Quality of higher education and earnings: Regression discontinuity evidence from the French Baccalaureate

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Quality of Higher Education and Earnings: Regression Discontinuity Evidence from the French Baccalaureate*

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Abstract

An emerging body of literature examines the economic returns to quality of postsecondary education. This literature has predominantly focused on the returns to the most selective universities. However, less is known about the extent to which these gains are realized for the academically marginal student who does not necessarily attend the most selective of institutions. In this paper, we address this question by exploiting the presence of the Baccalauréat Général (or the General Baccalaureate), a degree that students in France must earn to graduate from secondary school and enroll in postsecondary institutions. The degree is awarded upon passing a series of national exams. Students can retake the exam in the same year but the standards for passing are higher in the first round. Our data links individual-level information on secondary and postsecondary education to labor market outcomes, allowing us to track the complete educational and professional paths of all students in our sample. We use a regression discontinuity design that compares the outcomes of students who marginally pass and fail the first round of the French Baccalaureate exam. Marginally passing increases the likelihood of attending a higher quality university and a STEM major. Threshold crossing also raises earnings by 13.6 percent at the age of 27 to 29. After ruling out other channels that could affect earnings, we conclude that increased access to higher quality postsecondary education leads to a significant earnings premium for academically marginal students.

JEL Classification: H52, I21, I28, J24

Keywords: Quality of education, returns to education, regression discontinuity design

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1 Introduction

An emerging body of literature looks at whether quality of postsecondary education has a significant impact on students' future labor market outcomes. Previous studies find large returns to the most selective institutions and degrees. However, it is unclear whether these effects persist for academically marginal students who attend mildly selective universities which differ in quality. This is an important question as most students do not decide between attending an elite versus a non-elite university. In fact, admission rates at most "Ivy League" institutions in the U.S. are lower than 10%. In France, less than 4% of students in 2013 enrolled in preparatory classes for elite universities.[1] It is also of equal importance to understand how choice of major within an institution can affect future labor market outcomes. Recent reports suggest the presence of a persistent and growing wage premium for jobs in the fields of science, technology, engineering, and mathematics (STEM) (Langdon et al., 2011). From a policy perspective, these fields are perceived to be the basis for innovation and governments have been increasingly investing in STEM education. Finally, there is also a need to understand the combined effect of university quality and major choice, as students often make these decisions simultaneously.

This paper studies the impact of the quality of higher education on labor market outcomes for the academically marginal student. In our context, quality of higher education refers to both quality of university attended and field of study pursued.[2] This matters, as students in most countries often decide on an institution and field of study simultaneously. To do so, we exploit a unique feature of the French education system, the Baccalauréat Général or the General Baccalaureate.

The Baccalaureate is a national diploma granted to students in France upon graduating from secondary school and is required for university enrollment. In order to earn the degree,

[1] Sources: http://colleges.usnews.rankingsandreviews.com/best-colleges/rankings/lowest-acceptance-rate and http://cache.media.enseignementsup-recherche.gouv.fr/file/2014/58/8/NI_MESR_14_01_303588.pdf

[2] Institution quality is captured by a measure of the average performance of university peers in secondary school.

students have to sit for and pass national exit exams during their last academic year. Students are generally given two attempts to pass these "high stakes" exams within the same year. However, the standards for passing are significantly higher in the first round. We use a regression discontinuity design that compares the future educational and labor market outcomes of students who barely pass and barely fail the exam from the first attempt. This allows us to overcome selection bias arising from the fact that post-secondary educational choices are likely correlated with unobservable factors that may also affect future earnings, such as ability and motivation.

We find that marginally passing is associated with a 15.3 percentage point increase in the probability of attending a moderately higher quality university (versus a moderately lower quality one) and a 15.9 percentage point increase in the likelihood of pursuing a STEM degree. We also uncover a 13.6 percent earnings premium associated with threshold crossing, approximately 9 to 10 years after having initially taken the exam, with no significant employment effects. We rule out other possible channels through which threshold crossing may affect earnings. Specifically, we find no significant effect on years of post-baccalaureate education, or on the likelihood of obtaining a post-baccalaureate degree. Moreover, we find no discontinuity in the probability of eventually obtaining the Baccalaureate degree. This rules out the direct signaling value of the Baccalaureate degree as a potential channel that could have contributed to the documented increase in earnings. Accordingly, we conclude that increased access to better quality postsecondary education raises earnings by 13.6 percent for academically marginal students.

Our paper is related to a large body of literature that provides estimates on the returns to quality of higher education. Dale and Krueger (2002, 2014) compare students who were accepted at similar universities, but chose to attend different colleges. They find that the earnings gains from more selective colleges are restricted to students from low socio-economic backgrounds and minorities. Brewer et al. (1999) and Black and Smith (2004, 2006) show that there are significant returns to attending more selective universities. Our study is closest to more recent work which uses regression discontinuity designs to identify the returns to quality and quantity of education. Hoekstra (2009) finds that attending a flagship state university increases earnings by 20 percent for white males. Saavedra (2009) uncovers an increase in the earnings and employment rate of applicants who are marginally above the entry cutoff at selective universities in Colombia. Zimmerman (2014) estimates the returns to attending a four year university by comparing students who are marginally above and below the admissions cutoff at the least selective university in Florida. Recent studies also use regression discontinuity designs to estimate the returns to different fields of study. Hastings et al. (2013) and Kirkbøen et al. (2014) exploit the existence of varying admissions cutoffs to certain majors at selective universities in Chile and Norway respectively. They find heterogeneous returns by field of study and positive returns for the most selective of degrees.

We contribute to this literature in several ways. First, our focus is on universities that are moderately selective but which slightly differ in quality amongst each other. In fact, students who marginally pass the General Baccalaureate exam do not normally attend elite universities in France. This is in contrast to the rest of the literature which usually estimates the returns to the most selective universities. Thus, it is interesting to find that even among universities that are of moderate selectivity, there are positive returns to attending a higher quality institution.

Furthermore, our estimates concern students with moderate academic abilities. This is potentially important as the returns to college quality can be heterogeneous (Andrews et al., 2012). Goodman et al. (2014) also focus on the benefits of higher quality education for lower ability students. They use the admissions cutoffs at various universities in Georgia and find that marginally missing these cutoffs decreases BA completion rates. However, they do not analyze any subsequent labor market effects.

Second, we examine the returns to quality of postsecondary education using an entire national university system. Previous studies focused on the effects of attending a single institution or a subset of universities within a country. Additionally, our data allows us to track the complete educational paths for all students in our sample.

Third, we estimate that at least part of the observed effect of marginally passing on earnings is driven by pursuing STEM-designated degrees. We further provide suggestive evidence that the returns to STEM education, holding quality of institution constant, is 43 percent for students from lower socioeconomic backgrounds. The magnitude of this effect is comparable to estimates from previous studies in the U.S. Hamermesh and Donald (2008) estimate that the earnings of students who majored in engineering and hard business are respectively, 31.6 and 48.9 log points higher than those who majored in education. Altonji et al. (2012) suggest a wage premium of 56.1 and 51.8 log points for those who studied electrical engineering and finance relatively to education. Melguzio and Wozniak (2011) estimate a 25% to 40% STEM related premium for high achieving minority students. Further, they find a 50% STEM premium for individuals who ended up working in a congruent field.

This paper is related to another strand of literature which explores the effects of educational accountability programs on student outcomes. Recent studies show that the introduction of test-based accountability, like high school exit exams, increases the performance of students who are still in school (Jacob, 2005; Figlio and Rouse, 2006; Chiang, 2009). Other papers find that exit exams can increase high school dropout rates (Ou, 2010; Papay et al., 2010) and even reduce post-secondary educational attainment (Martorell, 2004).

We add to this literature in multiple ways. First, we find that marginally failing the exit exams from the first attempt does not have an impact on graduating from secondary school, graduating with a post-baccalaureate degree or years of education. This suggests that exit exams do not necessarily discourage students through increasing dropout rates and lowering higher educational attainment. In fact, when high-stakes exams with multiple retakes are given, students may persist in order to meet the graduation standards. In our case, this is reinforced by the fact that the second round of exams has lower standards for passing than the first one.

Second, we find that exit exams can have consequences that have not yet been considered in the literature. We show that marginally passing the exit exams from the first attempt increases the likelihood of accessing higher quality postsecondary education. This is due to either late enrollement in university/major combinations that are in high demand, a discouragement or a signaling effect. In our setting, the signaling effect explanation suggests that the timing of secondary school degree receipt may be a better signal of ability than whether the student actually receives the degree. In fact, allowing students to retake the exam with lower standards for passing on the second round could be devaluing the high school credential. This could partially explain recent findings that show that there is no signaling value to a high school credential (see Clark and Martorell, 2014). If students are allowed to retake exit exams until they eventually pass, employers and universities might question the true value of this credential.

Section two presents detailed information on the French Baccalaureate. Section three describes the data we use for this paper. Section four reviews our identification strategy. Section five presents the main empirical results as well as robustness checks. Finally, in section six, we discuss our results and we conclude in section seven.

2 Institutional Background

2.1 The General Baccalaureate

The Baccalauréat Général (or the General Baccalaureate) is a French national degree awarded to students in their last year of secondary school. It marks the completion of secondary education and is also required for enrollment in postsecondary institutions. Within the General Baccalaureate, students can choose one of three specializations: economics & sociology, literature or sciences. Specializations differ in terms of the subject matter that the curricula focus on. For instance, students specializing in literature have a curriculum predominately focused on subjects such as French literature and philosophy even though they are still required to take all subjects.[3] The percentage of students awarded the General Baccalaureate increased from 67.2% in 1975 to 80.3% in 2002 and 92% in 2013.

In order to be awarded the degree, students must pass a series of national written exams. The exams cover all subjects taken throughout the last academic year and are common to all students within the same specialization. Written and oral exams for the French literature section of the Baccalaureate are administered a year prior to all other tests. Each subject has a different weight depending on student specialization. The weighted average of all subjects is then used to compute the final score on the Baccalaureate exam.

After the exams are administered, they are randomly assigned to preselected secondary school teachers for grading. Two committees supervise the process to guarantee uniform grading. Juries across France then meet to decide whether or not a degree is conferred. Importantly, students' identities remain anonymous throughout this whole process. In order to be awarded the degree, a student's total weighted score must be greater than or equal to 10 out of 20 possible points. The student is also granted an *Assez Bien* (fairly good), *Bien* (good) or *Très Bien* (very good) distinction if he/she scores above a mark of 12, 14 and 16 respectively.

Students generally have two attempts to pass the exam in a given year. A student who fails the initial attempt can opt to retake the exam in the second round, conditional on scoring at least 8 points on the first try. With a total score below 8, the student has to wait an additional year to retake the exam. Students select two failing subjects to be retested on in the second round of exams. As a result, they vary from one student to the other. The new grades on these two subjects are then added back to the remaining grades from the first round to calculate a new total score. The student is granted the degree if his/her new average score is greater than or equal to 10. The second round exams of the Baccalaureate are often criticized for being unchallenging and unreliable. This is mainly because they are conducted orally and administered by only one teacher. This allows students to negotiate a

[3] In the results section, we control for exam specialization fixed effects, and the results remain unchanged.

passing score with their respective teacher (Buchaillat et al., 2011).

2.2 The jury

Following the grading of the first round exams, juries consisting of secondary school teachers decide on the conferral of the degree. A key part of the jury's role is to determine whether a person who is marginally below a certain cutoff should be given extra points to reach that threshold. If students are awarded the extra points, their final score will be pushed to somewhere between X and X.1 points, where X represents a significant threshold.[4]

Students are usually awarded extra points on the subjects for which they obtain the lowest scores. The jury member who specializes in the corresponding subject has to consent to giving the extra points. Decisions are made in a short period of time as juries need to go through hundreds of applications on a given day. Further, the juries tend to be fairly heterogeneous in their specializations. As a result, two classmates who both marginally fail the Baccalaureate because of their scores on the mathematics portion of the exam may be passed by one jury and not the other just because the former had a teacher in mathematics, while the latter did not. Students are not allowed to interact with jury members, nor do they know that their files are being reviewed until after the results are announced. Furthermore, students' names are hidden from the jury throughout the whole process, as to hinder any cheating or bribing.

The jury members observe students' Baccalaureate exams in all subject matter. They also have the option to access an academic report which contains teachers' evaluations of the student's performance in school. While this may raise concerns over strategic jury behavior in the allocation of extra points, anecdotal evidence suggests that this option is not always exercised. Furthermore, previous studies show that the presence of test-based accountability distorts teacher behavior. For example, Jacob and Levitt (2003) provide evidence of teacher cheating on the Iowa Test of Basic Skills in Chicago elementary schools. Dee et al. (2011)

[4]For example, if a student initially has a score of 9.95 and is deemed worthy of a pass, his/her final posted grade will be between 10 and 10.1. In our dataset, we can only observe this final heaped grade.

also show that teachers wanting to help their students, tend to inflate test scores on New York's high school assessment exams. In our case, it is possible that teachers' desire to help students might cause them to be more lenient in their evaluations. Thus, even if jury members take into consideration the teachers' evaluations, they may still be basing their decision on an unreliable assessment of the student's performance in school.

In section 5.1, we provide evidence of non-strategic jury behavior. Specifically, we show the smoothness of baseline characteristics at the passing threshold. Further, in section 5.6, we also show that excluding the small part of the sample whose scores could have been manipulated does not change the main results.

2.3 The higher education system in France

There are many academic routes that a student can take upon graduating from secondary school. In general, students can apply to universities, higher vocational institutes or the "Grandes Ecoles" − the most prestigious and selective institutions in France. Back in 2002, there was no national centralized system that students could use to apply to higher education establishments.[5] Further, students applied to an institution and major simultaneously.

The majority of universities in France are public and offer a variety of different majors. Time to completion for most degrees is three years.[6] By law, the only requirement for admission is holding the Baccalaureate degree. However, in practice, universities are capacity constrained and a student can be denied admission to the university and major of his choice. Priority is usually given to students who reside in the same area as the university. Other

[5] Although no national centralized system was in place, students from the Île-de-France region applied to higher education establishments via a centralized system called RAVEL. (Source: `http://www.lemonde.fr/orientation-scolaire/article/2012/03/08/apb-ou-le-passage-oblige-pour-acceder-au-superieur_1652943_1473696.html`)

[6] Students received an intermediate degree, the "Diplôme d'études universitaires générales" (or DEUG), after two years in universities. The "Licence" (or the equivalent of the Bachelor's degree) was awarded after an extra year. Starting 2003, the DEUG was gradually phased out. However, only 13 universities had partially eliminated the degree by 2003. We are not too concerned about the effects of this reform on our sample as more than 90% of the students who failed the first round of the 2002 exams had obtained their Baccalaureate degree by 2003.

Source: `http://www.mesr.public.lu/enssup/dossiers/bologne/processus_bologne.pdf` students are admitted on a "first come, first serve basis". Although public universities are not normally selective, in a recent report, the National Union of Students in France (L'Union Nationale des Etudiants de France (UNEF)) found that some universities have been using the results of the Baccalaureate exam as a screening device to select more successful applicants.[7]

Students need to have proof of Baccalaureate receipt in order to enroll in universities. They can apply for admission well after the results of the first and second rounds of the General Baccalaureate are announced. More specifically, for the academic year 2001-2002, the first round exams took place from June 13 to June 20. Students received the results of the first round on July 5. The second round oral exams were administered from July 8 to July 11. The final results were announced on July 11. Admissions to universities are usually open until the beginning of the academic year in September.

The "Grandes Ecoles" are the most prestigious and selective post-baccalaureate institutions in France. They offer degrees in a multitude of fields including engineering, business and political sciences. Time to completion for these degrees is usually five years. Students can enroll in the "Grandes Ecoles" either immediately after secondary school or after attending two years of preparatory classes in lyceums. Admission to both these routes is based on the students' academic results in the last two years of secondary education, their scores on the French literature portion of the baccalaureate exams and tests that are specific to each institution. Admissions decisions are made before students sit for the first round of baccalaureate exams. Appendix A.3 offers a more detailed description of the traditional higher education system.

Admissions to vocational and professional institutes are considered competitive. Most degrees require three years to complete. Students are in general admitted based on their academic results in the last two years of secondary education or upon obtaining a distinction on the baccalaureate exams. Appendix A.4 provides an overview of the higher vocational system.

[7]Sources: `http://lajeunepolitique.com/2013/07/29/27-french-universities-denounced-for-illegal-selecti` and `http://unef.fr/wp-content/uploads/2013/07/DOSSIER-DE-PRESSE-UNEF-2013-FII-11.pdf`

3 Data

Our data links individual-level information on secondary and post-secondary education to labor market outcomes and are taken from three surveys, the "Panel d'élèves du second degré, recrutement 1995", administered by the French statistical office (INSEE). The data contains student demographics, detailed scores on the baccalaureate exams taken from administrative records, post-secondary field of study, institution attended and graduated, earnings information and employment status.

Data on post-secondary education are available on a semiannual basis for up to 9 years after receiving the General Baccalaureate degree. Labor market outcomes are reported yearly from 2005 to 2012, up to 10 years after the General Baccalaureate exams. Thus, one advantage of our dataset is that we are able to observe detailed long-term outcomes. A potential drawback of the data is that it does not include outcomes for individuals working abroad. Also, some individuals do not report their earnings or drop out of the sample because they could not be followed by the interviewers. This could potentially cause problems insofar as it is correlated with treatment. We address these issues in section 5.1 by showing that there is no discontinuity in the probability of being observed in the labor market portion of the survey.

The initial sample consists of 17,830 students who were enrolled in grade 6 (6ème) in the academic year 1995-1996. We restrict our data to students who sat for the first round of the General Baccalaureate exam in the academic year 2001-2002.[8] We do not use the results from the second round because retaking the exam can induce differences between students who are marginally below and above the threshold (Martorell and McFarlin Jr., 2011). Fur-

[8]It is worth noting that grade repetition is very common in France. Given that we use the 2002 first round of exams, then by definition our final sample only includes students who did not repeat a grade between grade 6 and their last year of secondary school. If many students in our initial sample repeated an academic year between these two grades, this would put into question the external validity of our results. Fortunately, we only observe 23 students who sat for the General Baccalaureate exam for the first time after 2002. This is consistent with the fact that the majority of grade repetition in France takes place in early elementary grades. Further, students who follow the traditional route of education are less prone to grade repetition.

ther, the second round exams can be strategically manipulated as they are conducted orally and administered by only one teacher. We also exclude students who attended vocational secondary schooling as their post Baccalaureate academic options are limited.

The main labor market outcome of interest is the natural log of average monthly net earnings, stacked for the years 2011 and 2012. This results in up to two observations for each individual. Since earnings of individuals in their early twenties are not usually considered a good predictor of future income, we use earnings reported approximately 9 to 10 years after taking the baccalaureate exam, when the students are aged between 27 and 29.

In our analysis of the quality of post-Baccalaureate institutions, the main measure used is the average Baccalaureate score of all students in our sample attending a certain institution.[9] Thus, we consider a university to be of "better quality" if the students who enroll in it have, on average, a higher Baccalaureate exam score. Concerning field of study, the main outcome of interest is a dummy variable that is equal to 1 if the student is enrolled in a STEM designated degree or an advanced business degree. Advanced business degrees are classified as STEM because they usually require good quantitative skills. A complete account of the majors we designate as STEM versus non-STEM can be found in Appendix Table A.5.

Finally, we use father's occupation as a proxy for students' socioeconomic status. The occupation of the father is stratified into 42 different positions that are represented by two digit identifiers. The first digit of each identifier represents one of four main skill levels. These skill levels are the official French socioeconomic classification as represented by the "Nonmenclature des professions et categories socioprofessionelles" (PCS) and are used as a reference in all official collective agreements. Our definition of high skilled workers includes the first two skills levels, while low skilled workers are represented by the last two.

Descriptive statistics for students who sat for the first round of the 2002 General Baccalaureate are reported in Table 1. 38 percent of the students are male and 57 percent are

[9]Stratifying institutions by tier is not as straightforward in France as it would be in the U.S. Further, data on out of sample average Baccalaureate score by institution is not available.

from a high socioeconomic background.[10] The average score on the Baccalaureate exam is 11.17 points, with approximately 75 percent of students passing from the first round. Further, 98 percent of the students in our sample eventually graduate high school (i.e. eventually pass the Baccalaureate). Respondents have an average of 3.2 years of postsecondary education and 28 percent of students are enrolled in a STEM major in their first year of postsecondary education. As for labor market outcomes, the average monthly net earnings for individuals in the sample are 1,625 and 1,725 Euros for 2011 and 2012 respectively, with an employment rate of 93 percent for both years.

4 Identification Strategy

We use a standard regression discontinuity framework (Lee and Lemieux, 2010; Imbens and Lemieux, 2008) to estimate the effects of passing the Baccalaureate exam from the first try (treatment) on educational attainment, quality of education and future labor market outcomes. The key identifying assumption underlying an RD design is that all determinants of future outcomes vary smoothly across the threshold. In that sense, any observed discontinuity at the threshold can be attributed to the causal effect of scoring above a 10 on the Baccalaureate exam, i.e. passing on the first attempt.

Formally, we estimate the following reduced form equation:

$$Y_i = \alpha + g(S_i) + \tau D_i + \lambda D_i * g(S_i) + \delta X_i + \epsilon_i$$

where the dependent variable Y is the outcome of interest, representing earnings and educational outcomes for individual i. D is a dummy variable indicating whether a person passed or failed the French Baccalaureate exam on the first try. S is the running variable and represents an individual's score on the first attempt of the exam. It is defined as grade points

[10] 51.61 percent of the students in our initial sample are male. This number is reduced to 38 percent after excluding students who were in vocational secondary schooling. However, this does not pose any threat to identification, as we observe no discontinuity in the likelihood of being of a certain sex at the threshold (See Section 5.1).

relative to the threshold passing grade of 10. The function g(.) captures the underlying relationship between the running variable and the dependent variable. We allow the slopes of our fitted lines to differ on either side of the passing threshold by interacting g(.) with treatment D in order to control for differential trends in grades. X is a vector of controls that should improve precision by reducing residual variation in the outcome variable, but should not significantly alter the treatment estimates. The term ϵ represents the error term. The parameter of interest is τ which gives us the local average treatment effect for each regression.

In all regressions, we use population survey weights to estimate treatment effects for the various outcomes of interest.[11] Further, heteroskedastic adjusted errors are used in all regressions.[12] There are two ways to estimate the parameter τ in an RD design. First, one can impose a specific parametric function for g(.), using all the available grade data, to estimate the above equation via ordinary least squares —typically referred to as the global polynomial approach. Alternatively, one can specify g(.) to be a linear function of S and estimate the equation over a narrower range of data, using a local linear regression. In this paper, the preferred specifications are drawn from local linear regressions within 1.5 grade points on either side of the cutoff using uniform kernel weights. This avoids the problem of identifying local effects using variation too far away from the passing threshold. Our choice of bandwidth is motivated by graphical fit, data driven optimal bandwidth selectors and the existence of other cutoff grades. Specifically, we use a robust data driven procedure, outlined in Calonico, Cattaneo and Titiunik (2014), to predict the optimal bandwidths (Henceforth CCT).[13] This bandwidth selector improves upon previous selectors that yield large bandwidths. Specifically, it accounts for bias-correction stemming from large initial bandwidth choice, while also correcting for the poor finite sample performance attributed to this bias correction. While

[11] Results remain unchanged when using un-weighted regressions.

[12] Our running variable is fairly continuous as it is reported to the nearest one hundredth of a decimal point (i.e 9.91, 9.92, etc...). Accordingly, we are not too concerned about random specification error resulting from a discrete running variable as reported in Lee and Card (2008).

[13] The optimal local linear bandwidth for most of our specifications ranges from 1.2 to 1.5 score points.

our preferred specifications are drawn from local linear regressions, we still present results for a variety of bandwidths and functional forms, as has become standard in the RD literature (Lee and Lemieux, 2010). The results are robust to these varying specifications leading us to conclude that passing the Baccalaureate exam from the first attempt results in significant differences in quality of schooling and subsequent labor market outcomes.

5 Results

5.1 Tests of the Validity of the RD design

A standard concern with any RD design is the ability for individuals to precisely control the assignment variable. In our context, this can occur if students and/or graders manipulate scores in such a way that the distribution of unobservable determinants of education and earnings are discontinuous at the cutoff. The first concern is if students themselves are able to precisely sort to either side of the cutoff, especially given that the cutoff score is known beforehand. However, the Baccalaureate exam comprises all subject matter taken during the year, most of which is in essay format, making it highly unlikely for any student to be able to precisely control their grade. A potentially more worrying concern is whether graders are sorting students to either side of the passing threshold in a non random way. If borderline students with better future prospects are marginally passed at a higher rate than those with worse prospects, then our education and earnings estimates would be upward biased.

In addressing these concerns, we consider a few tests that have become standard in the RD literature. The first informative test would be to check for any discontinuity in the density of grades at the cutoff point (McCrary, 2008). The rationale behind this test is that if individuals are manipulating grades around the cutoff, then the grade distribution will be discontinuously uneven for grades just below and above the cutoff. However, a running variable with a continuous density is neither necessary nor sufficient for identification. Specifically, this test may not be as helpful if discontinuities in the grade distribution can be attributed to other exogenous factors such as grade rounding.[14] As mentioned in Section 2.2, after the initial grading of the exams, jury members decide whether they should award extra points to individuals just short of an important cutoff. The empirical distribution in Panel A of Figure 1 is consistent with this idea. At each representative grade cutoff, we observe a dip in the number of students who are just short of said cutoff combined with a spike in the number of students who are just above it.[15] This heaping is consistent with a priori expectations that jury members are bunching grades at important cutoffs. These distributional discontinuities could be the result of strategic cutoff crossing, or an alternative random sorting process. While, the first case is obviously problematic, the latter poses no threat to identification. As highlighted in McCrary (2008):"If teachers select at random which students receive bonus points, then an ATE would still be identified." In what follows, we provide evidence against strategic cutoff crossing.

In the presence of a running variable that is discontinuously distributed for exogenous reasons, an informative visual test for grade manipulation is to verify the smoothness of baseline characteristics. This test has become standard in the RD literature as an alternative and often preferred approach for testing the validity of the RD design (Lee and Lemieux, 2010). The intuition here is that if we observe discontinuities in exogenous variables, then the treatment is not randomly assigned and an average treatment effect is not identified. Further, as part of this exercise, we also check for the presence of a discontinuity in the probability of being observed in the follow-up labor force segment of the survey. Specifically, if probability of survey response is correlated with treatment, then the standard interpretation of our treatment effect would be problematic.

All panels in Figure 2 present estimates of the effects of threshold crossing on baseline characteristics. These figures take the same form as those after them in that open circles represent local averages over a 0.25 score range. All figures represent local linear regressions

[14] See Zimmerman (2014) for a similar case.

[15] Recall, that the cutoff grades of 8 ,10 ,12 ,14 and 16 all serve a specific purpose in terms of awarded degree.

within 1.5 score points of the cutoff. Further, estimates are computed using population weights with robust standard errors reported in parentheses.

We first check for the presence of a discontinuity in the averaged score of the oral and written French literature portion of the Baccalaureate exam. There are two advantages to looking at this variable. First, these exams are administered in grade 11, one year before all other Baccalaureate tests. In that sense, it is a very recent indicator of student ability. Second, jury members cannot award extra points on this particular component of the Baccalaureate exam. Panel A of Figure 2 reveals an insignificant treatment effect (0.0196) on the average score of the French literature exam. We further test for a discontinuity in the Brevet national exam test scores. This high stakes exam is taken in grade 9 and is required for entry into high school, with the grading scale also being from 0-20. We have the averaged score for the three major components of the Brevet exam (Mathematics, French and foreign language). We also look at another national exam taken at the beginning of grade 6. The goal of this exam is to evaluate the level of students in mathematics and its grading scale is from 0 to 78. In Panel B of Figure 2, we find an insignificant treatment estimate (0.158) on Brevet scores. Panel C of Figure 2 also shows an insignificant treatment effect (-0.847) on the mathematics exam scores in grade 6. This eases concerns that jury members might be sorting students around the cutoff, based on their academic ability.

In Panel D, we check for the presence of a discontinuity in the likelihood of being from a high socioeconomic status (S.E.S). We also find no significant effect (0.022). Further, in Panels E through G, we check for the smoothness of covariates that are known to affect education and wages, but that should be independent of treatment. Estimates on gender (0.0029), order of birth (-0.098) and number of siblings (0.138) are all statistically insignificant. To alleviate any concerns over bandwidth and/or functional form chosen, we present the baseline characteristics over varying functional forms and bandwidths in Table 2. All estimates remain insignificant. Finally, we show that the predicted Baccalaureate score, as a function of the above covariates, is continuous at the cutoff. Both panels in Figure 3 highlight these results using a local linear and global polynomial fit respectively.

These results reject the hypothesis of strategic threshold crossing in favor of a non strategic sorting hypothesis.[16] They are also consistent with the fact that students' identities are never disclosed to neither graders nor jury members.

As highlighted in Barreca, Lindo and Waddell (2013), heaping in the running variable can have serious consequences if it is associated with determinants of the outcome variables. However, heaping will only bias the estimates to the extent that it creates imbalances in outcome determinants around the cutoff. Therefore, as a complement to our balanced characteristics test, we implement additional checks to further investigate the existence of strategic sorting. Specifically, we run 'Donut RDs' that deal with the heaped data at each cutoff. Panel B of Figure 1 highlights the new distribution of grades resulting from Donut type RD regressions, which essentially involves cutting out all potentially manipulable data points. We implement these regressions in Section 5.6 with the main results remaining unchanged.

Finally, if marginally failing students were more likely to leave the country in order to have access to higher quality universities or if they endogenously chose not to respond to the follow up survey as a result of failing, then the interpretation of our results would be problematic. As an important RD validity check, we show that there is no significant threshold crossing effect on the likelihood of being observed in the follow-up wage survey. These results are reported in Panel H of Figure 2 and Table 2. The absence of any differential selection into the earnings sample alleviates any concerns attributed to leaving the sample due to barely failing the French Baccalaureate exam.

[16]In Table A1, we also show that the baseline characteristics are smooth around all other important thresholds. Indeed, If juries were strategically manipulating results, then this phenomenon should occur at all important cutoffs. We find no evidence of significant discontinuities at any of these cutoffs for our above baseline covariates.

5.2 Is the Baccalaureate cutoff rule binding in practice?

In this paper, we estimate the impact of passing the French Baccalaureate from the first try on future educational and labor market outcomes. Before proceeding with the results, we first show that there is a discontinuity in the first round pass rate at the threshold. Figure 4 is a graphical representation of the 'first stage', i.e. the probability of being awarded the Baccalaureate degree on the first round conditional on first round exam scores. The figure shows a clear discontinuity at the cutoff, with a sharp 100 percentage point jump in the probability of passing at the threshold. This indicates that the Baccalaureate cutoff rule was fully binding in practice and subsequently rules out any non-compliance issues.

5.3 Impact on Quantity of Education

In this section, we investigate whether marginally passing the Baccalaureate exam on the first round affects the quantity of education pursued.

We first check whether barely passing from the first attempt affects the likelihood of ever graduating from secondary school. In Panel A of Figure 5, we plot the probability of ever passing the French Baccalaureate exam as a function of the first exam score.[17] Panel A shows an insignificant treatment effect (0.003) on the probability of ever graduating from secondary school. Estimates for varying bandwidths and functional forms are reported in Panel A of Table 3, with the results remaining insignificant.

Next, we look at whether there is a treatment effect on the likelihood of receiving a post-baccalaureate degree. Panel B of Figure 5 shows no significant effect of threshold crossing on the probability of having a post-baccalaureate degree. The results remain insignificant over varying bandwidths and functional forms as is evident from Panel B of Table 3.

We then look at whether threshold crossing leads to variation in the number of years of postsecondary education pursued. In Panel C of Figure 5, we plot the years of post

[17] Global polynomial figures for all "Quantity of education" variables can be found in Appendix Figure A1.

baccalaureate education as a function of the first round exam scores. We also find no significant treatment effect. Corresponding regression estimates are reported in Panel C of Table 3. The estimates are consistent with the figure and rule out any significant effects.

Finally, we investigate whether threshold crossing affects the age of post-secondary graduation. In Panel D of Figure 5, we plot the age at graduation as a function of first round exam scores. We find a significant treatment effect (0.39 years) when using a local linear regression over a bandwidth of 1.5 points. However, as shown in Panel D of Table 3, this estimate is not robust to different bandwidths and functional forms.

All results remain unchanged when we add controls. These controls include exam specialization fixed effects, date of birth, number of siblings, birth order, socioeconomic status, scores on the Brevet examination, scores on the French portion of the Baccalaureate taken in grade 11 and scores in the grade 6 national assessment exam in Mathematics.

In summary, we rule out that passing the General Baccalaureate on the first attempt affects the quantity of education pursued.

5.4 Impact on Quality of Education

In this section, we explore whether passing the Baccalaureate exam on the first attempt affects quality of postsecondary education pursued. Specifically, we look at the impact of threshold crossing on the quality of institution attended and the likelihood of enrolling in a STEM major.

Stratifying institutions by tier is not as straightforward in France as it would be in the US. As a result, we rely on in-sample institution average Baccalaureate score as a proxy for institution quality.[18] A potential drawback to this approach is that the relatively small number of observations within each institution could lead to inference problems. Specifically, all individuals within the same institution share a common measurement error component. We correct for this by clustering at the institution level thus allowing for a grouped error

[18]Since this variable also measures peer quality, we compute average institution score for each individual after leaving him/her out.

structure. In Panel A of Figure 6, we plot the average student Baccalaureate score of each institution as a function of the first round exam score. As in previous figures, open circles represent local averages over a 0.25 score range. All figures represent a population weighted local linear regression using data within 1.5 points on either side of the threshold, which has again been chosen by the CCT bandwidth selector.[19]

We find a significant treatment effect to the order of 0.26 Baccalaureate points. This represents a 2.4 percent difference in average institution score for institutions just above the cutoff. This would be comparable to attending a US college that averaged 1024 SAT points off of a base college whose students averaged 1000 SAT points.[20] Since our study deals with marginal universities on either side of the threshold, as opposed to elite versus non-elite type universities, the order of magnitude seems reasonable and economically significant. To put things into perspective, Hoekstra (2009) finds a 20 percent earnings premium for males attending the most selective public university in their state. The average SAT score for students attending that university was 65 points higher than the next most selective university.

Panel A of Table 4 depicts discontinuity estimates using different bandwidths and functional forms. The estimates range from 0.21 to 0.29 Baccalaureate points and are all statistically significant at the 5% level. Additionally, the inclusion of controls does not significantly change the estimates, which is consistent with the identifying assumption.

To ease interpretation, we impose some structure on the above institution quality measure. Specifically, we create a binary indicator to designate an institution as higher versus lower quality.[21] Institutions where attended students average above the median on the Bac-

[19]Even though the negative slope on the right hand side of the threshold is not significant, it is consistent with discouragement type behavior. In Appendix A2, we also present global polynomial figures that reveal the entire fit.

[20]We arrive at this comparison in the following way: The average institution Baccalaureate score just to the left of the cutoff is 10.82 points. In our data, this corresponds to ranking in the 45th percentile of all students. We then compare this number to the 45th percentile score of SAT National Percentile Ranks, which is equivalent to 1000 (We use the Verbal + Mathematics percentile rank).

[21]To put things into perspective, simple OLS estimates without controls predict a 17 percent earnings premium from attending a higher quality university—as per our definition of quality.

calaureate exam are listed as higher quality, whereas those with scores below the median are listed as lower quality.[22] Panel B of Figure 6 shows that threshold crossing leads to a 15.3 percentage point increase in the likelihood of attending a higher quality university. Importantly, estimates are robust to varying bandwidths, functional forms and the inclusion of controls as can be seen in Panel B of Table 4. The above results indicate that barely passing the Baccalaureate exam from the first try leads to significant variation in the quality of institution attended.

Students in France simultaneously enroll in a postsecondary institution and field of study. Consequently, we check whether there is a discontinuity in the likelihood of being enrolled in a STEM versus non-STEM major. Panel C of Figure 6 plots the probability of being enrolled in a STEM major as a function of first exam score. Threshold crossing induces a 15.9 percentage point increase in the probability of being in a STEM major. Panel C of Table 4 reports the discontinuity estimates using different bandwidths and functional forms and with the inclusion of controls. All estimates remain statistically significant at the 5% level.

The data allows us to observe whether an individual graduates from a certain institution rather than just being admitted to an institution. This is potentially important as completion rates are sometimes low and vary across institutions, which would in turn complicate the interpretation of the results. Consequently, we present local linear estimates on the quality of institutions that students graduate from as well as the likelihood of graduating with a STEM-designated major in Appendix Figures A3. All figures show a clear discontinuity at the threshold, similar to the initial attendance figures. This lead us to conclude that any potential labor market effects should be the result of both attending and graduating with higher quality schooling.

[22] We also run this exercise with the 60th and 40th percentile marks as the higher quality and lower quality cutoffs respectively. Results remain similar.

5.5 Impact on Labor Market Outcomes

We now turn to whether the induced variation in the quality of education is associated with positive labor market returns. Figure 7 graphically depicts the relationship between labor market outcomes and the distance from the first round exam cutoff. All panels report estimates from local linear regressions using a bandwidth of 1.5 points, with standard errors clustered at the individual level.[23] We first check whether threshold crossing generates any significant changes in the likelihood of employment. In Panel A of Figure 7, we find an insignificant -0.008 percentage point change in the likelihood of employment at the threshold. As shown in Panel A of Table 5, all regression estimates remain statistically insignificant over varying bandwidths and functional forms. Further, the addition of controls does not significantly affect estimates.

We then explore whether threshold crossing affects earnings. Specifically, we focus on the average monthly net earnings for the years 2011 and 2012. The earnings from both years are stacked, resulting in up to two observations per individual. Accordingly, standard errors are clustered at the individual level. We look at net monthly earnings as a function of exam score in Panel B of Figure 7. We find that first round passing is associated with a €252 monthly premium. Additionally, in Panel C, we look at logged monthly earnings. We find that threshold crossing leads to a 12.8 log point (13.6 percent) increase in earnings. Corresponding regression estimates are shown in Panels B and C of Table 5. These estimates are robust to different bandwidths and functional forms. For instance, the estimates for logged earnings vary from 12.6 to 18 log points and are all statistically significant at the 1% level. Further, the addition of exogenous controls does not significantly alter the estimates for earnings, which is consistent with the identifying assumption. We conclude that while passing the Baccalaureate exam on the first try does not affect the likelihood of employment, it does significantly alter future earnings.

[23]Global polynomial figures for all "Labor market" variables can be found in Appendix Figure A4.

5.6 Robustness Checks

Before interpreting our results, we run additional robustness checks. Primarily, we address concerns that heaping in the running variable could lead to bias—even in the presence of balanced covariates. To alleviate such concerns, we run 'Donut' type RDs, as highlighted in Barreca, Lindo and Wadell (2013), by dropping all potentially manipulable data points. Specifically, scoring within 0.25 points to the left of a cutoff generally allows for a student's grade to be reconsidered. Further, grades are pushed to anywhere between X to X.1 points, with X representing a respective cutoff. As a result, we drop all individuals whose first exam grade lies anywhere between 7.75-8.1, 9.75-10.1, 11.75-12.1, 13.75-14.1 and 15.75-16.1 points. The new distribution of grades can be seen in Panel B of Figure 1. Regression estimates from these 'Donut' type RD specifications can be found in Tables 6, 7 and 8, where we report modified treatment estimates for quantity of education, quality of education and labor market outcomes respectively. We report all outcome variables over the same bandwidths and functional forms previously analyzed. Precision is reduced in most specifications, which is to be expected given the reduced data. However, all previously significant treatment effects remain so. Further, point estimates slightly increase for most specifications, which is at odds with a strategic sorting story. If jury members were endogenously sorting students, then we would expect our new point estimates to be significantly reduced.

Generally, jury members give special attention to grades that are within 0.25 points short of a cutoff. However, we cannot rule out the possibility of certain jury members awarding extra points for scores that are even further away from the threshold. To further investigate this issue, we take a closer look at the distribution of Baccalaureate test scores within a 9 to 11 grade window in Figure 8. Noticeably, the distribution of test scores drops sharply and linearly in the range of 9.65 to 9.99 Baccalaureate points. This sudden drop in the distribution is consistent with the potential for manipulation of test scores as reported in Dee et. al (2011). As a result, we further exclude from our 'Donut RD' analysis all individuals scoring between 9.65 and 9.75 points which effectively takes care of all test scores that could potentially be manipulated. We then reestimate all treatment effects. These results are also reported in Tables 6, 7 and 8. Precision is further reduced in most specifications. Nonetheless, all previously significant effects remain so. Altogether, the results from both Donut RD specifications reject a strategic sorting hypothesis and are in line with our main results and conclusions.

Finally, we check for earnings discontinuities at pseudo cutoff scores around the passing threshold score. To do so, we gradually estimate treatment effects for 50 fake cutoff scores on either side of the original passing threshold. We use logged monthly earnings as the outcome variable in this placebo test. Results indicate that the cutoff score of 10 provides for the largest and most significant discontinuity. Figure A5 of the appendix summarizes these findings by graphing t-statistics for these various placebo cutoff scores. The estimated t-statistic at the zero cutoff score represents the original one, with all others being placebo statistics for fake cutoff treatments relative to the original.[24] All significant estimates are highlighted in the graph with a large red filled circle. We observe only 2 significant treatment effects out of a possible 100. We conclude that no other important cutoff value (8 ,12, 14, 16) has a significant effect on earnings except for the original high stakes passing cutoff of 10. These results also provide further evidence on the importance of passing the Baccalaureate exam from the first round and the significant earnings premium that this induced variation leads to.

6 Discussion

6.1 Interpreting the documented labor market premium

We interpret our results as intent to treat effects whereby increased access to higher quality schooling results in a 13.6 percent earnings premium. We do so after ruling out other

[24] Each open circle represents the t-statistic from a local linear regression of bandwidth = 1.5 Baccalaureate points.

potential channels through which marginally passing the Baccalaureate exam on the first round could affect earnings. First, we show that there is no impact on the likelihood of ever being awarded the Baccalaureate degree. This is not surprising as students are required to hold the degree if they wish to enroll in postsecondary education. Furthermore, students who want to enter the labor force immediately after secondary school could use the baccalaureate degree as a signal of their ability to potential employers. Therefore, students are incentivized to retake the exam until they are awarded the degree. This is in line with recent evidence which finds that exit exams don't cause increased high school dropout rates (Clark and See, 2011). Second, we find that threshold-crossing has no impact on the likelihood of obtaining a post-baccalaureate degree nor on the years of postsecondary education. These results are expected given the vast number of non selective universities and majors in France whose only requirement for admission is holding the Baccalaureate degree.

Another factor that can affect the interpretation of our estimates is that the documented increase in earnings could be driven by employers who use passing on the first round as a signal of productivity. To alleviate such concerns, we focus on a segment of the population who have chosen not to attend college.[25] If employers are using the first round of the Baccalaureate exam as a signal of productivity, then we would expect the signal to be most pronounced for this segment of the population. Appendix Figure A6 shows that there is no threshold crossing effect on earnings for this subpopulation. While the estimate is not precise due to small sample issues, it is still comforting to see that there is no discernible discontinuity at the cutoff.[26] Furthermore, it is unlikely that employers are able to distinguish students who marginally passed and marginally failed the first round exams.

A final concern is that age of Baccalaureate or post Baccalaureate graduation is lower for marginal passers. In this case, at least part of the observed earnings premium might be explained by work experience. While we cannot reject the existence of a threshold crossing

[25]We have previously shown that there is no discontinuity in college attendance which is why we are not too wary about conditioning on non-college attendance.

[26]We use a quadratic polynomial regression because there is insufficient data to run meaningful local linear regressions.

effect on age of post baccalaureate graduation, the results indicate that marginally passing from the first attempt potentially increases the age at graduation. This would cause us to understate the earnings estimate, in so far as work experience is positively correlated with earnings. The results are not surprising given that some STEM majors require more time to complete in France. For example, engineering degrees are awarded after five years in higher education, as opposed to three years for most other degrees. Finally, for age at Baccalaureate receipt, Appendix figure A7 reveals no significant treatment effect.

6.2 Returns to STEM education?

Although it would be interesting to examine the effects for different subgroups of students, our sample size does not allow us to run a thorough heterogeneity analysis.

We do however investigate the impacts for students from lower socioeconomic backgrounds. This allows us to present suggestive evidence on the earnings premium of pursuing a STEM degree, holding quality of university constant. Specifically, we look at a subpopulation of students whose quality of schooling is likely to differ in only one dimension. In fact, students from lower socioeconomic backgrounds may be less likely to attend higher quality institutions. This seems plausible as the default choice of education in France is to attend the public university that is closest to the area of residence. These universities are not always of the highest quality and are a less expensive option for lower earning families, in terms of housing and transportation. Further, the possibility of pursuing a STEM degree at a lower quality university is higher than it would be at a better quality one. The results from Table 9 are consistent with this idea. Our preferred specification in column 3 suggests that students from low socioeconomic backgrounds are not attending better universities. However, they are 26.4 percentage point more likely to pursue a STEM degree.[27] We also estimate an 11.4 percent earnings premium for this subgroup of students. If we were to believe that no other changes were happening at the threshold, then rescaling the reduced form wage

[27]We do not provide any figures for these results as the smaller samples leads to the under-smoothing of mean plots.

estimate by the documented increase in the likelihood of pursuing a STEM major suggests a 43 percent return to pursuing a STEM designated major for students of low socioeconomic backgrounds.[28]

6.3 How does passing from the first round affect quality of higher education?

In this paper, we find that marginally passing the French Baccalaureate exam on the first attempt leads to an increase in quality of post secondary education as well as future earnings. We present three possible explanations for the observed increase in schooling quality.

First, universities could perceive the timing of degree receipt as a signal of student ability which would then factor into admissions decisions. This is reinforced by the fact that the second round of exams have lower standards for passing and are often deemed unreliable (see Buchaillat et al., 2011). Most public universities in France are not selective but they are capacity constrained. Back in 2002, they were required to give priority in their admissions to students residing in the same area. Other students usually enrolled on a "first come, first serve" basis. However, in a recent report, the National Union of Students in France (L'Union Nationale des Etudiants de France) found that some universities were using the results from the Baccalaureate exam to select students into majors that are in high demand. Thus, we cannot rule out selection by universities as a channel through which marginally failing the first round affects the quality of higher education.

Second, the documented impact of threshold crossing on higher education quality could be due to a discouragement effect. Marginally failing students may be discouraged by their results, making them more susceptible to impulsive educational decisions such as enrolling in lower quality universities or non-STEM majors. This discouragement effect has been previously documented in the literature by looking at whether exit exams induce increased

[28] It should be noted that this is only suggestive evidence as the threshold crossing effect on quality of university is not very precise.

high school dropout rates, with the results being mixed (Martorell, 2004; Arshan et al., 2010; Ou, 2010; Papay, 2010; Clark and See, 2011).

Third, students who sat for the second round of exams could have been at a disadvantage because universities admitted students on a "first come, first serve" basis. The results of the second round of exams were announced a week after the results of the first round. While this might seem like a short period of time, this extra week could still be an important advantage for those who wish to enroll in the university/major combinations that are in high demand. For instance, our education survey asks students whether they are content with the field they are pursuing and the reason they didn't enroll in the major of their choice. Amongst those who failed the first round, 11.88% said that they were too late in enrolling in their first choice of major. This number is only 4.88% for students who passed the first round exams.

6.4 How does quality of higher education affect earnings?

The two classical channels through which quality of higher education can affect earnings are human capital formation and signaling. Our measure of university quality is the average performance of peers in secondary school. Better peers can affect future earnings through both signaling (i.e. better peers attend better institutions) and human capital accumulation. One test of the signaling channel would be to look at whether the earnings effect decreases with age (Hoekstra, 2009). Our data only allows us to observe detailed labor market outcomes between the ages of 27 to 29.[29] Thus, we are unable to perform this test.

Another possible explanation for the earnings effect, that would favor the human capital channel, is that students who are marginally above the cutoff attend university/major combinations that have more resources. Most universities in France are public and receive most of their funding from the governement. Nonetheless, spending per student is different across

[29]Even though we observe labor market outcomes for years prior to this, detailed earnings data is only available for the last two years of the survey.

institutions. For example, universities spent, on average, 6,500 euros per student in 2000. This number is 8,600 euros in higher technical institutes. Students in engineering schools and preparatory classes for the "Grandes Ecoles" benefited from 11,500 and 12,600 euros respectively.[30] While students around the cutoff do not usually attend preparatory classes for the "Grandes Ecoles", there is still some heterogeneity in spending across different university/major combinations. Unfortunately, detailed data on spending per university is not available for the period of our study.[31] Therefore, we are unable to test whether higher quality universities and majors affect earnings through providing students with better resources.

7 Conclusion

This paper estimates the labor market gains to higher quality postsecondary education for academically marginal students. We use a regression discontinuity design that compares individuals who marginally pass and fail the French Baccalaureate exam on the first attempt. Specifically, we find that marginally passing increases the likelihood of attending a higher quality university and a STEM major by 15.3 and 15.9 percentage points respectively. Future earnings are also increased by 13.6 percent for marginal passers but we find no effect on employment. We find no impact on the likelihood of graduating from secondary school or college nor on years of postsecondary education. We interpret our results as intent to treat effects whereby increased access to higher quality postsecondary education results in a 13.6 percent earnings premium for 27 to 29 year olds in France.

Our results have significant policy implications. First, while it remains an open question as to the extent to which our results apply to other settings, they suggest that academically marginal students benefit from higher quality postsecondary education in a significant way. From a policy perspective, this indicates that there are potential gains from increasing

[30]Source: http://www.ladocumentationfrancaise.fr/var/storage/rapports-publics/034000148/0000.pdf

[31]This data was made available starting 2009. However, the algorithm used to allocate resources to universities also changed. As a result, it would misleading to use recent data on spending per university.

marginal students' access to better universities and STEM majors. Second, while we find that students who marginally fail the Baccalaureate are not discouraged from entering higher education or graduating college, our results suggest that there exist substantial costs associated with exit exams that have not yet been considered. Exit exams may restrict access to higher quality postsecondary education which in turn can have a significant impact on earnings. These costs should be considered in the current debate over the use of exit exams in the United States.

References

Altonji, J.G., Blom, E, Costas, M., 2012. Heterogeneity in Human Capital Investments: High school Curriculum, College Major, and Careers. *Annual Review of Economics* 4 (1): 185-223.

Andrews, R.J., Li, J., Lovenheim, M.F., 2012. Quantile Treatment Effects of College Quality on Earnings: Evidence from Administrative Data in Texas. *NBER Working Paper 18068.*

Arshan, N., Atterberry, A., Kurlaender, M., Reardon, S.F., 2010. Effects of Failing a High School Exit Exam on Course Taking, Achievement, Persistence, and Graduation. *Educational Evaluation and Policy Analysis* 32 (4): 498-520.

Barreca, A.I., Guldi, M., Lindo, J.M., Waddell, J.R., 2011. Saving babies? Revisiting the effect of very low birth weight classification. *The Quarterly Journal of Economics* 126 (4): 2117-2123.

Barreca, A.I., Lindo, J.M., Waddell, J.R., 2011. Heaping-induced bias in regression-discontinuity designs. *NBER Working Paper 17408.*

Black, D.A., Smith, J.A., 2004. How robust is the evidence on the effects of college quality? Evidence from matching. *Journal of Econometrics* 121 (1): 99-124.

Black, D.A., Smith, J.A., 2006. Estimating the Returns to College Quality with Multiple Proxies for Quality. *Journal of Labor Economics* 24 (3): 701-728.

Brewer, D., Eide, E., Ehrenberg, R., 1999. Does it Pay to Attend an Elite Private College? Cross-Cohort Evidence on the Effects of College Type on Earnings. *Journal of Human Resources* 34 (1): 104-123.

Buchaillat, M., Fort, M., Gauthier, R.F., Olivier, M., Steiner, R., Mathias, P., Kesler, S., 2011. Propositions pour une évolution du baccalauréat. *Rapport de l'inspection générale de l'éducation nationale No 2011-117.*

Calonico, S., Cattaneo, M,D., Titiunik, R., 2014. Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs. *Econometrica* 82 (6): 2295-2326.

Chiang, H., 2009. How accountability pressure on failing schools affects student achievement. *Journal of Public Economics* 93 (9): 1045-1057.

Clark, D., Martorell, P., 2014. The Signaling Value of a High School Diploma. *Journal of Political Economy* 122 (2): 282-318.

Clark, D., See, E., 2011. The impact of tougher education standards: Evidence from Florida. *Economics of Education Review* 30 (6): 1123-1135.

Dale, S.B., Krueger, A.B., 2002. Estimating the payoff to attending a more selective college: An application of selection on observables and unobservables. *The Quarterly Journal of Economics* 17 (4): 1491-1527.

Dale, S.B., Krueger, A.B., 2014. Estimating the return to college selectivity over the career using administrative earnings data. *Journal of Human Resources* 49 (2): 323-358.

Dee, T.S., Jacob, B.A., Rockoff, J.E., McCrary, J., 2011. Rules and discretion in the evaluation of students and schools: The case of the New York regents examinations. *Columbia Business School Research Paper.*

Ehrenberg, R.D., 2010. The Economics of Tuition and Fees in American higher Education, *in The International Encyclopedia of Education, 3rd Edition, (Oxford: Elsevier).*

Enquête sur l'entrée dans la vie adulte des élèves entrés en 6ème en 1995 (EVA) - 2005-2011 - (2011) [fichier électronique], INSEE [producteur], Centre Maurice Halbwachs (CMH) [diffuseur].

Figlio, D.N., Rouse, C.E., 2006. Do accountability and voucher threats improve low-performing schools? *Journal of Public Economics* 90 (1): 239-255.

Goodman, J., Hurwitz, M., Smith, J., 2014. College access, intial college choice and degree completion. *Harvard Kennedy School Faculty Research Working Paper Series 14-030.*

Hamermesh, D.S., Donald, S.G., 2008. The effect of college curriculum on earnings: An affinity identifier for non-ignorable non-response bias. *Journal of Econometrics* 144 (2): 479-491.

Hastings, J.S., Neilson, C.A., Zimmerman, S.D., 2013. Are some degrees worth more than others? Evidence from college admission cutoffs in Chile. *NBER Working Paper 19241.*

Hoekstra, M., 2009. The Effect of Attending the Flagship State University on Earnings: A Discontinuity-Based Approach. *The Review of Economics and Statistics* 91 (4), 717-24.

Imbens, G.W., Lemieux, T., 2008. Regression discontinuity designs: A guide to practice. *Journal of Econometrics* 142 (2), 615-35.

Jacob, B.A., 2005. Accountability, incentives and behavior: the impact of high-stakes testing in the Chicago Public Schools. *Journal of Public Economics* 89 (5): 761-796.

Jacob, B.A., Levitt, S.D., 2003. Rotten Apples: An Investigation of the Prevalence and Predictors of Teacher Cheating. *The Quarterly Journal of Economics* 118 (3): 843-877.

Kirkebøen, L., Leuven, E., Mogstad, M., 2014. Field of Study, Earnings, and Self-Selection. *NBER Working Paper 20816.*

Langdon, D., McKittrick, G., Beede, D., Khan, B., Doms, M., 2011. STEM: Good Jobs Now and for the Future. *ESA Issue Brief 03-11, US Department of Commerce.*

Lee, D.S, 2008. Randomized Experiments from Non-random Selection in U.S. House Elections. *Journal of Econometrics* 142 (2), 675-697.

Lee, D.S, Card, D. 2008. Regression discontinuity inference with specification error. *Journal of Econometrics* 142 (2), 655-674.

Lee, D.S., Lemieux, T., 2010. Regression discontinuity designs in economics. *Journal of Economic Literature* 48 (2), 281-355.

Martorell, P., 2004. Do High School Graduation Exams Matter? A Regression Discontinuity Approach. *UC Berkeley Manuscript.*

Martorell, P., McFarlin Jr., I., 2011. Help or hindrance? The effects of college remediation on academic and labor market outcomes. *The Review of Economics and Statistics* 93 (2): 436-454.

McRary, J., 2008. Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test. *Journal of Econometrics* 142(2), 698-714.

Melguzio, T., Wolniak, C. G., 2011. The Earnings Benefits of Majoring in STEM Fields Among High Achieving Minority Students. *Research in Higher Education* 53 (4), 383-405.

Oreopoulos, P., Petronijevic, U., 2013. Making College Worth it: A Review of Research on the Returns to Higher Education. *NBER Working Paper 19053*.

Ou, D., 2010. To Leave or Not to Leave? A Regression Discontinuity Analysis of the Impact of Failing the High School Exit Exam. *Economics of Education Review* 29 (2), 171-186.

Panel d'élèves du second degré, recrutement 1995 - 1995-2011 - (2006) [fichier électronique], DEPP — INSEE [producteur], Centre Maurice Halbwachs (CMH) [diffuseur].

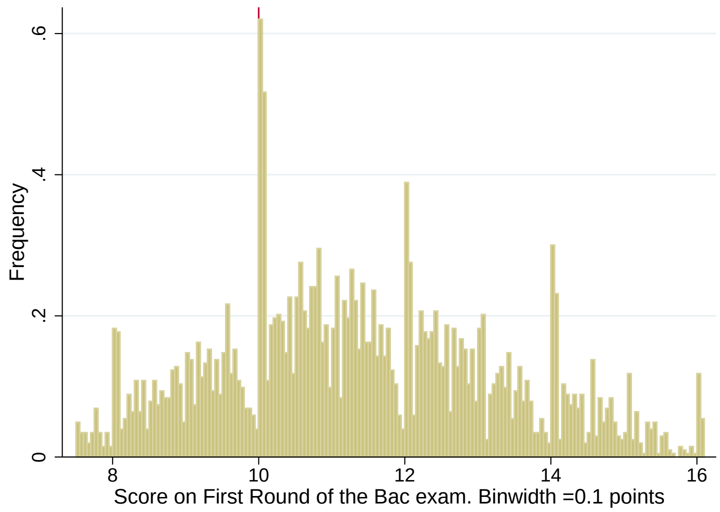
Saavedra, J., 2009. The Learning and Early Labor Market Effects of College Quality: A Regression Discontinuity Analysis. *Rand Corporation Working Paper.*

Spence, M., 1973. Job market signalling. *The Quarterly Journal of Economics* 87 (3), 355-374.

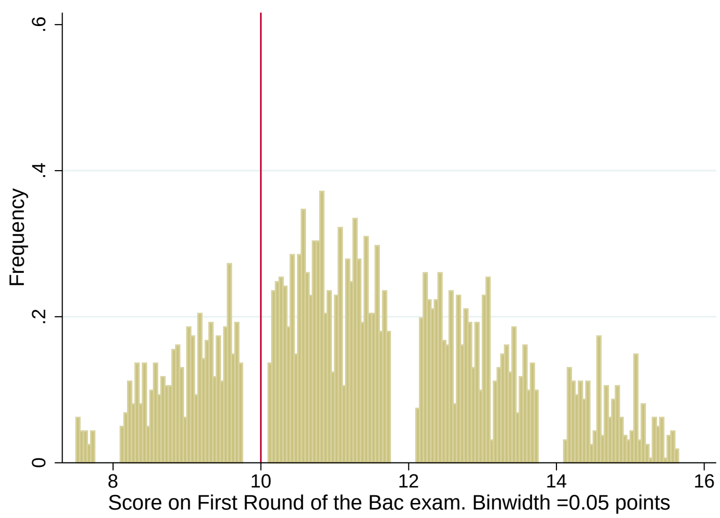
Zimmerman, S., 2014. The Returns to College Admission for Academically Marginal Students. *Journal of Labor Economics* 32 (4): 711-754.

A Figures

Figure 1: Distribution of scores on the first round of the French Baccalaureate in the year 2002.



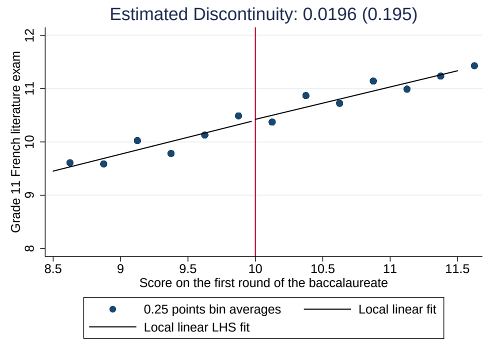
(a) Distribution of all students taking the exam.



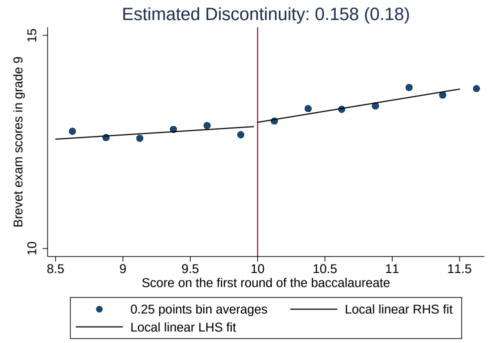
(b) Distribution of remaining students after cutting all heaped data)

Notes: Sample includes students who took the exam in the first round of the year 2002. Histograms reported with bin width of 0.05 points. Panel B drops all individuals scoring within 0.25 points to the left and 0.1 points to the right of each significant cutoff

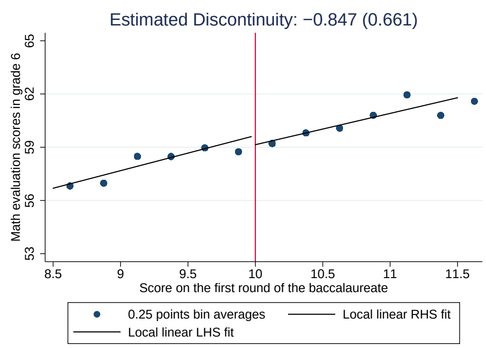
Figure 2: Testing for the smoothness of baseline characteristics



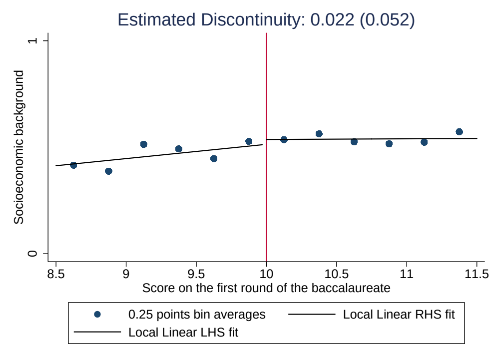
(a) National exam scores in French in grade 11



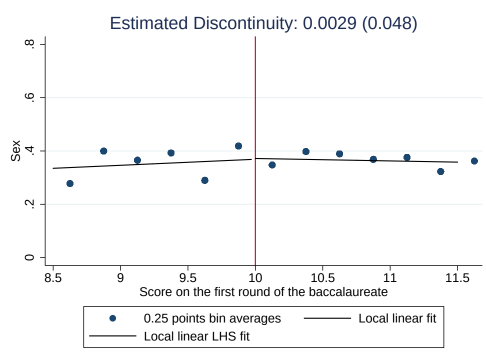
(b) Brevet exam scores in grade 9



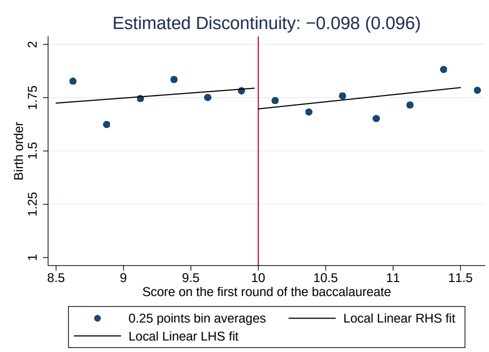
(c) Mathematics exam scores in grade 6



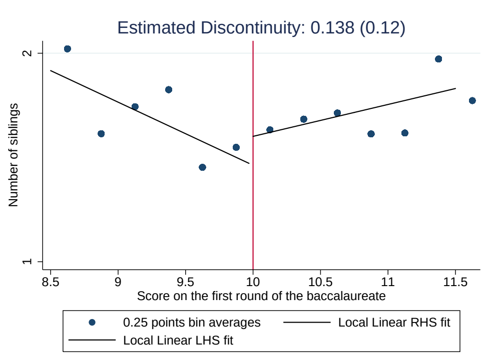
(d) Socioeconomic Status



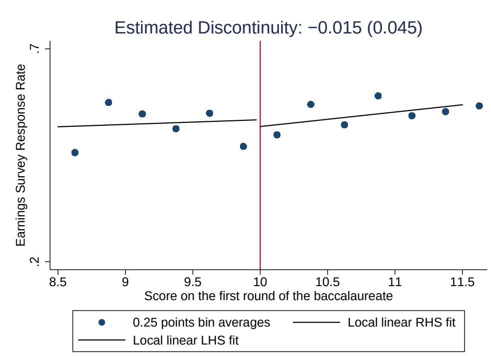
(e) Gender



(f) Birth order



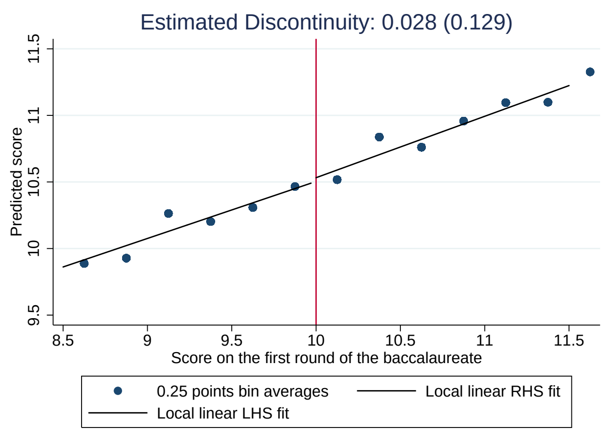
(g) Number of siblings



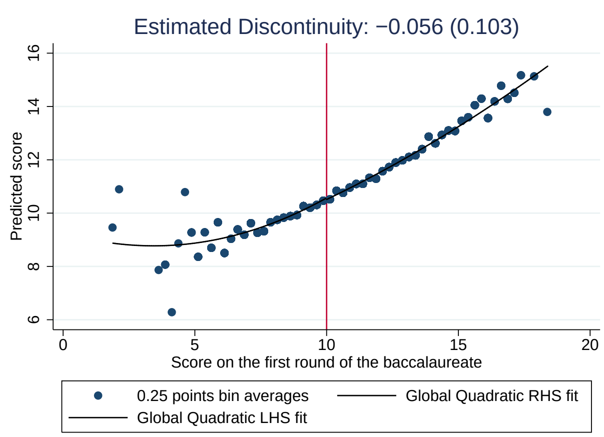
(h) Earnings Survey response rate

Notes: Sample includes students who took the exam in the first round of the year 2002. Robust standard errors reported in parentheses.

Figure 3: Predicted score based on baseline characteristics



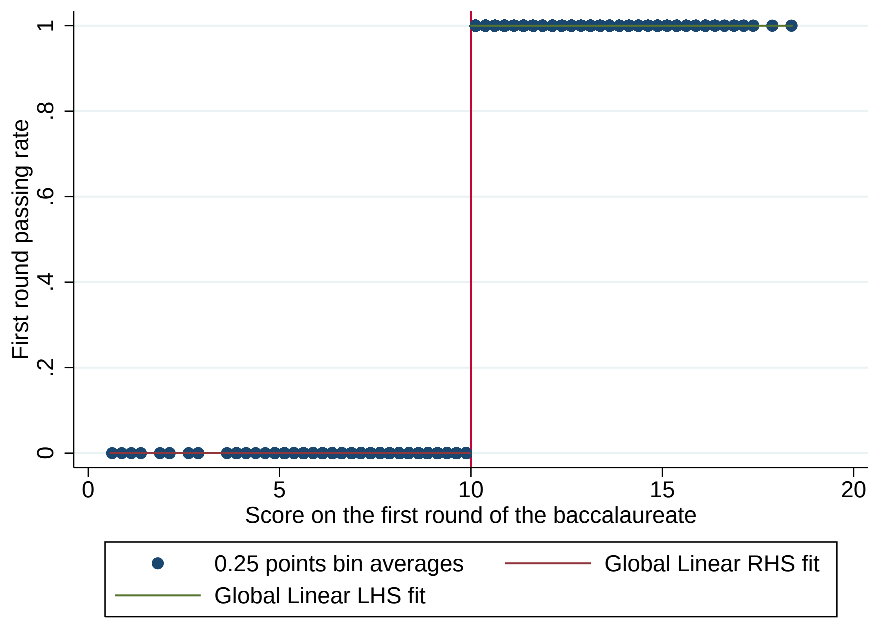
(a) Local linear



(b) Global Quadratic

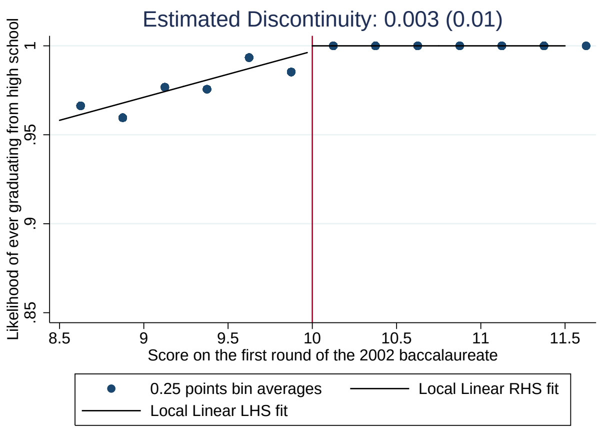
Notes: Sample includes students who took the exam in the first round of the year 2002. Robust standard errors reported in parentheses. Covariates include: Scores on the oral and written portion of the Grade 11 national French exam, Score on the Brevet exam in grade 9, mathematics scores on the grade 6 exam, socioeconomics status, number of siblings, birth order, place of residence and gender.

Figure 4: Likelihood of passing in the first round based on first round scores of the French Baccalaureate exam (Global linear graph)

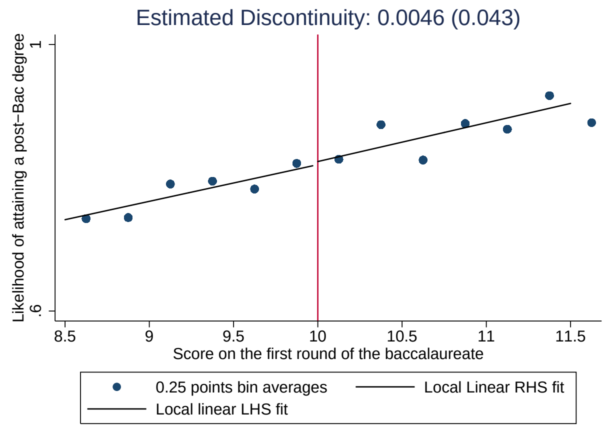


Notes: Sample includes students who took the exam in the first round of the year 2002. Robust standard errors reported in parentheses.

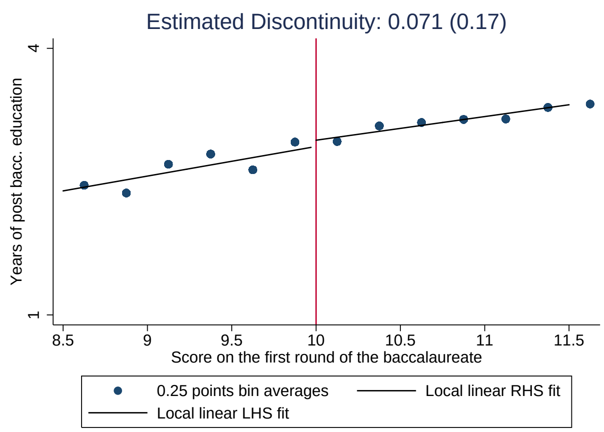
Figure 5: Quantity of education effects based on first round scores of the French Baccalaureate exam



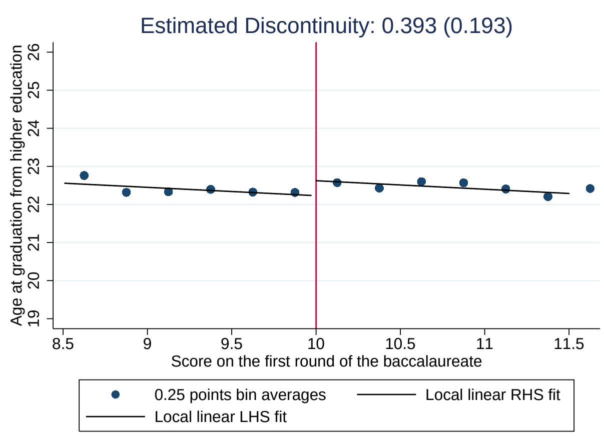
(a) Likelihood of attaining a high school degree



(b) Likelihood of attaining a Post-Baccalaureate degree



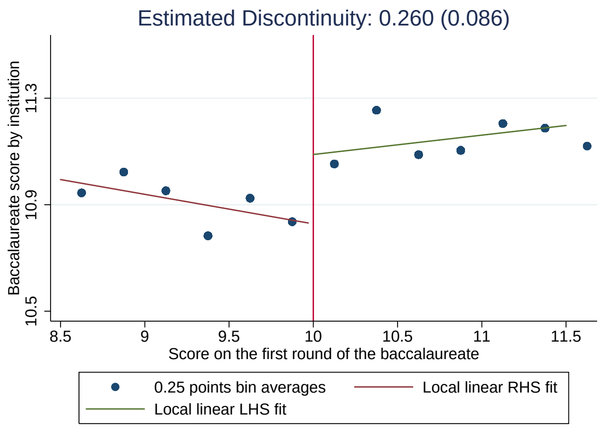
(c) Years of Post-Baccalaureate education



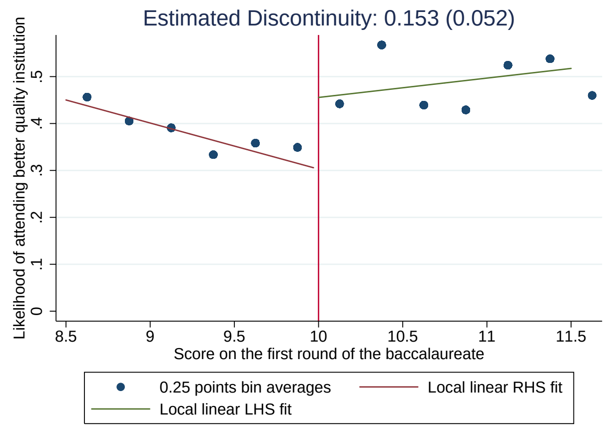
(d) Age at Post-Baccalaureate graduation

Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Robust standard errors reported in parentheses.

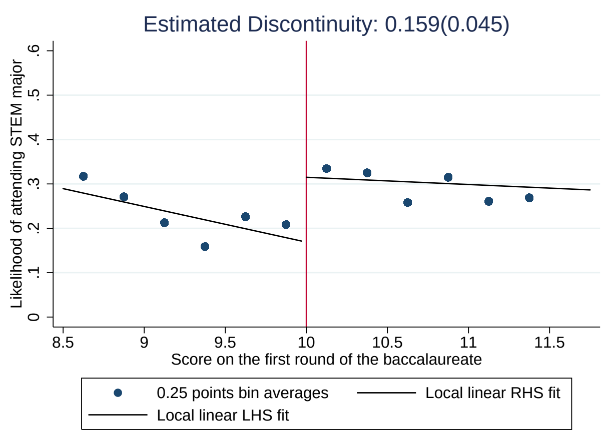
Figure 6: Quality of education effects based on first round scores of the French Baccalaureate exam



(a) Average Baccalaureate score by attended institution



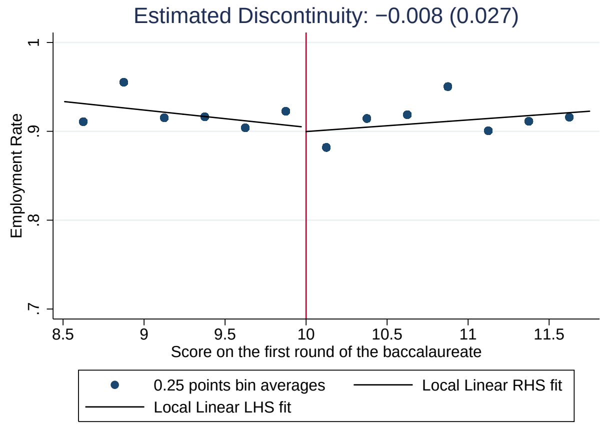
(b) Likelihood of attending a more selective university



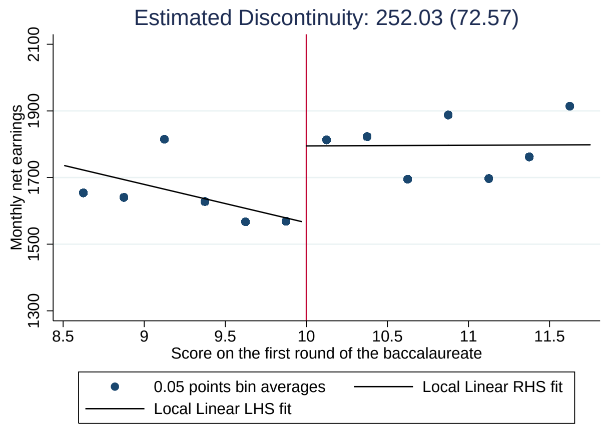
(c) Likelihood of attending STEM major

Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Standard errors clustered by university and reported in parentheses (Robust standard errors used for STEM estimates).

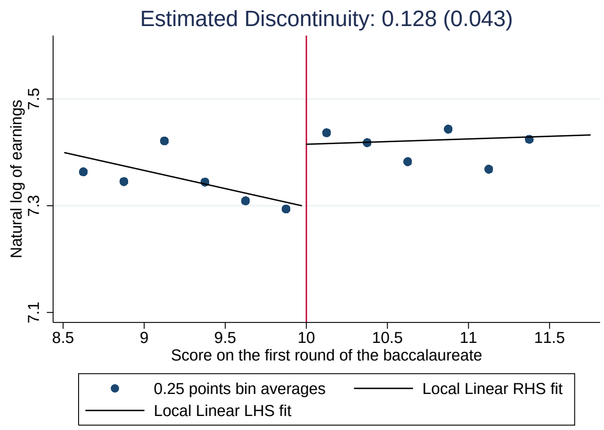
Figure 7: Labor market effects based on first round scores of the French Baccalaureate exam



(a) Likelihood of employment



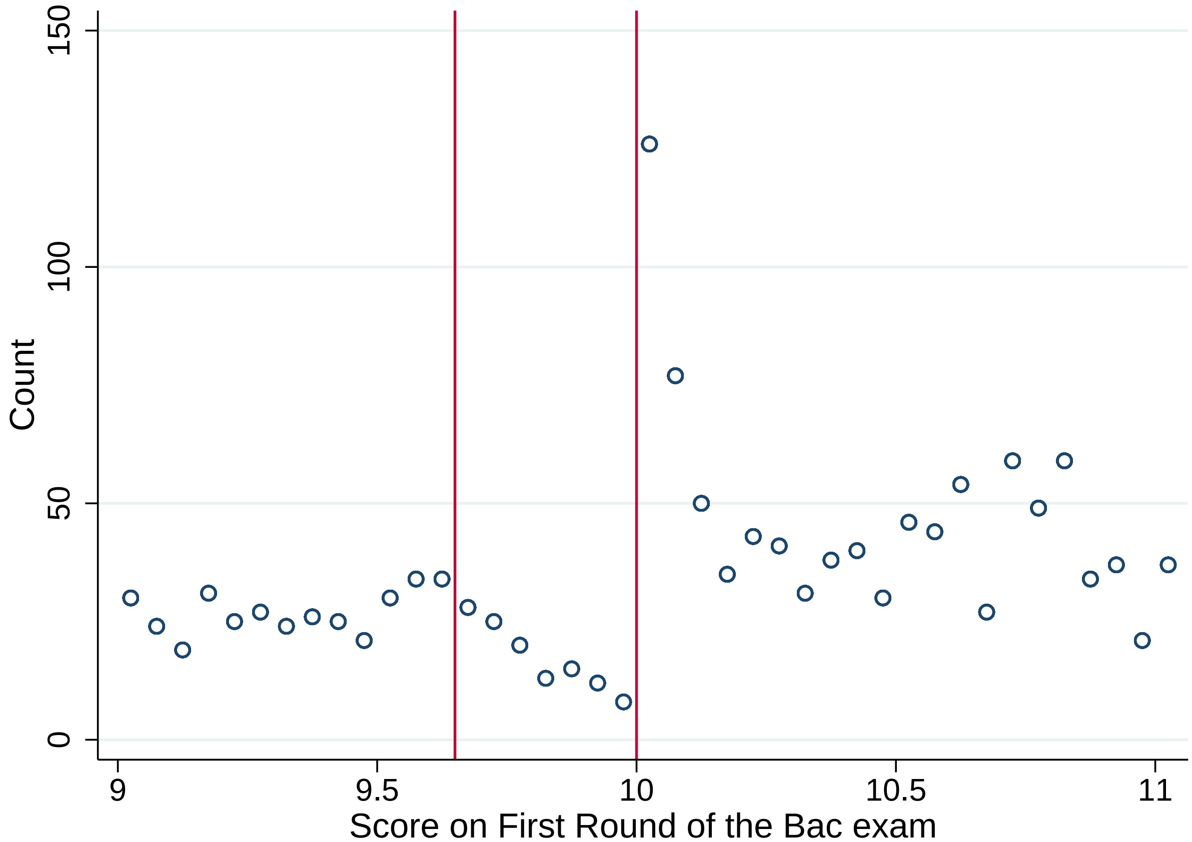
(b) Monthly earnings(in Euros)



(c) Monthly logged earnings

Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Wages are stacked for the two most recent years provided(2010-2011). Standard errors clustered at the individual level and reported in parentheses.

Figure 8: Distribution of scores on the first round of the French Baccalaureate in the year 2002 within a 9 to 11 Baccalaureate test score grade window.



Notes: Sample includes students who took the exam in the first round of the year 2002. Histogram reported with bin width of 0.05 points.

B Tables

Table 1: Summary statistics for students who sat for the first round of the 2002 General Baccalaureate exam

Variable	**Mean**
Male	**0.38**
	(0.48)
Birth order	**1.74**
	(0.95)
Number of siblings	**1.68**
	(1.17)
High S.E.S.	**0.57**
	(0.49)
Score on the Grade 6 Mathematics exam	**61.3**
	(8.62)
Score on the Brevet exam	**13.7**
	(1.95)
Score on the French oral exam	**12.2**
	(2.93)
Score on the French written exam	**10.2**
	(2.94)
Score on the Baccalaureate exam	**11.17**
	(1.38)
Percentage of first time passers	**0.75**
	(0.43)
High school graduation rate	**0.98**
	(0.14)
Years of Post-Baccalaureate education	**3.2**
	(1.63)
STEM enrollment rate	**0.28**
	(0.45)
Employment rate in 2011 and 2012	**0.93**
	(0.25)
Monthly earnings in 2011 (in Euros)	**1625**
	(818)
Monthly earnings in 2012 (in Euros)	**1725**
	(881)
Observations	4337

mean coefficients; sd in parentheses

The number of observations represents students with reported grades on the first round of the 2002 General Baccalaureate exam.

High S.E.S. is a dummy variable that represents father's occupation where 1 denotes higher skilled jobs and 0 denotes manual labor/ lower skilled jobs.

Table 2: Regression Discontinuity estimates for baseline covariates.

Bandwidth	0.25 points	1 points	1.5 points	2 points	2.5 points	5 points
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Discontinuity in Grade 11 French exam [Oral+ Written]	–.119	–.098	.020	–.260	–.044	.042
	(.26)	(.24)	(.20)	(.26)	(.24)	(.24)
Panel B: Discontinuity in Brevet exam in grade 9	.250	.131	.158	.193	.160	.101
	(.24)	(.23)	(.19)	(.25)	(.23)	(.23)
Panel C: Discontinuity in National Maths exam in grade 6	.424	.034	–.516	–1.323	–.352	–.786
	(1.06)	(1.09)	(.88)	(1.18)	(1.10)	(1.05)
Panel D: Discontinuity in S.E.S	.011	.094	.023	.037	.049	.049
	(.07)	(.07)	(.05)	(.07)	(.06)	(.06)
Panel E: Discontinuity in Gender	–.057	.002	.003	–.019	–.025	–.030
	(.07)	(.06)	(.05)	(.07)	(.06)	(.06)
Panel F: Discontinuity in birth order	.001	–.021	–.098	–.019	–.088	–.154
	(.13)	(.13)	(.10)	(.13)	(.12)	(.12)
Panel G:: Discontinuity in number of siblings	.080	.205	.138	.228	.103	.098
	(.14)	(.14)	(.12)	(.15)	(.14)	(.14)
Panel H:: Discontinuity in probability of being in earnings survey	.045	–.020	–.016	–.010	–.011	.018
	(.05)	(.04)	(.04)	(.05)	(.04)	(.04)
Score Polynomial	Zero	One	One	Two	Two	Three
Observations	401	1310	1855	2314	2717	3802

Notes: Sample includes students who took the French Baccalaureate in the first round of 2002. Each cell represents a separate regression with baseline covariates as the dependent variable and the treatment variable ‘scoring above 10 points’.
All specifications control for a flexible polynomial of score in which the slope is allowed to vary on either side of the cutoff.
Robust standard errors reported in parentheses. Socioeconomic status proxied by father’s occupation.
Brevet exam graded from 0 to 20. Grade 6 exam graded from 0 to 78.
*** p <0.01 ** p <0.05 * p <0.1

Table 3: Regression discontinuity estimates for quantity of education measures

Bandwidth	0.5 points (1)	1 points (2)	1.5 points (3)	2 points (4)	2.5 points (5)	5 points (6)
Panel A: Discontinuity in likelihood of ever graduating secondary school	.010	.003	.003	−.005	−.008	.045**
	(.01)	(.01)	(.01)	(.01)	(.01)	(.02)
With Controls	.012	.003	.009	−.000	−.003	.045**
	(.01)	(.01)	(.01)	(.02)	(.01)	(.02)
Panel B: Discontinuity in likelihood of having a post Baccalaureate degree	.050	.019	.005	−.018	.016	.023
	(.04)	(.05)	(.04)	(.06)	(.05)	(.05)
With Controls	.051	.007	.003	−.016	.013	.003
	(.04)	(.06)	(.05)	(.06)	(.06)	(.06)
Panel C: Discontinuity in years of Post-Baccalaureate education	.304**	.125	.071	.051	.070	.065
	(.14)	(.21)	(.17)	(.23)	(.21)	(.21)
With Controls	.355**	.185	.151	.172	.139	.079
	(.16)	(.23)	(.18)	(.24)	(.22)	(.22)
Panel D: Discontinuity in age at Post-Baccalaureate graduation	0.201	0.191	0.393**	0.361	0.332	0.317
	(0.15)	(0.23)	(0.19)	(0.23)	(0.21)	(0.21)
With Controls	.273	.229	.450**	.396	.355	.288
	(.18)	(.26)	(.21)	(.28)	(.25)	(.25)
Score Polynomial	Zero	One	One	Two	Two	Three
Observations	679	1310	1855	2316	2720	3807

Notes: Sample includes students who took the French Baccalaureate in the first round of 2002.
Each cell represents a separate regression with educational outcomes as the dependent variable and the treatment variable 'scoring above 10 points'.
All specifications control for a flexible polynomial of score in which the slope is allowed to vary on either side of the cutoff.
Controls include exam specialization fixed effects, date of birth, number of siblings,birth order, socioeconomic status, scores on the Brevet examination, score on the grade 11 national French exam and scores in grade 6 national assessment exam in mathematics. Number of observations reduced slightly with the addition of controls.
*** p <0.01 ** p <0.05 * p <0.1. Robust standard errors reported in parentheses.

Table 4: Regression discontinuity estimates for education quality measures using different bandwidths and specifications

Bandwidth	0.5 points	1 points	1.5 points	2 points	2.5 points	5 points
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Discontinuity in average institution Baccalaureate score	.217***	.246**	.261***	.307**	.260***	.292**
	(.07)	(.10)	(.09)	(.12)	(.10)	(.12)
With Controls	.222***	.233**	.257***	.293***	.234***	.259***
	(.07)	(.09)	(.07)	(.10)	(.08)	(.09)
Panel B: Discontinuity in Institution Quality	.130***	.143**	.153***	.190***	.165**	.162**
	(.04)	(.07)	(.05)	(.07)	(.06)	(.06)
With Controls	.122**	.123*	.158***	.175**	.158**	.139**
	(.05)	(.07)	(.05)	(.07)	(.06)	(.06)
Panel C: Discontinuity in likelihood of being in STEM major	.107***	.124**	.159***	.151**	.160***	.170***
	(.04)	(.06)	(.05)	(.06)	(.06)	(.05)
With Controls	.116***	.115**	.161***	.157***	.167***	.163***
	(.04)	(.05)	(.04)	(.06)	(.05)	(.05)
Score Polynomial	Zero	One	One	Two	Two	Three
Observations	630	1254	1793	2245	2641	3715

Notes: Sample includes students who took the French Baccalaureate in the first round of 2002.
Each cell represents a separate regression with educational outcome as the dependent variable and the treatment variable 'scoring above 10 points'.
All specifications control for a flexible polynomial of score in which the slope varies on either side of the cutoff.
Our preferred specification for earnings is the local linear regression of bandwidth 1.5 points, which has been computed using the method proposed in Calocino et. al (2014).
Controls include exam specialization fixed effects, date of birth, number of siblings,birth order, socioeconomic status, scores on the Brevet examination, score on the grade 11 national French exam and scores in grade 6 national assessment exam in Mathematics. Number of observations reduced slightly with the addition of controls.
*** p <0.01 ** p <0.05 * p <0.1. Standard errors clustered by university and reported in parentheses (Robust standard errors used for STEM estimates)

Table 5: Regression discontinuity estimates for labor market outcomes using different bandwidths and specifications

Bandwidth	0.5 points (1)	1 points (2)	1.5 points (3)	2 points (4)	2.5 points (5)	5 points (6)
Panel A: Discontinuity in						
Employment rates	−.019	−.029	−.008	−.015	.009	.002
	(.02)	(.03)	(.03)	(.04)	(.03)	(.03)
With Controls	−.033	−.035	−.020	−.024	.006	−.003
	(.02)	(.04)	(.03)	(.04)	(.04)	(.04)
Panel B: Discontinuity in						
monthly earnings (Euros)	250.29***	343.57***	252.03***	340.58***	279.5***	255.40***
	(62.59)	(92.57)	(72.57)	(96.56)	(87.96)	(88.00)
With Controls	218.58***	275.13***	242.72***	313.47***	243.42***	222.49**
	(63.15)	(93.95)	(72.07)	(97.41)	(87.24)	(87.18)
Panel C: Discontinuity in						
monthly logged earnings	.126***	.180***	.128***	.176***	.142***	.147***
	(.04)	(.06)	(.04)	(.06)	(.05)	(.06)
With Controls	.120***	.140**	.129***	.172***	.132**	.144**
	(.04)	(.06)	(.05)	(.06)	(.06)	(.06)
Score Polynomial	Zero	One	One	Two	Two	Three
Observations	711	1404	1991	2532	3003	4296

Notes: Sample includes students who took the French Baccalaureate in the first round of 2002.
Each cell represents a separate regression with labor market outcomes as the dependent variable and the treatment variable 'scoring above 10 points'.
All specifications control for a flexible polynomial of score in which the slope is allowed to vary on either side of the cutoff.
Standard errors are clustered at the individual level and reported in parentheses.
Our preferred specification for earnings is the local linear regression of bandwidth 1.5 points, which has been computed using the method proposed in Calocino et. al (2014).
Controls include exam specialization fixed effects, date of birth, number of siblings,birth order, socioeconomic status, scores on the Brevet examination, score on the grade 11 national French exam, scores in grade 6 national assessment exam in Mathematics. Number of observations reduced slightly with the addition of controls.
Standard errors are clustered at the individual level and reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1

Table 6: 'Donut' type Regression discontinuity estimates for quantity of education variables

Bandwidth	0.5 points	1 points	1.5 points	2 points	2.5 points
	(1)	(2)	(3)	(4)	(5)
Panel A: Discontinuity in likelihood of ever graduating secondary school					
(Excluding [**9.75-10.1**] region)	.007	−.006	−.002	−.023	−.024
	(.01)	(.01)	(.01)	(.02)	(.02)
(Excluding [**9.65-10.1**] region)	.011	−.000	.002	−.022	−.024
	(.01)	(.02)	(.02)	(.03)	(.02)
Panel B: Discontinuity in likelihood of having a post Baccalaureate degree					
(Excluding [**9.75-10.1**] region)	.010	.078	.068	.019	.003
	(.06)	(.08)	(.06)	(.09)	(.08)
(Excluding [**9.65-10.1**] region)	.085	.074	.017	−.009	.061
	(.05)	(.10)	(.06)	(.11)	(.09)
Panel C: Discontinuity in years of Post-Baccalaureate education					
(Excluding [**9.75-10.1**] region)	.443**	.318	.145	.226	.211
	(.17)	(.31)	(.22)	(.34)	(.30)
(Excluding [**9.65-10.1**] region)	.406**	.172	.039	.030	.059
	(.20)	(.37)	(.25)	(.41)	(.35)
Score Polynomial	Zero	One	One	Two	Two
Observations (excluding 9.75-10.1)	411	1042	1587	2048	2452
Observations (excluding 9.65-10.1)	361	992	1537	1998	2402

Notes: Sample includes students who took the French Baccalaureate in the first round of 2002.
Each cell represents a separate regression with educational outcomes as the dependent variable and the treatment variable 'scoring above 10 points'.
All specifications control for a flexible polynomial of score in which the slope is allowed to vary on either side of the cutoff.
*** p <0.01 ** p <0.05 * p <0.1. Robust standard errors reported in parentheses.

Table 7: ‘Donut’ type Regression discontinuity estimates for quality of education variables

Bandwidth	0.5 points	1 points	1.5 points	2 points	2.5 points
	(1)	(2)	(3)	(4)	(5)
Panel A: Discontinuity in average institution Baccalaureate score					
(Excluding [**9.75-10.1**] region)	.291***	.377***	.337***	.455***	.387***
	(.08)	(.13)	(.09)	(.17)	(.12)
(Excluding [**9.65-10.1**] region)	.286***	.425***	.362***	.530***	.414***
	(.09)	(.15)	(.11)	(.19)	(.13)
Panel B: Discontinuity in likelihood of being in STEM major					
(Excluding [**9.75-10.1**] region)	.111**	.150*	.187***	.209**	.209***
	(.05)	(.08)	(.06)	(.09)	(.08)
(Excluding [**9.65-10.1**] region)	.127**	.207**	.231***	.286***	.270***
	(.05)	(.10)	(.07)	(.11)	(.09)
Score Polynomial	Zero	One	One	Two	Two
Observations (excluding 9.75-10.1)	403	1027	1566	2018	2414
Observations (excluding 9.65-10.1)	358	982	1521	1973	2369

Notes: Sample includes students who took the French Baccalaureate in the first round of 2002.
Sample includes students who took the French Baccalaureate in the first round of 2002.
Each cell represents a separate regression with labor market outcomes as the dependent variable and the treatment variable ‘scoring above 10 points’.
All specifications control for a flexible polynomial of score in which the slope is allowed to vary on either side of the cutoff.
Standard errors are clustered at the individual level and reported in parentheses.
*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$. Standard errors clustered by university and reported in parentheses (Robust standard errors used for STEM estimates).

Table 8: 'Donut' type Regression discontinuity estimates for labor market variables

Bandwidth	0.5 points	1 points	1.5 points	2 points	2.5 points
	(1)	(2)	(3)	(4)	(5)
Panel A: Discontinuity in likelihood of employment					
(Excluding [**9.75-10.1**] region)	−.011	−.021	.012	.020	.050
	(.03)	(.05)	(.04)	(.06)	(.05)
(Excluding [**9.65-10.1**] region)	−.032	−.061	−.008	−.022	.031
	(.03)	(.06)	(.04)	(.07)	(.06)
Panel B: Discontinuity in net monthly earnings					
(Excluding [**9.75-10.1**] region)	276.763***	439.358***	275.388***	457.806***	321.402***
	(81.43)	(138.75)	(94.90)	(145.81)	(124.27)
(Excluding [**9.65-10.1**] region)	236.559***	401.969**	211.524**	367.397**	224.037
	(89.70)	(162.32)	(105.61)	(168.49)	(141.90)
Score Polynomial	Zero	One	One	Two	Two
Observations (excluding 9.75-10.1)	433	1128	1715	2256	2727
Observations (excluding 9.65-10.1)	375	1070	1657	2198	2669

Notes: Sample includes students who took the French Baccalaureate in the first round of 2002.
Sample includes students who took the French Baccalaureate in the first round of 2002.
Each cell represents a separate regression with labor market outcomes as the dependent variable and the treatment variable 'scoring above 10 points'.
All specifications control for a flexible polynomial of score in which the slope is allowed to vary on either side of the cutoff.
Standard errors are clustered at the individual level and reported in parentheses.
*** $p < 0.01$ ** $p < 0.05$ * $p < 0.1$. Standard errors clustered at the individual level and reported in parentheses.

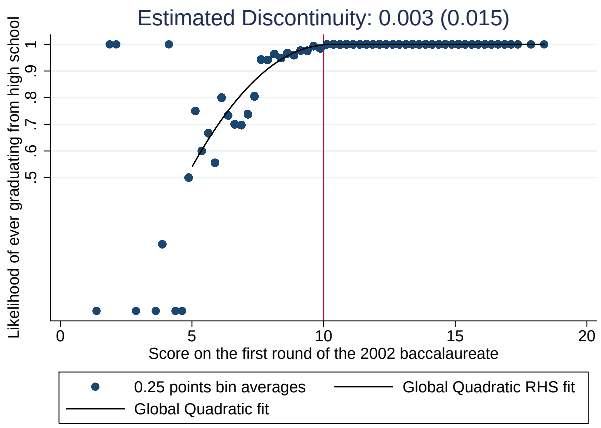
Table 9: Regression discontinuity estimates for individuals from low socioeconomic backgrounds

Bandwidth	0.5 points	1 points	1.5 points	2 points	2.5 points	5 points
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Averaged institution						
Baccalaureate score	.149	.107	.173	.235	.159	.059
	(.10)	(.17)	(.12)	(.18)	(.17)	(.10)
Panel B: Likelihood of being in						
higher quality institution	.052	.035	.067	.101	.068	.059
	(.06)	(.10)	(.08)	(.11)	(.10)	(.10)
Panel C: Likelihood of being in						
STEM major	.178***	.234***	.264***	.296***	.304***	.317***
	(.05)	(.07)	(.06)	(.08)	(.07)	(.07)
Panel D: Monthly logged earnings	.138***	.187***	.108**	.188***	.126**	.129**
	(.04)	(.06)	(.05)	(.06)	(.06)	(.06)
Score Polynomial	Zero	One	One	Two	Two	Three
Observations	327	674	959	1181	1369	1795

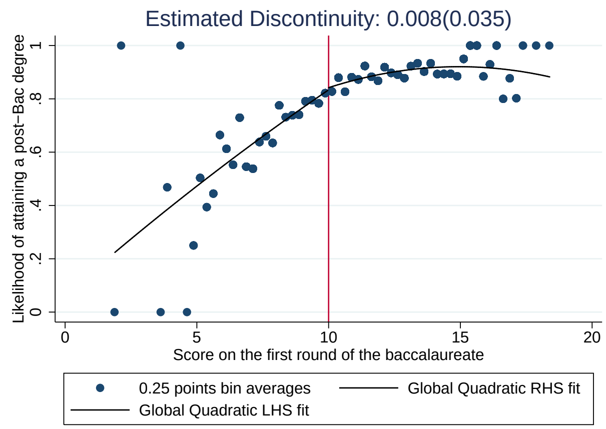
Notes: Number of observations corresponds to the earnings measures. This number is smaller for the quality outcome measures. Sample includes students who took the French Baccalaureate in the first round of 2002.
Each cell represents a separate regression with previously significant outcome variables as the dependent variable and the treatment variable 'scoring above 10 points'.
All specifications control for a flexible polynomial of score in which the slope is allowed to vary on either side of the cutoff.
Standard errors are clustered at the individual level and reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1

C Appendix Figures

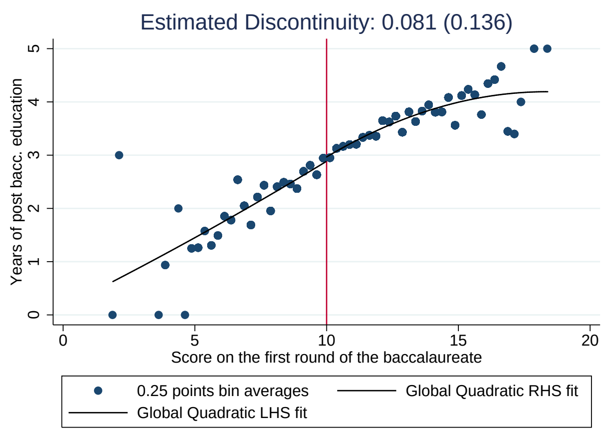
Figure A1: Quantity of education effects based on first round scores of the French Baccalaureate exam (Global Polynomial Graphs).



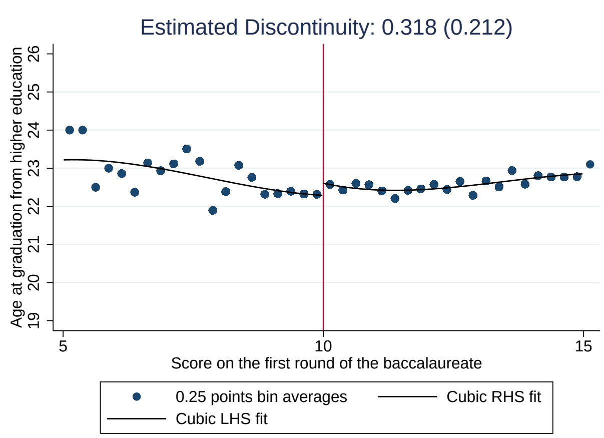
(a) Likelihood of attaining a high school degree



(b) Likelihood of attaining a Post-Baccalaureate degree



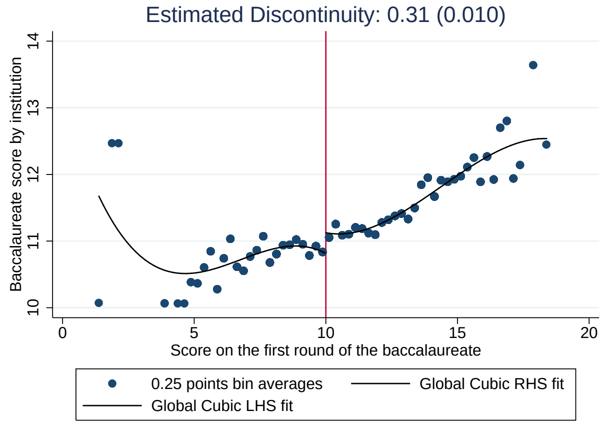
(c) Years of Post-Baccalaureate education



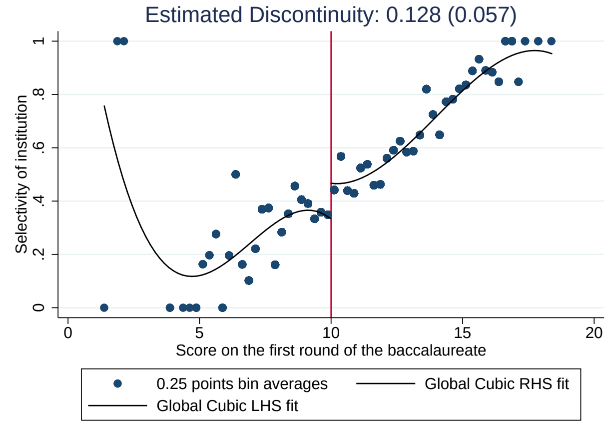
(d) Age at Post-Baccalaureate graduation

Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Robust standard errors reported in parentheses.

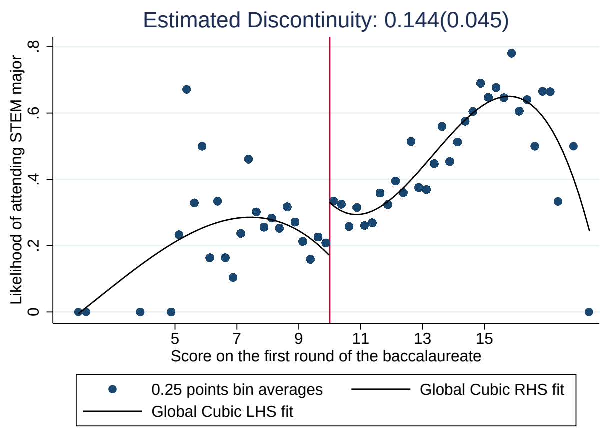
Figure A2: Quality of education effects based on first round scores of the French Baccalaureate exam (Global polynomial graphs)



(a) Average Baccalaureate score by attended institution



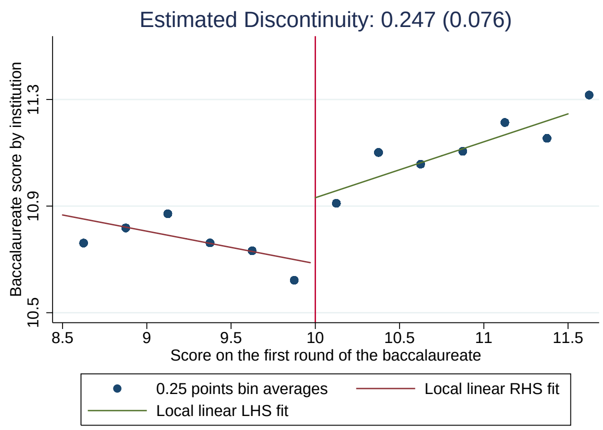
(b) Likelihood of attending a more selective university



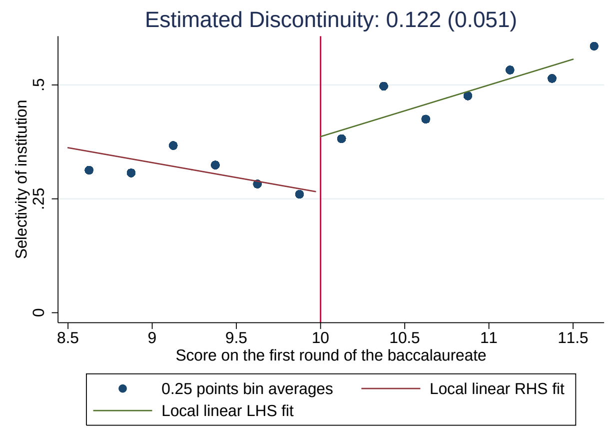
(c) Likelihood of attending STEM major

Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Robust standard errors reported in parentheses.

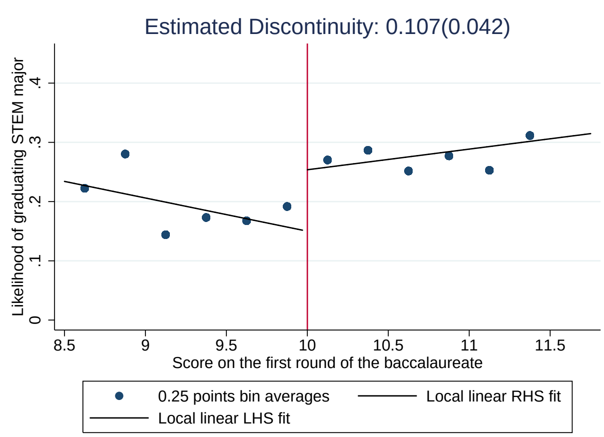
Figure A3: Quality of education ‘graduation’ effects based on first round scores of the French Baccalaureate exam



(a) Average Baccalaureate score by graduated institution



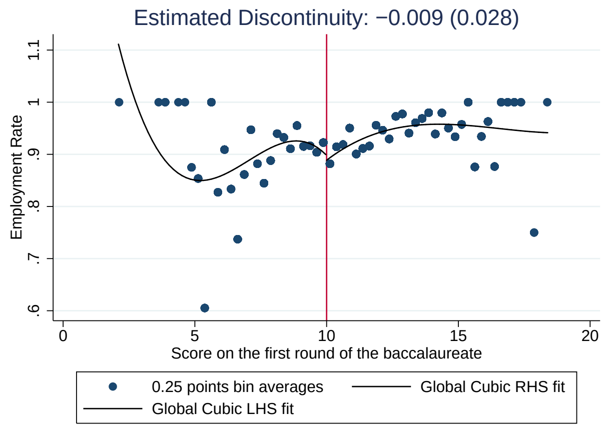
(b) Likelihood of graduating a more selective university



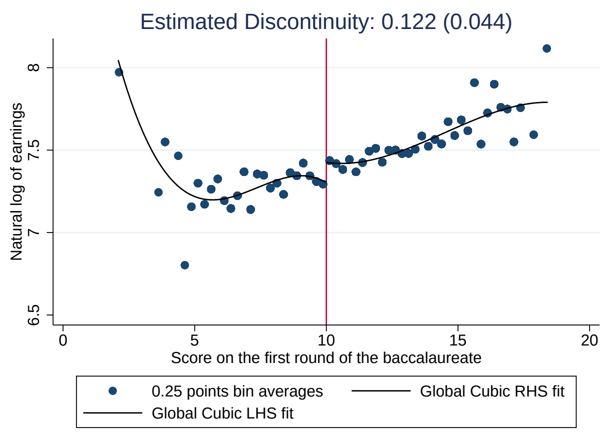
(c) Likelihood of graduating STEM major

Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Robust standard errors reported in parentheses.

Figure A4: Labor market effects based on first round scores of the French Baccalaureate exam (Global Polynomial Graphs)



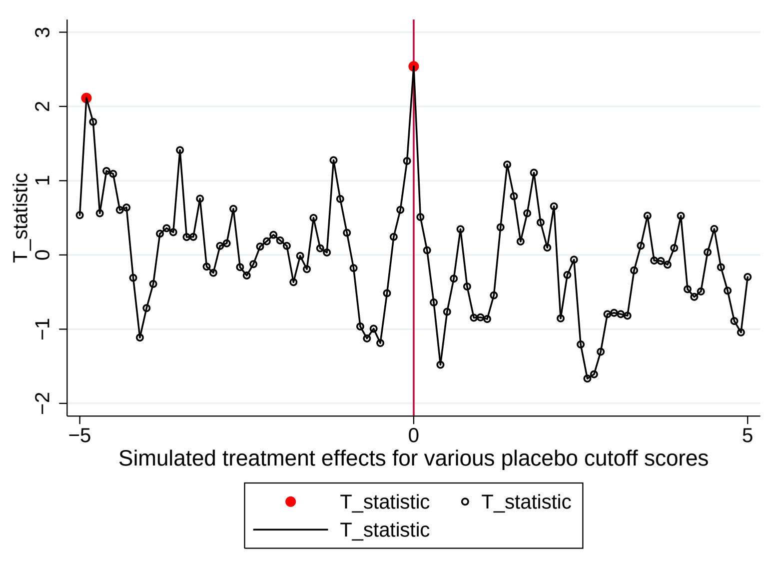
(a) Likelihood of employment



(b) Monthly logged earnings

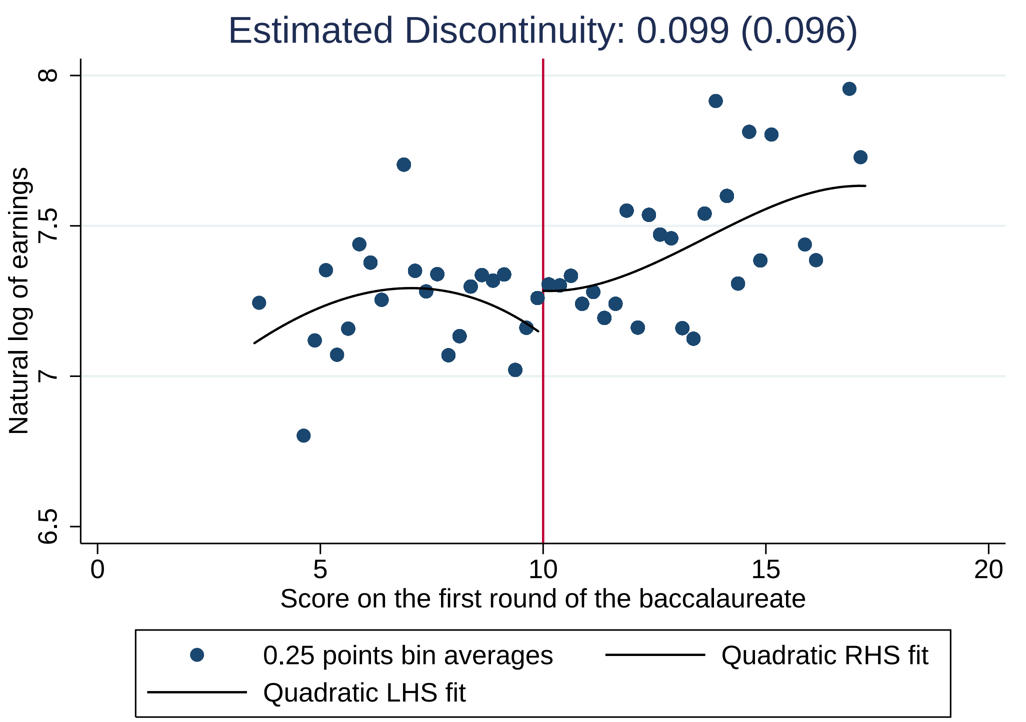
Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Wages are stacked for the two most recent years provided(2010-2011). Standard errors clustered at the individual level and reported in parentheses.

Figure A5: Placebo test - T-statistics for reduced form effects on logged monthly wages using various fake cutoff scores



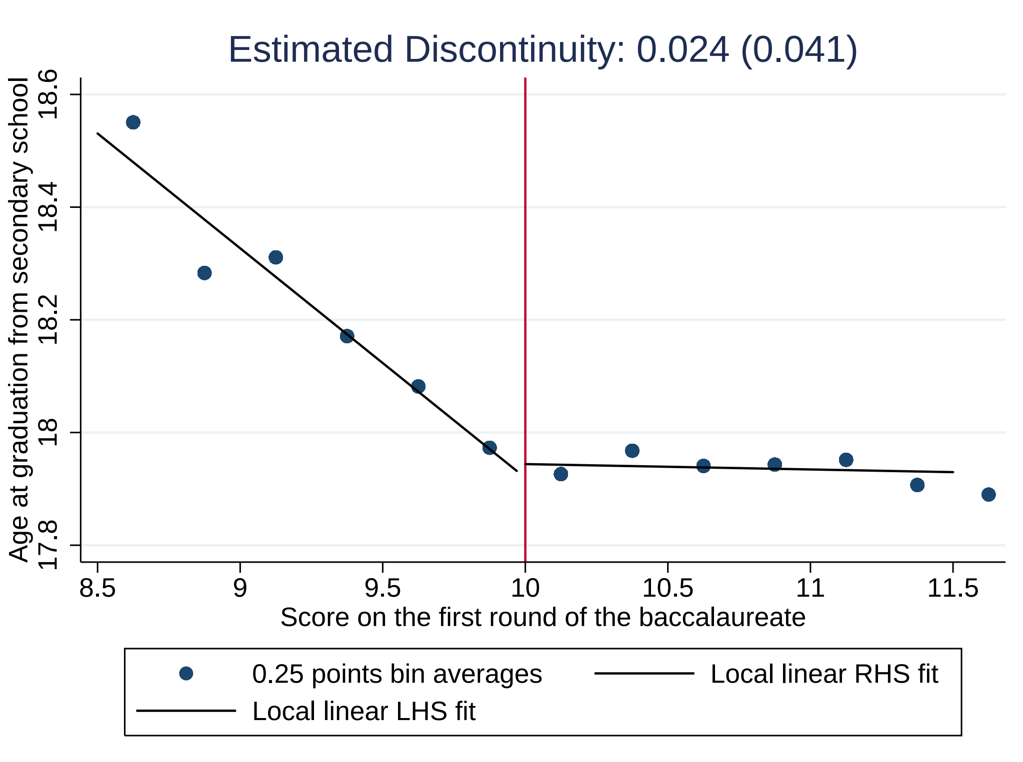
Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Each open circle represents the t-statistic from a local linear regression of bandwidth = 1.5 Baccalaureate points, using logged monthly wages as the dependent variable. A grade of zero on the x-axis represents the original passing threshold grade of 10, and we simulate 50 fake cutoff treatment effects to the right and left of that point within intervals of 0.1 score points. Clustered standard errors are used for computation of t-stats.

Figure A6: Discontinuity in earnings for individuals who never attended college (Global Polynomial Graph)



Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Wages are stacked for the two most recent years provided(2010-2011). Standard errors clustered at the individual level and reported in parentheses.

Figure A7: Discontinuity in age at graduation from secondary school



Notes: Sample includes students who took the French Baccalaureate in the first round of the year 2002. Robust standard errors reported in parentheses.

D Appendix Tables

Table A1: Regression discontinuity estimates for baseline characteristics at all important cutoffs

	cutoff = 8	cutoff = 12	cutoff = 14	cutoff = 16
Panel A: Disc. in French lit. exam	.403	.056	–.033	–.579
	(.33)	(.18)	(.25)	(0.43)
Panel B: Disc. in Brevet exam in grade 9	.032	.109	–.227	–.458
	(.29)	(.17)	(.24)	(0.41)
Panel C: Disc. in Grade 6 math exam	2.090	1.164	–.086	–1.071
	(1.62)	(.76)	(.86)	(1.74)
Panel D: Disc. in S.E.S	.02	–.024	–.069	–.183
	(.07)	(.05)	(.06)	(.13)
Panel E: Disc. in Gender	–.158**	.042	–.044	–.084
	(.08)	(.05)	(.06)	(.12)
Panel F: Disc in birth order	–.038	–.120	.053	.173
	(.15)	(.08)	(.11)	(.19)
Panel G: Disc in no. of siblings	–.241	–.206*	–.377***	.279
	(.25)	(.11)	(.14)	(.23)
Observations	694	1648	880	258

Notes: Sample includes students who took the French Baccalaureate in the first round of 2002.
Each cell represents a separate regression with baseline covariates as the dependent variable
and the treatment variable 'scoring above cutoff'. All estimates represent local linear regressions of bandwidth 1.5 points
All specifications control for a flexible polynomial of score in which the slope is allowed to
vary on either side of the cutoff.
Robust standard errors reported in parentheses.
*** p <0.01 ** p <0.05 * p <0.1

Table A2: Organization of high school in France

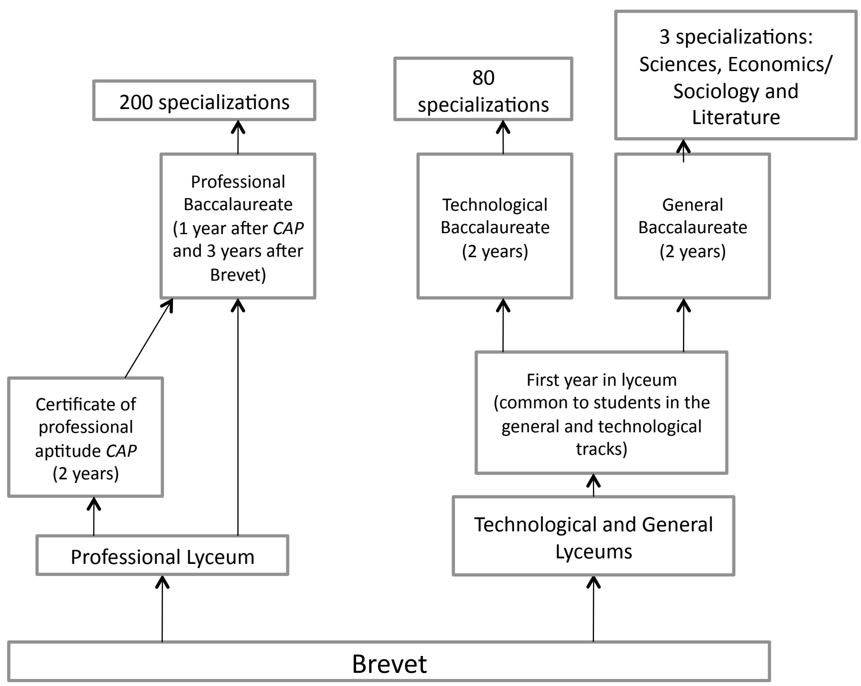


Table A3: Organization of higher education in France

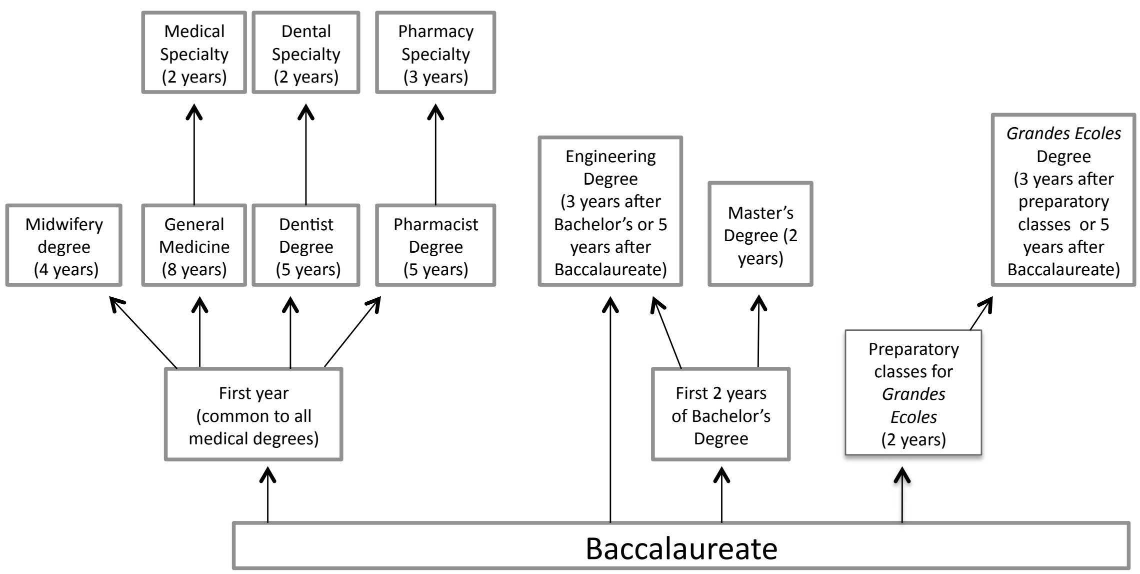


Table A4: Organization of higher vocational system in France

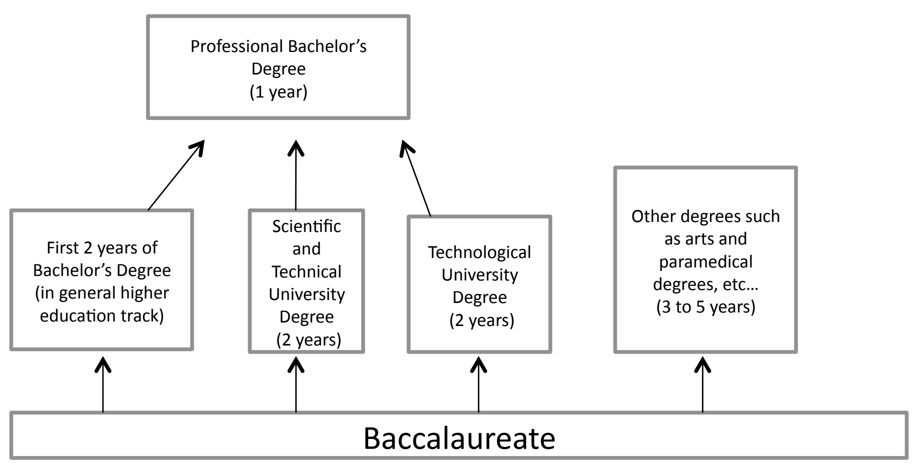


Table A5: Classification of majors into STEM and non-STEM degrees

1. **STEM designated majors**

   Agricultural sciences
   Economic sciences
   Engineering
   Fundamental sciences and applications
   Life sciences, health and earth sciences
   Materials sciences
   Medical degrees
   Pharmacy
   Sciences and technology

2. **Non-STEM majors**

   Accounting degrees
   Arts
   Higher technical certificate of production
   Higher technical certificate of services
   Languages
   Paramedical degrees
   Political Sciences
   Professional degrees
   Social sciences and humanities degrees
   Social work degrees
   Sports
   Technical degrees