - Quality index	0.00186	-0.00484	0.00128	0.00500	0.00262	0.00710	0.00472
	[0.00522]	[0.00511]	[0.00515]	[0.00523]	[0.00523]	[0.00540]	[0.00570]
PreviousCohort							
Previous cohort - percentage at formal sector	0.22907***	0.15887***	0.15538***	0.12536***	0.11410***	0.12578***	0.12228***
	[0.04573]	[0.04555]	[0.04474]	[0.04452]	[0.04375]	[0.04489]	[0.04637]
Previous cohort - Log Real Hourly Wage	0.00417	0.00493	-0.02101	-0.01893	-0.01031	-0.00239	0.00702
	[0.01339]	[0.01376]	[0.01359]	[0.01312]	[0.01297]	[0.01311]	[0.01406]
Previous cohort Specific test - senior year	0.00409	0.00100	-0.00081	0.00057	0.00465	-0.00135	-0.00228
	[0.00528]	[0.00529]	[0.00512]	[0.00511]	[0.00524]	[0.00537]	[0.00560]
CurrentCohort							
Average General test - senior year	0.00098	0.00614	0.00008	-0.00539	-0.01101**	-0.01122**	-0.00831
	[0.00502]	[0.00496]	[0.00494]	[0.00485]	[0.00489]	[0.00516]	[0.00537]
Average Specific test - senior year	-0.02159**	-0.01802**	-0.00966	-0.00231	0.00737	0.00789	0.00562
	[0.00855]	[0.00852]	[0.00861]	[0.00845]	[0.00854]	[0.00885]	[0.00933]
FollowingCohort							
Following cohort General test - freshman year	0.00214	-0.00480	0.00100	0.00339	0.00706*	0.00608	0.00454
	[0.00405]	[0.00402]	[0.00399]	[0.00389]	[0.00399]	[0.00417]	[0.00429]
Constant	0.20817**	0.39855***	0.61169***	0.73982***	0.75694***	0.75017***	0.72035***
	[0.09763]	[0.09715]	[0.10037]	[0.08392]	[0.08366]	[0.07107]	[0.07582]
Observations	13,839	13,839	13,839	13,839	13,839	13,839	13,839
Adjusted R-squared	0.28444	0.12801	0.07073	0.04353	0.02944	0.02435	0.02710
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table B.3: Log Hourly Wage, Sample A (1)

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6	(8) t7	(9) t8
IndividualScores									
General test - freshman year	0.01951	0.02758**	0.02142*	0.02474**	0.01965	0.01468	0.03523***	0.04494***	0.05253***
	[0.01419]	[0.01333]	[0.01259]	[0.01254]	[0.01235]	[0.01313]	[0.01267]	[0.01303]	[0.01294]
Specific test - freshman year	0.01519	0.01174	0.03929***	0.02092	0.03582***	0.02018	0.02048	0.03499**	0.03268**
	[0.01468]	[0.01435]	[0.01320]	[0.01312]	[0.01304]	[0.01323]	[0.01356]	[0.01447]	[0.01410]
General test - senior year	0.03509**	0.03231**	0.04174***	0.03305***	0.03067**	0.05389***	0.04875***	0.03974***	0.04068***
	[0.01481]	[0.01357]	[0.01337]	[0.01277]	[0.01313]	[0.01322]	[0.01332]	[0.01403]	[0.01370]
Specific test - senior year	0.03655**	0.03168**	0.02679*	0.05482***	0.05327***	0.04943***	0.03618**	0.05103***	0.04027***
	[0.01681]	[0.01536]	[0.01506]	[0.01419]	[0.01408]	[0.01453]	[0.01455]	[0.01570]	[0.01530]
Signals									
QualityIndex									
Major - Quality index	-0.02750	-0.02832*	-0.03007*	-0.01824	-0.00246	-0.00546	-0.01005	-0.01385	0.00717
	[0.01681]	[0.01660]	[0.01629]	[0.01608]	[0.01547]	[0.01562]	[0.01591]	[0.01676]	[0.01613]
PreviousCohort									
Previous cohort - percentage at formal sector	0.11011	0.13980*	0.05913	0.07684	0.07121	0.01608	0.05189	0.08456	-0.01688
	[0.08524]	[0.08081]	[0.07100]	[0.06610]	[0.07112]	[0.06775]	[0.06706]	[0.07263]	[0.07114]
Previous cohort - Log Real Hourly Wage	0.33461***	0.33896***	0.38901***	0.35824***	0.31871***	0.30609***	0.32625***	0.35317***	0.30294***
	[0.04909]	[0.05525]	[0.04242]	[0.03887]	[0.03584]	[0.03688]	[0.03610]	[0.03860]	[0.03699]
Previous cohort Specific test - senior year	0.00437	0.02795	0.02077	0.04955***	0.05910***	0.04396***	0.04085**	0.04320***	0.03360**
	[0.01785]	[0.01752]	[0.01595]	[0.01580]	[0.01619]	[0.01569]	[0.01589]	[0.01666]	[0.01644]
CurrentCohort									
Average General test - senior year	0.02272	0.03769**	0.03459**	0.03098**	0.01511	0.01737	0.02279	0.03356**	0.01592
	[0.01605]	[0.01600]	[0.01601]	[0.01554]	[0.01488]	[0.01538]	[0.01548]	[0.01602]	[0.01552]
Average Specific test - senior year	-0.08383***	-0.08628***	-0.07638***	-0.08622***	-0.07944***	-0.07384***	-0.05578***	-0.07958***	-0.08470***
	[0.01871]	[0.01866]	[0.01784]	[0.01785]	[0.01734]	[0.01723]	[0.01756]	[0.01871]	[0.01854]
FollowingCohort									
Following cohort General test - freshman year	-0.00704	-0.01168	-0.01100	-0.01303	-0.00666	-0.01523	0.00519	0.00381	0.01172
	[0.01525]	[0.01507]	[0.01464]	[0.01467]	[0.01384]	[0.01399]	[0.01383]	[0.01461]	[0.01406]
Constant	1.48541***	1.58735***	1.59668***	1.75486***	1.92113***	2.08162***	2.06458***	1.96950***	2.19285***
	[0.13223]	[0.14140]	[0.11757]	[0.11147]	[0.10255]	[0.10625]	[0.10485]	[0.11455]	[0.11278]
Observations	2,255	2,615	2,806	2,952	3,036	3,036	3,021	2,960	2,869
Adjusted R-squared	0.07591	0.07426	0.08127	0.07599	0.06487	0.05925	0.05972	0.07014	0.06323
HEI dummies	NO	NO	NO	NO	NO	NO	NO	NO	NO
Group dummies	NO	NO	NO	NO	NO	NO	NO	NO	NO
Controls	NO	NO	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Log Hourly Wage, Sample A (2)

VARIABLES	(10) t0	(11) t1	(12) t2	(13) t3	(14) t4	(15) t5	(16) t6	(17) t7	(18) t8
IndividualScores									
General test - freshman year	0.01246	0.02474*	0.01272	0.01702	0.00913	0.00541	0.02878**	0.03834***	0.04704***
	[0.01387]	[0.01296]	[0.01231]	[0.01206]	[0.01211]	[0.01278]	[0.01242]	[0.01282]	[0.01252]
Specific test - freshman year	0.01966	0.02338	0.05770***	0.03920***	0.04881***	0.03719***	0.03966***	0.04364***	0.03982***
	[0.01551]	[0.01476]	[0.01367]	[0.01378]	[0.01364]	[0.01377]	[0.01401]	[0.01527]	[0.01451]
General test - senior year	0.02652*	0.02459*	0.02562*	0.02280*	0.01933	0.04237***	0.03625***	0.02715**	0.02960**
	[0.01469]	[0.01329]	[0.01341]	[0.01247]	[0.01290]	[0.01285]	[0.01298]	[0.01362]	[0.01295]
Specific test - senior year	0.05383***	0.04274***	0.04576***	0.07320***	0.07396***	0.05983***	0.05118***	0.07108***	0.05563***
	[0.01669]	[0.01506]	[0.01473]	[0.01404]	[0.01398]	[0.01464]	[0.01453]	[0.01549]	[0.01508]
Signals									
QualityIndex									
Major - Quality index	0.00393	-0.01835	-0.01740	-0.01229	-0.00912	-0.00456	-0.01306	-0.01333	0.01158
	[0.02166]	[0.02114]	[0.01927]	[0.02027]	[0.01936]	[0.01987]	[0.01981]	[0.02080]	[0.02013]
PreviousCohort									
Previous cohort - percentage at formal sector	0.26899*	0.39664***	0.25861*	0.27813**	0.26866**	0.23307*	0.21458*	0.07956	-0.01270
	[0.15605]	[0.14845]	[0.13360]	[0.12089]	[0.12611]	[0.12782]	[0.12926]	[0.13899]	[0.13512]
Previous cohort - Log Real Hourly Wage	0.09577	0.02429	0.08184	0.04046	0.01048	-0.02121	-0.01440	-0.01757	0.01580
	[0.06625]	[0.07941]	[0.05892]	[0.05030]	[0.04829]	[0.04899]	[0.04560]	[0.05273]	[0.04935]
Previous cohort Specific test - senior year	-0.04358	-0.00556	-0.00775	0.02005	0.02052	0.03232	-0.00221	-0.00441	-0.01265
	[0.02786]	[0.02546]	[0.02434]	[0.02335]	[0.02420]	[0.02425]	[0.02540]	[0.02693]	[0.02675]
CurrentCohort									
Average General test - senior year	-0.03041	-0.00268	-0.01780	-0.00625	-0.02282	-0.02398	-0.01181	-0.00408	-0.02575
	[0.01854]	[0.01845]	[0.01722]	[0.01648]	[0.01649]	[0.01686]	[0.01680]	[0.01742]	[0.01642]
Average Specific test - senior year	-0.02951	-0.01539	0.00097	-0.01084	0.02759	0.02887	0.05181*	0.01731	0.02148
	[0.03426]	[0.03324]	[0.03034]	[0.03012]	[0.02957]	[0.02901]	[0.03004]	[0.03261]	[0.03242]
FollowingCohort									
Following cohort General test - freshman year	-0.01115	-0.02315	-0.01739	-0.01619	-0.01066	-0.02150	-0.00473	-0.00411	0.00927
	[0.01685]	[0.01684]	[0.01616]	[0.01646]	[0.01552]	[0.01559]	[0.01551]	[0.01542]	[0.01509]
Constant	1.88028***	2.56741***	2.60166***	3.37031***	3.48042***	3.69710***	3.47305***	3.57864***	3.31774***
	[0.38928]	[0.37266]	[0.31630]	[0.24563]	[0.37616]	[0.33220]	[0.25146]	[0.32851]	[0.29429]
Observations	2,255	2,615	2,806	2,952	3,036	3,036	3,021	2,960	2,869
Adjusted R-squared	0.15614	0.16204	0.16286	0.17399	0.16311	0.15547	0.16471	0.16689	0.17265
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	NO	NO	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Log Hourly Wage, Sample A (3)

VARIABLES	(19) t0	(20) t1	(21) t2	(22) t3	(23) t4	(24) t5	(25) t6	(26) t7	(27) t8
IndividualScores									
General test - freshman year	0.00895	0.02697**	0.01632	0.02463*	0.01797	0.00804	0.04289***	0.04018***	0.04201***
	[0.01403]	[0.01347]	[0.01230]	[0.01262]	[0.01251]	[0.01367]	[0.01337]	[0.01377]	[0.01393]
Specific test - freshman year	0.00204	0.00902	0.03745***	0.02663*	0.02159	0.01068	0.01274	0.02380	0.01486
	[0.01586]	[0.01521]	[0.01405]	[0.01448]	[0.01415]	[0.01468]	[0.01529]	[0.01589]	[0.01564]
General test - senior year	0.01919	0.01703	0.01459	0.01363	0.01278	0.03913***	0.02349*	0.01206	0.01601
	[0.01450]	[0.01388]	[0.01314]	[0.01297]	[0.01306]	[0.01431]	[0.01397]	[0.01398]	[0.01361]
Specific test - senior year	0.04050**	0.02542	0.04337***	0.05997***	0.06071***	0.04754***	0.04441***	0.05545***	0.05013***
	[0.01701]	[0.01559]	[0.01464]	[0.01432]	[0.01434]	[0.01571]	[0.01578]	[0.01656]	[0.01685]
Signals									
QualityIndex									
Major - Quality index	-0.00551	-0.02718	-0.03641	-0.00240	-0.00854	-0.05265**	-0.02384	-0.02448	-0.02405
	[0.02608]	[0.02457]	[0.02355]	[0.02397]	[0.02290]	[0.02566]	[0.02414]	[0.02501]	[0.02621]
PreviousCohort									
Previous cohort - percentage at formal sector	0.23976	0.44295***	0.37913***	0.40953***	0.38987***	0.36635**	0.32010**	0.22629	0.26295*
	[0.16396]	[0.16583]	[0.14551]	[0.13330]	[0.13313]	[0.14375]	[0.13911]	[0.14567]	[0.14362]
Previous cohort - Log Real Hourly Wage	0.02928	-0.00509	0.03717	0.01074	0.04237	0.03880	-0.00880	-0.01396	0.04123
	[0.06134]	[0.08005]	[0.05929]	[0.05231]	[0.04930]	[0.05034]	[0.05313]	[0.06083]	[0.05087]
Previous cohort Specific test - senior year	-0.09698***	-0.01769	-0.00199	0.02194	0.00938	0.04027	-0.00168	0.01415	-0.02729
	[0.03094]	[0.02823]	[0.02676]	[0.02708]	[0.02697]	[0.02809]	[0.02906]	[0.02848]	[0.02963]
CurrentCohort									
Average General test - senior year	-0.00805	0.01417	-0.02253	-0.00414	0.00230	-0.01495	-0.01041	-0.01459	-0.01602
	[0.01919]	[0.01993]	[0.01839]	[0.01748]	[0.01739]	[0.01865]	[0.01800]	[0.01920]	[0.01784]
Average Specific test - senior year	-0.02898	0.00685	0.04106	-0.01792	-0.00302	0.08601**	0.04165	0.04189	0.07041
	[0.04261]	[0.04220]	[0.03938]	[0.03945]	[0.03730]	[0.04161]	[0.03822]	[0.04348]	[0.04606]
FollowingCohort									
Following cohort General test - freshman year	-0.01085	-0.03430*	-0.01539	-0.01678	-0.00989	-0.02126	0.00851	-0.00256	0.00539
	[0.01741]	[0.01789]	[0.01684]	[0.01704]	[0.01641]	[0.01622]	[0.01630]	[0.01653]	[0.01630]
Constant	2.44665***	2.78523***	3.05320***	3.54740***	3.95437***	3.81281***	3.51238***	3.75988***	2.57487***
	[0.32653]	[0.47398]	[0.39688]	[0.30878]	[0.46327]	[0.59248]	[0.39045]	[0.79944]	[0.36302]
Observations	1,770	1,974	2,160	2,259	2,257	2,141	2,244	2,201	2,039
Adjusted R-squared	0.31613	0.30247	0.32177	0.30693	0.30759	0.28384	0.27494	0.27190	0.28954
HEI dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Table B.4: Log Hourly Wage, Sample B (1)

VARIABLES	(1) t0	(2) t1	(3) t2	(4) t3	(5) t4	(6) t5	(7) t6
IndividualScores							
General test - freshman year	0.02325***	0.02362***	0.02040***	0.02604***	0.02422***	0.02412***	0.02179***
	[0.00567]	[0.00562]	[0.00578]	[0.00584]	[0.00593]	[0.00600]	[0.00614]
Specific test - freshman year	0.04305***	0.04754***	0.04841***	0.04205***	0.04753***	0.03969***	0.04734***
	[0.00584]	[0.00583]	[0.00598]	[0.00600]	[0.00596]	[0.00617]	[0.00634]
General test - high school senior	0.06468***	0.07744***	0.08682***	0.10486***	0.10364***	0.10714***	0.11197***
	[0.00589]	[0.00583]	[0.00603]	[0.00598]	[0.00589]	[0.00622]	[0.00636]
Signals							
QualityIndex							
Major - Quality index	0.00075	0.01772***	0.01748***	0.01296**	0.01791***	0.01984***	0.02728***
	[0.00639]	[0.00624]	[0.00652]	[0.00650]	[0.00657]	[0.00689]	[0.00701]
PreviousCohort							
Previous cohort - percentage at formal sector	0.28583***	0.25874***	0.17801***	0.04064	-0.01978	-0.01558	-0.09395**
	[0.04214]	[0.03993]	[0.03976]	[0.03821]	[0.03882]	[0.03940]	[0.04113]
Previous cohort - Log Real Hourly Wage	0.38446***	0.39041***	0.38599***	0.40522***	0.37299***	0.38527***	0.38701***
	[0.01469]	[0.01396]	[0.01397]	[0.01369]	[0.01325]	[0.01394]	[0.01434]
Previous cohort Specific test - senior year	-0.00857	-0.00620	-0.00582	-0.01318**	-0.00950	-0.00923	-0.01728**
	[0.00631]	[0.00617]	[0.00645]	[0.00632]	[0.00641]	[0.00647]	[0.00672]
CurrentCohort							
Average General test - senior year	0.00652	-0.02007***	-0.01138	-0.01702**	-0.02744***	-0.02536***	-0.02888***
	[0.00689]	[0.00697]	[0.00723]	[0.00702]	[0.00711]	[0.00741]	[0.00764]
Average Specific test - senior year	-0.01037	-0.01540**	-0.01896**	-0.01301*	-0.01287*	-0.01042	-0.00940
	[0.00721]	[0.00711]	[0.00747]	[0.00715]	[0.00710]	[0.00742]	[0.00756]
FollowingCohort							
Following cohort General test - freshman year	-0.00114	0.00099	-0.00435	0.00283	0.00385	0.00287	-0.00800
	[0.00596]	[0.00601]	[0.00612]	[0.00602]	[0.00607]	[0.00636]	[0.00654]
Constant	1.00547***	1.16031***	1.36597***	1.53534***	1.75414***	1.77053***	1.84801***
	[0.05090]	[0.04904]	[0.04883]	[0.04772]	[0.04699]	[0.04933]	[0.05077]
Observations	13,277	14,675	15,285	15,603	15,716	15,528	15,117
Adjusted R-squared	0.09055	0.09361	0.08776	0.10126	0.09212	0.09121	0.09468
HEI dummies	NO	NO	NO	NO	NO	NO	NO
Group dummies	NO	NO	NO	NO	NO	NO	NO
Controls	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Log Hourly Wage, Sample B (2)

VARIABLES	(8) t0	(9) t1	(10) t2	(11) t3	(12) t4	(13) t5	(14) t6
IndividualScores							
General test - freshman year	0.02063***	0.02389***	0.02281***	0.02710***	0.02369***	0.02496***	0.02176***
	[0.00553]	[0.00556]	[0.00567]	[0.00574]	[0.00582]	[0.00585]	[0.00600]
Specific test - freshman year	0.04651***	0.05389***	0.05545***	0.05165***	0.06396***	0.06063***	0.06989***
	[0.00624]	[0.00622]	[0.00640]	[0.00639]	[0.00627]	[0.00652]	[0.00663]
General test - high school senior	0.06794***	0.07738***	0.08759***	0.10654***	0.10491***	0.10756***	0.11145***
	[0.00591]	[0.00590]	[0.00602]	[0.00601]	[0.00586]	[0.00616]	[0.00631]
Signals							
QualityIndex							
Major - Quality index	0.00125	0.01542**	0.01155	0.00417	0.00831	0.00761	0.01086
	[0.00751]	[0.00744]	[0.00751]	[0.00774]	[0.00759]	[0.00787]	[0.00807]
PreviousCohort							
Previous cohort - percentage at formal sector	0.07203	0.19596***	0.11954*	0.14728**	0.10533	0.14422**	0.11472*
	[0.07568]	[0.07106]	[0.07201]	[0.06794]	[0.06707]	[0.06705]	[0.06941]
Previous cohort - Log Real Hourly Wage	0.11003***	0.12141***	0.11295***	0.14220***	0.09878***	0.11666***	0.11867***
	[0.02298]	[0.02218]	[0.02206]	[0.02190]	[0.02130]	[0.02251]	[0.02307]
Previous cohort Specific test - senior year	0.01087	0.01646**	0.00530	0.00121	0.00539	0.01016	0.00335
	[0.00811]	[0.00807]	[0.00838]	[0.00804]	[0.00836]	[0.00840]	[0.00874]
CurrentCohort							
Average General test - senior year	0.01014	-0.01164	0.00460	-0.00228	-0.01364*	-0.01004	-0.00635
	[0.00760]	[0.00761]	[0.00795]	[0.00794]	[0.00796]	[0.00829]	[0.00854]
Average Specific test - senior year	-0.01234	-0.01729	-0.02551*	-0.00247	-0.00028	-0.00325	0.00217
	[0.01315]	[0.01279]	[0.01343]	[0.01311]	[0.01287]	[0.01345]	[0.01403]
FollowingCohort							
Following cohort General test - freshman year	-0.00239	0.00178	-0.00217	0.00725	0.00845	0.00893	-0.00177
	[0.00611]	[0.00622]	[0.00627]	[0.00623]	[0.00628]	[0.00661]	[0.00677]
Constant	1.86392***	2.02306***	2.24813***	2.25187***	2.59930***	2.61161***	2.58429***
	[0.11646]	[0.12058]	[0.11444]	[0.10848]	[0.11218]	[0.12157]	[0.11641]
Observations	13,277	14,675	15,285	15,603	15,716	15,528	15,117
Adjusted R-squared	0.16988	0.16775	0.16781	0.17251	0.17419	0.18133	0.18649
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	NO	NO	NO	NO	NO	NO	NO

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Log Hourly Wage, Sample B (3)

VARIABLES	(15) t0	(16) t1	(17) t2	(18) t3	(19) t4	(20) t5	(21) t6
IndividualScores							
General test - freshman year	0.01999***	0.01007	0.01146*	0.01025	0.00161	0.00722	0.00732
	[0.00607]	[0.00613]	[0.00631]	[0.00635]	[0.00648]	[0.00667]	[0.00687]
Specific test - freshman year	0.03729***	0.04030***	0.04435***	0.03769***	0.05211***	0.04718***	0.05356***
	[0.00692]	[0.00683]	[0.00721]	[0.00713]	[0.00705]	[0.00734]	[0.00755]
General test - high school senior	0.03889***	0.05760***	0.05755***	0.07468***	0.07450***	0.07877***	0.09020***
	[0.00670]	[0.00670]	[0.00688]	[0.00684]	[0.00681]	[0.00725]	[0.00743]
Signals							
QualityIndex							
Major - Quality index	0.02694***	0.02653***	0.02795***	0.02510***	0.02204**	0.01877*	0.01646
	[0.00926]	[0.00917]	[0.00930]	[0.00968]	[0.00947]	[0.00989]	[0.01048]
PreviousCohort							
Previous cohort - percentage at formal sector	0.10297	0.11473	0.09573	0.12732	0.15869**	0.10686	0.10714
	[0.08647]	[0.08389]	[0.08475]	[0.08009]	[0.07876]	[0.07938]	[0.08296]
Previous cohort - Log Real Hourly Wage	0.05583**	0.07876***	0.05849**	0.11527***	0.07449***	0.08931***	0.09515***
	[0.02516]	[0.02434]	[0.02455]	[0.02388]	[0.02380]	[0.02483]	[0.02531]
Previous cohort Specific test - senior year	0.00972	0.01686*	0.00534	-0.00276	0.00870	0.00681	-0.00120
	[0.00945]	[0.00912]	[0.00948]	[0.00910]	[0.00965]	[0.00967]	[0.01013]
CurrentCohort							
Average General test - senior year	-0.00637	-0.02178**	-0.00872	-0.00712	-0.00985	-0.01071	-0.00550
	[0.00873]	[0.00878]	[0.00897]	[0.00890]	[0.00907]	[0.00942]	[0.00981]
Average Specific test - senior year	-0.03129**	-0.03077**	-0.02148	-0.01965	-0.02311	-0.01637	-0.00836
	[0.01539]	[0.01551]	[0.01544]	[0.01537]	[0.01522]	[0.01590]	[0.01686]
FollowingCohort							
Following cohort General test - freshman year	0.00502	0.01113	-0.00153	0.00692	0.00626	0.00702	-0.00931
	[0.00699]	[0.00718]	[0.00724]	[0.00705]	[0.00714]	[0.00744]	[0.00772]
Constant	2.42806***	2.17476***	2.65450***	2.36767***	2.44882***	2.68471***	2.51686***
	[0.27316]	[0.14054]	[0.28050]	[0.13828]	[0.13590]	[0.13672]	[0.15897]
Observations	8,777	9,620	9,944	10,135	10,200	10,016	9,694
Adjusted R-squared	0.33333	0.32853	0.31983	0.33098	0.32343	0.30454	0.29414
HEI dummies	YES	YES	YES	YES	YES	YES	YES
Group dummies	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.10$

Annex

ANNEX A – QUESTIONNAIRE WITH STUDENTS - 2014

PESQUISA DE OPINIÃO DO JOVEM

(Preencha totalmente o quadrado da opção escolhida em cada questão – Ex: ■)

Olá jovem,

Convidamos você para responder uma pesquisa de opinião sobre a ação, feita com voluntários em sua sala de aula.

O questionário não possui respostas certas ou erradas. Você deve preenchê-lo com a sua opinião, de forma individual e sincera. Você não precisa colocar o seu nome no questionário.

Obrigado!

1. Escola:_____ **2. Série:** 1ª☐ 2ª☐ 3ª☐ **3. Turma:** _____

4. Sexo: A ☐ Masculino B ☐ Feminino

5. Idade: _____ anos

6. Tem filhos?
A ☐ Não B ☐ Sim. Quantos? 1☐ 2☐ 3ou+☐

7. É casado(a)/mora junto com companheiro(a)?
A ☐ Não B ☐ Sim

8. Você trabalha atualmente?
A ☐ Não, nunca trabalhei
B ☐ Não, mas já trabalhei.
C ☐ Sim. **Responda esse bloco apenas se trabalha** ➡

9. Frequência do trabalho:
A ☐ Eventual, são bicos
B ☐ De 1 a 3 dias por semana
C ☐ 4 ou mais dias por semana

10. Qual o principal motivo para trabalhar?
A ☐ Ter o meu próprio dinheiro
B ☐ Pela necessidade de ajudar em casa
C ☐ Para ganhar experiência profissional e investir no meu futuro
D ☐ Outro. Qual?_____

11. Até os 14 anos de idade você viveu com quais pessoas responsáveis por você?
(Marque apenas UMA opção)

A ☐ Pai e mãe durante todo o tempo
B ☐ Mais com a mãe
C ☐ Mais com o pai
D ☐ Com nenhum deles, mas com outro parente
E ☐ Com outra(s) pessoa(s) de fora da família

12. Indique a escolaridade da sua mãe e se não tiver convivido com ela, indique a escolaridade da pessoa responsável por você?
(Marque apenas UMA opção)

A	☐	Não sabe ler e escrever
B	☐	Fundamental incompleto
C	☐	Fundamental completo
D	☐	Médio incompleto
E	☐	Médio completo
F	☐	Superior incompleto
G	☐	Superior completo
H	☐	Não sei informar

13. A escolaridade que indicou na questão 12 é a escolaridade da sua mãe?
A ☐ Sim B ☐ Não, é de outra pessoa

14. Quando você está desmotivado, quem mais te incentiva a ESTUDAR? *(Marque apenas UMA opção)*

A ☐ Mãe C ☐ Irmão/Irmã E ☐ Amigo(a) G ☐ Outra pessoa
B ☐ Pai D ☐ Avó/Avô F ☐ Professor(ra) H ☐ Ninguém

15. Indique se alguém do seu convívio te incentiva a TRABALHAR no presente? *(Marque apenas UMA opção)*

A ☐ Mãe C ☐ Irmão/Irmã E ☐ Amigo(a) G ☐ Outra pessoa
B ☐ Pai D ☐ Avó/Avô F ☐ Professor(ra) H ☐ Ninguém

16. Você já perdeu o ano por ter abandonado a escola (por desistir de ir assistir as aulas)?
A ☐ Não B ☐ Uma vez C ☐ Mais de uma vez

17. Você pretende fazer o ENEM? A ☐ Sim B ☐ Não C ☐ Não tenho certeza

18. Você pretende fazer uma faculdade/universidade? A ☐ Sim B ☐ Não C ☐ Não tenho certeza

19. Você pretende fazer um curso técnico ou qualificação profissional? A ☐ Sim B ☐ Não C ☐ Não tenho certeza

20. Qual é a profissão que você gostaria de ter no futuro? _____

Quando você pensa na conclusão do Ensino Médio, o quanto os sentimentos abaixo te afetam?

		Nada	Um pouco	Bastante	Demais
21	Medo de fracassar	☐	☐	☐	☐
22	Ansiedade para concluir logo e começar nova etapa de vida	☐	☐	☐	☐
23	Pressão vinda de cobranças da família e da sociedade	☐	☐	☐	☐

Pensando em TRABALHO, qual o grau de importância que você dá a cada uma das alternativas abaixo:

		Nada/Nenhuma	Um pouco	Bastante	Demais
24	"Sobreviver" / se sustentar	☐	☐	☐	☐
25	Ter o respeito das pessoas	☐	☐	☐	☐
26	Dar sentido à vida	☐	☐	☐	☐
27	Poder comprar as coisas que gosto	☐	☐	☐	☐
28	Sustentar minha família e dar uma boa educação para os meus filhos.	☐	☐	☐	☐

29. O que você acha ser <u>mais importante</u> para conseguir um bom trabalho? *(Marque apenas UMA opção)*

A ☐ Estudo
B ☐ Empenho pessoal
C ☐ Experiência
D ☐ Boa aparência
E ☐ Contatos pessoais
F ☐ Sorte

Indique o quanto você concorda com as afirmações abaixo: *(Marque apenas UMA opção por frase)*

		Nada	Um pouco	Bastante	Demais
30	Sinto que é inútil me esforçar na escola porque a maioria dos alunos é mais inteligente do que eu.	☐	☐	☐	☐
31	Sinto que a melhor maneira de lidar com os problemas é apenas não pensar neles.	☐	☐	☐	☐
32	Sinto que muitas vezes não vale a pena me esforçar porque, de qualquer modo, as coisas nunca dão certo mesmo.	☐	☐	☐	☐
33	Sei exatamente o que gosto e o que não gosto de fazer	☐	☐	☐	☐
34	Tenho certeza da profissão que gostaria de ter	☐	☐	☐	☐
35	Sei o quanto preciso estudar para ter a profissão que desejo	☐	☐	☐	☐
36	Sei que a cada etapa de ensino que eu conclua terei novas possibilidades de trabalho	☐	☐	☐	☐

37. Para você, a principal razão para ir à escola é: *(Marque apenas UMA opção)*

A ☐ Aprender conteúdos e habilidades que vou precisar para ser um bom profissional.
B ☐ Ter amigos e as amizades dessa época permanecem.
C ☐ Ter um diploma que a sociedade valoriza e que me permite seguir estudando.
D ☐ Nenhuma das respostas anteriores. Qual a sua razão?_____

"Nos próximos cinco anos eu <u>GOSTARIA DE</u>:" *(Marque apenas UMA opção por frase)*

		Nada	Um pouco	Bastante	Demais
38	Ter um bom salário	☐	☐	☐	☐
39	Estar cursando uma faculdade/universidade	☐	☐	☐	☐
40	Ter filhos	☐	☐	☐	☐
41	Poder ajudar mais minha família	☐	☐	☐	☐
42	Ter um emprego	☐	☐	☐	☐
43	Estar cursando ou ter concluído um curso técnico	☐	☐	☐	☐
44	Casar/morar junto com companheiro(a)	☐	☐	☐	☐

"Nos próximos cinco anos, o quanto você <u>ACHA QUE VAI CONSEGUIR</u>:" *(Marque apenas UMA opção por frase)*

		Nada	Um pouco	Bastante	Demais
45	Ter um bom salário	☐	☐	☐	☐
46	Estar cursando uma faculdade/universidade	☐	☐	☐	☐
47	Ter filhos	☐	☐	☐	☐
48	Ajudar mais minha família	☐	☐	☐	☐
49	Ter um emprego	☐	☐	☐	☐
50	Cursar ou concluir um curso técnico	☐	☐	☐	☐
51	Casar/morar junto com companheiro(a)	☐	☐	☐	☐

52. No que a escola pode te ajudar no seu futuro?

_____
_____
_____
_____
_____

53. Conhecer os voluntários ajudou você a pensar no seu futuro?

A ☐ Não

B ☐ Sim. Justifique sua resposta: *(Marque quantas opções quiser)*

A ☐ Dicas sobre estudo
B ☐ Dicas sobre profissões
C ☐ Dicas sobre emprego
D ☐ Oportunidade de tirar dúvidas
E ☐ Acreditaram em você
F ☐ Não determinaram escolhas para seu futuro
G ☐ Espaço para você ser você mesmo
H ☐ Fiquei com mais esperança para o futuro

54. Você gostaria que um dos voluntários ajudasse você em seu projeto de vida / a planejar o seu futuro profissional? *(Marque apenas UMA opção)*

A ☐ Sim, gosto da ideia

B ☐ Talvez, posso testar essa experiência

C ☐ Não, prefiro pensar sozinho sobre isso

D ☐ Não, prefiro a ajuda de pessoas mais próximas

RESPONDA AS PRÓXIMAS PERGUNTAS APENAS SE MARCOU "A" OU "B" NA QUESTÃO ANTERIOR (QUESTÃO 54)

Pensando em seu projeto de vida, que tipo de contato gostaria de ter com os voluntários: *(Marque apenas UMA opção por linha)*

55	**Tipo de comunicação**	☐ Presencial	☐ Virtual (ex: facebook, e-mail,...)	☐ Presencial e Virtual
56	**Local**	☐ Na escola	☐ Fora da escola	☐ Na escola e fora da escola
57	**Jovens envolvidos**	☐ Individual (só você)	☐ Em grupo	☐ Individual e em grupo
58	**Voluntários envolvidos**	☐ Apenas um voluntário	☐ Com um grupo de voluntários	

59. Gostaria que esses encontros com os voluntários acontecessem: *(Marque apenas UMA opção)*

A ☐ A cada 15 dias
B ☐ Todo mês
C ☐ A cada três meses
D ☐ Duas vezes ao ano

60. Cada encontro presencial deveria ter a duração de: *(Marque apenas UMA opção)*

A ☐ No máximo uma hora

B ☐ Um período do dia (manhã, tarde ou noite)

C ☐ Um dia inteiro de atividades

61. Quais temas gostaria de aprender/discutir com os voluntários? *(Marque quantas opções quiser)*

A ☐ Arte/Cultura
B ☐ Faculdade/Universidade
C ☐ Curso Técnico/Qualificação Profissional
D ☐ ENEM
E ☐ Profissões
F ☐ Saúde
G ☐ Vestibular
H ☐ Mercado de trabalho
I ☐ Planejamento financeiro
J ☐ Outro(s). Qual (Quais)? _____

62. Utilize esse espaço para realizar sugestões de atividades que gostaria de realizar com os voluntários:

_____

_____

_____

_____

_____

Muito obrigado pela atenção!