The impact of stereotype distortions on human capital accumulation: evidence from affirmative action in France.

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This paper exploits the design of a large-scale affirmative action program in France to assess the role of self-stereotyping in low-income students' human capital decisions. Having access to the program theoretically influenced students' applications in two possible ways: 1) a mechanical channel: applying to other selective colleges becomes less attractive, 2) a stereotype channel: the program increases the salience of social differences in college attendance, which may distort low-SES students' beliefs in their own chances of admission. The program was targeted at low-income students but increased the probability that all students enrolled in partner high schools would attend a prestigious and selective French college. This design enables me to distinguish between the role of both channels: all students in partner high schools are affected by the mechanical channel but the increased salience of social inequalities should further discourage low-income students from applying to other selective colleges.

I use a novel administrative dataset which allows me to observe which colleges French students applied to and eventually enrolled in. My results suggest that inter-group stereotypes influenced low-SES students' human capital decisions: low-SES students exposed to the affirmative action program apply disproportionately less to other selective colleges than their high-SES peers. Interestingly, this channel does not affect the behavior of high-achievers. I provide suggestive evidence that the affirmative action program increased low-SES high-achievers' exam preparedness and that they are more likely to enroll in other selective colleges as a result.

This paper contributes to two different strands of the literature. This is, as far as I know, one of the first attempts to use administrative data to assess the relevance of stereotype distortions in human capital decisions. Secondly, it provides insights regarding the way under-represented students' college application behaviors adjust to affirmative action, a question still under-studied in the affirmative action literature.

I. Introduction

Stereotypes permeate the way we understand the world around us and theory predicts that they can distort economic outcomes and exacerbate existing in-

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equalities (Bordalo et al., 2016*a*). Experimental evidence confirms the importance of stereotypes to explain the behavior of members of under-represented groups. Stereotypes shape beliefs about one's and others' performance (Bordalo et al., 2016*b*), increase the reluctance to contribute ideas to a group decision (Katherine, 2014) and affect actual performance on test scores (Steele and Aronson, 1998) and at work (Glover, Pallais and Pariente, 2017). However, field experiments have provided so far only limited evidence regarding the impact of stereotypes on human capital accumulation, and notably so in a domain where social inequalities are growing: higher education.

The social gap in college attainment has been widening in most OECD countries (Bailey and Dynarski, 2011; Chetty et al., 2017) and is partly driven by low and high-income students' different college application behaviors (Hoxby and Avery, 2012): low-income students systematically apply to less prestigious and selective colleges than their high-income peers. Could group stereotypes explain this divergence in application behavior? This paper follows Bordalo et al. (2016*a*)'s theory of stereotype formation, in which stereotypes results from "representativeness heuristic" (Amos and Kahneman, 1974): if a type is more representative for one group of individuals than others, then this type will be over-weighted in probability judgement. Let's take the example of France: 33.3% of high-SES students who had graduated a French public high school in 2015 attended a selected college the following academic year, while only 14.5% of low-SES students did (DEPP-MEN-SISE). This implies that the type "Attends a selective college" is more representative for high than low-SES students. The theory then predicts that a low-SES student, knowing that her peer group is under-represented in selective colleges, will under-estimate her own chances of attending and be discouraged from applying, while a high-SES student will over-estimate her chances.

I propose to exploit the structure of a large-scale affirmative action program to look at how social class stereotypes can deepen existing social inequalities in higher education. This program was initiated in 2001 by a prestigious and selective French college, Sciences Po. It was built on bilateral agreements signed between the college and high schools with a large proportion of low-SES students. Sciences Po is famous for selecting its students through a very competitive entrance exam. The affirmative action program allowed all students in partner high schools to take a different entrance exam and increased their probability of admission in Sciences Po. The program was publicized as a way to diversify the student intake in Sciences Po and emphasized the under-representation of low-income students in elite French colleges. I look at the impact of the affirmative action program on students' applications to other prestigious colleges. Having access to the program may influence applications behavior through two channels: 1) a mechanical channel: increasing the probability of being admitted to Sciences Po makes applying to other selective colleges less attractive, 2) a stereotype channel: entering the program increases the salience of social differences in college attendance, which may distort the students' beliefs in their own chances of

admission.

The design of this specific affirmative action program enables me to disentangle between those two channels. The mechanical channel would affect all students in treated high schools in the same way, while the behavioral channel would affect low and high-income students differently: it would lower low-income students' beliefs in their probability of admission in selective colleges and increase those of high-income students.

I exploit a novel administrative dataset which allows me to observe which colleges French high school students applied to and eventually enrolled in. I use a Propensity Score Matching strategy to create a proper counter-factual pool of high schools. My findings are in line with my theoretical predictions and provide evidence for the relevance of the behavioral channel: low-SES students enrolled in treated high schools apply disproportionately less to other selective, prestigious programs than their high-SES peers. This channel, however, does not affect high-achievers. Interestingly, this change in application behavior does not affect negatively students' educational outcomes: I find that the affirmative action program has overall no effect on enrollment in selective colleges. I provide suggestive evidence that it boosted the enrollment of low-SES high-achievers in other selective institutions which I attribute to an increase in exam preparedness among high-achievers in treated high schools.

This paper is organised as follows. The next section describes the institutional setting of my empirical analysis: the specificities of higher education in France and Sciences Po's affirmative action program. The following section introduces my model of affirmative action and college application behavior. A fourth section describes my data and provides descriptive evidence of a large social gap in application behavior. A fifth section shows that the introduction of the affirmative action program has increased the enrollment of high-SES students in Sciences Po. In a sixth section, the analysis shifts to the impact of the program on applications to other colleges and a seventh section assesses the impact of the program on college enrollment. The eigth section concludes.

II. Background: Higher Education in France

A. The importance of Grandes Ecoles in Higher Education.

A graduating French high school student has the choice between three different types of higher education programs and this choice will heavily influence the type of career she can aspire to upon graduation. The majority of French students enroll in "Universities" which are not selective: until 2018, being a high school graduate was sufficient to guarantee you admission. Others enroll in short, technical programs. Finally, a minority of students attempt to enter the selective "Grandes Ecoles" (GE) which recruit students through their own entrance exams. Those exams are often taken after two or three years of preparation in "Classes Préparatoires aux Grandes Ecoles" (CPGE), or, more rarely, during the last year

of high school.

Table 1 illustrates how Universities differ from Grandes Ecoles in terms of ressources or composition of the student body. A higher proportion of high-achievers and high-SES students enroll in GE/CPGE than in Universities. Those who enroll in a GE/CPGE immediately after high school will be more likely to have obtained at least a Master degree 6 years after enrolling and will be less likely to have dropped out from higher education. Finally, almost 50% more public resources are spent on students enrolled in CPGE than on students enrolled in Universities. The difference in ressources allocated to Grandes Ecoles and Universities can be a source of perpetuation of economic inequalities: children of teachers or managers are 13 times more likely that attend a "Grande Ecole" than children of farmers or manual workers (Albouy and Wanecq, 2003). For the rest of this paper "selective colleges" will refer to Grandes Ecoles or Preparatory Courses to the Grandes Ecoles.

B. Sciences Po's affirmative action program.

Sciences Po is one of France's most prestigious Grandes Ecoles: it is, for instance, the Alma Mater of three of the last four French Presidents. Its website boasts that 40% of its graduates are recruited even before graduation. Students are admitted to Sciences Po through a competitive entrance exam that they take during the last year of high school. They are selected based on their high school grades, three written exams and one oral exam. In 2016, 5,528 candidates took the entrance exam to the first year and 804 (14.54%) were admitted (SciencesPo, 2016). This process discourages applications from low-SES students and the student intake lacks social diversity. In 2010, 78% of candidates at the regular entrance exam were high-SES, as were 70% of those admitted (Tiberj, 2011).

In 2001, Sciences Po Paris started a large affirmative action program, known as the Conventions d'Education Prioritaire (CEP). It was developed on the basis of bilateral agreements signed with public high schools with a large proportion of low-SES students. Those agreements provide for the admission of students through a separate exam. Sciences Po justified this program with the following argument: "The lack of social and cultural openness of the large French selective institutions has led Sciences Po to propose a new admission procedure in the first year. The students experience four major obstacles that locks them out of selective institutions: a lack of financial means, a lack of information, a social bias (related to the very nature of the selection tests) as well as a phenomenon of self-censorship. The CEP procedure aims to restore equal opportunities by fighting against all four obstacles." [1]. The under-representation of low-income students in selective colleges, and notably their under-preparedness to take entrance exams, explicitely motivates the need for a special entrance exam targetting low-income students. This paragraph is quoted in most of the websites of partner high schools

[1]Source: http://lycee-pierre-poivre.ac-reunion.fr/sciences-po-paris

presenting the affirmative action program to their students. I argue in this paper that students from those high schools are affected by this affirmative action program in two ways: their probability of being admitted to Sciences Po increases and so does their awareness of the under-representation of low-income students in selective schools.

All students enrolled in partner high schools are eligible to apply to the CEP program, independently of their own socio-economic background. They are initially selected by their high-school teachers. Their teachers offer additional tutoring to help selected students to prepare a press review and an oral examination. The students are then admitted to Sciences Po on the basis of this oral examination and their Baccalauréat grades (Diagne and Wasmer, n.d.). As of 2016, 106 high schools were part of the program. This procedure remains highly competitive: only 17% of those selected by their teachers gain admission.

The program had a positive impact on social diversity in Sciences Po: in 2010, 89% of students recruited through CEP were low-SES, while 70% of those recruited through the regular procedure were high-SES (Tiberj, 2011).

Previous studies have found that low-SES students recruited through CEP take as much time to find a job as other graduates and have higher median salary (Tiberj, 2011). The program was not found to have an impact on students' efforts in high school, as measured by the Baccalauréat pass rate in treated high schools (Diagne and Wasmer, n.d.), but there is some evidence that more high-SES students enrolled in treated high schools as a result to take advantage of the program (Diagne and Wasmer, n.d.).

C. Application process to other higher education programs.

The majority of higher education programs in France allow students to apply through a centralized website, "Admission Post-Bac", which matches students' wishes and offers according to a deferred acceptance algorithm (Gale and Shapley, 1962). The student lists and ranks the programs she wants to apply to and will receive offers over 3 rounds. In each round, she only receives an offer from the program that she ranked the highest among all those that accepted her, and each time she can decide to accept or reject the offer, leave the system or wait for a better offer.

Sciences Po is one of the only French colleges that has not joined this system, so that it can hold its admission process according to its own timetable.

III. A model of college application, stereotypes and affirmative action.

My model of college application behavior builds on the structures of Card and Krueger (2004)'s model of affirmative action and college application behavior and Bordalo et al. (2016*b*)'s model of stereotype distortion.

A student i attaches utility U_{ij} to attending college j. This utility term can depend on the expected wages of the college graduates and on subjective factors

such as the composition of the student body. For simplicity, I assume that all students attach the same utility to attending j: $U_{ij} = U_j$. This restriction may be relaxed for instance to allow low-SES students to prefer to attend institutions with a substantial fraction of students from a similar background.

Students differ in their ability and socio-economic status. Applying to a selective college carries a cost c, and student i has beliefs $\tilde{p}_{ij}$ about her probability of gaining acceptance to this college. Those beliefs are a function of her true probability of admission p_{ij}, based on her ability, and of her group identity.

Student i's optimal application set, C_i, is an ordered list of J selective colleges s.t. $U_0 \leq U_1 \leq ... \leq U_J$, where U_0 is the utility attached to applying to a non-selective college.

Let J be the number of colleges student i applies to. For a given choice set C_i, $\tilde{\pi}_{ij} = \tilde{p}_{ij} * \prod_{k=j+1}^{J}(1 - \tilde{p}_{ik})$ denotes i's subjective probability that college j will be the best college granting her admission and $\tilde{\pi}_{i0} = \prod_{k=1}^{J}(1 - \tilde{p}_{ik})$ the subjective probability that she gets none of her selective choices and enrolls in the non-selective college. The student's expected utility from a given application set is therefore:

$$EC(C_i) = \sum_{k=0}^{J} \tilde{\pi}_{ik} U_k - Jc$$

Therefore, student i will apply to college j, iff $\tilde{p}_{ij}$ is above a threshold value:

$$\tilde{p}_{ij} \geq \frac{c}{\sum_{m=0}^{J} \tilde{\pi}_{im} max(0, U_j - U_m)}$$

I now allow i' beliefs about her chances of admission to be influenced by stereotypes exaggerating existing group differences. For each college j, a fraction p_{Gj} of group G is admitted and $1 - p_{Gj}$ is not. I assume that a higher proportion of high-income students are of the "admitted" type than of low-income students: $p_{Hj} > p_L j$. Hence the "non-admitted" type is more representative of group L. Following Bordalo et al. (2016*b*), I assume that beliefs about a member of group L will therefore give more weight to its most "representative" type. In my setting, if student i belongs to group L, her beliefs about her probability of admission to j is distorted by stereotypes about her group affiliation:

$$\tilde{p}_{ij} = p_{ij} * (\frac{p_{Lj}}{p_{Hj}})^{\theta_j \sigma} * \frac{1}{Z_{ij}}$$

p_{ij} is student i's true probability of acceptance, which depends on her ability relative to that of other applicants'. $\theta_j \geq 0$ is a measure of representativeness-driven distortion. I allow θ_j to vary across colleges. If a student does not have

a lot of information about a college, she will attach more weight to the relative representativeness of admitted in her own group. But if she has access to more information about a college, for instance if more graduates of her high school have attended a given college, she will attach less weight to this representativeness measure when forming her beliefs about her probability of admission. σ represents the mental prominence of inter-group comparisons and Z_{ij} is a normalizing factor.

If p_{Hj} is close to p_{Lj}, then:

$$\tilde{p}_{ij} \simeq p_{ij} + \theta_j \sigma(p_{Lj} - p_{Hj})$$

Those stereotype distorsions imply that student i will apply to college j if the following condition is met:

$$p_{ij} + \theta_j \sigma(p_{Lj} - p_{Hj}) \geq \frac{c}{\sum_{m=0}^{J} \tilde{\pi}_{im} max(0, U_{ij} - U_{im})}$$

A program such as Sciences Po's affirmative action program would affect low and high-income students through two channels when introduced to their high school:

1) A mechanical effect: the probability of admission to Sciences Po increases. It makes applying to Sciences Po more attractive and applying to less preferred colleges less attractive to both high and low-SES students enrolled in this high school;

2) A behavioral effect: the arrival of the program emphasizes the lack of representation of low-SES students in selective programs in France. The salience of inter-group differences is increased. This leads low-SES students to underestimate their own individuals chances of admission into selective programs, and high-SES students to over-estimate theirs.

The predictions of our model concerning the introduction of an affirmative action program targetting low-income students by a single college can be summarized as follow:

1) H_1: Students will apply more to the college which introduced the affirmative action program;

2) H_2: Students will apply less to other colleges;

3) H_3: Low-SES students' applications to other colleges should decrease more than those of high-SES students.

IV. Data and descriptive statistics

I use data from the "Admission Post-Bac" (APB) website. This database contains the list of programs the students have applied to, which offers they have accepted, students' demographic characteristics and high school identifiers. The dataset contains the universe of students enrolled in a French high school in 2016 and covers 10,700 higher education programs. Applications to Sciences Po do not go through APB and I therefore cannot observe which students applied to Sciences Po in this dataset.

I also exploit data on grades at the Baccalauréat (OCEAN database), a uniform exam taken at the end of high school and on enrollment in higher education (Base Scolarité). Both of those databases are managed by the French Ministry of Education-DEPP and are available for the years 2009-2016.

I restrict my sample to students enrolled in the last year of the academic stream of high school, in a public high school of continental France.

I present summary statistics in Table 2. Following the litterature (Guyon and Huillery, 2016), I define high-SES students as those having at least one parent in a high skilled occupation, typically requiring 5 years of higher education. Low-SES students are those with two parents who never worked or whose highest skilled occupation is manual laborer, low-skilled white collar, craftman or storekeeper or work in intermediate occupations. They represent 54.8% of my sample.

5.4% of students in my sample are enrolled in a high school which is covered by the CEP program, 90% passed the Baccalauréat, the standardized exam at the end of high school, 52% do so with a distinction (ie. with a grade higher than 12/20). 99.4% of them apply to at least one program via APB and 99.6% of those who apply receive one valid offer of admission. 30% of them applied to a selective program and 16% got an offer of admission. This table shows that the characteristics of low and high-SES students enrolled in the last year of high school are different: low-SES students are more likely to be women and born in a foreign country, they are slightly older and have less siblings already enrolled in higher education. Low-SES students have a lower pass rate in the Baccalauréat and are less likely to obtain a distinction.

High schools which have signed a bilateral agreement with Sciences Po are not representative of the universe of public high schools in France. Table 3 shows that treated high schools have a higher proportion of low-SES and female students and slightly lower baccalauréat pass rates.

College application behavior strikingly differs depending on a student's social background: only 22% of low-SES students apply to a selective program while 40% of their high-SES peers do. As a result, only 9.5% of low-SES students accept an offer from a selective program, in contrast to 24% of high-SES students. This gap in college application behavior is not fully explained by a gap in academic achievement in high school. Figure 1 shows that low-SES students who achieved the highest distinction at the Baccalauréat (with a grade higher than 16) are 12 percentage points less likely than similar high-SES students to apply to a

selective program. As a result, high-achieving low-SES students are 16 pp. less likely to accept an offer from a selective program, as illustrated in Figure 2. Interestingly, at all levels of academic achievements, low-SES students whose preferred application was to a selective program are more likely than their high-SES peers to be admitted to their preferred choice (See Figure 3).

V. Impact of the affirmative action program on enrollment at Sciences Po.

Students cannot apply to Sciences Po through the APB website and I rely on aggregated data from Sciences Po' admission procedure to derive a very rough estimate of the increase in applications. Sciences Po notes that 956 students enrolled in schools which have signed an agreement with Sciences Po (*treated* schools) applied under this program in 2016 and 163 of them were admitted (17.05% success rate). 5,528 students from untreated high schools applied and were admitted at a rate of 14.54% (SciencesPo, 2016). I estimate that 2.68% of all students enrolled in a non-partner high school applied to Sciences Po in 2016, while 6.35% of students in partner high schools did (Source: DEPP). A back-of-the-enveloppe calculation brings the upper bound on the increase in applications to Sciences Po following the introduction of CEP to 3.67 pp.

I use data on actual enrollment at Sciences Po to more precisely estimate the impact of the treatment. This data is available from 2009 to 2016. Figure 4 shows the evolution of the proportion of low-SES students who enroll at Sciences Po the year following their high school graduation, in treated and untreated schools.

To deal with the fact that schools get treated at different points in time, I adopt the "stacking" strategy developed by Gormley and Matsa (2011). I build a separate sample for each high school cohort treated in a given year, with a comparison group containing all control high schools and previously untreated high schools until they are treated. I then center those samples around the time of treatment and stack them. Figure 4 shows that enrollment at Sciences Po increased in treated high schools after they signed a bilateral agreement, while it remained stable in control schools.

I formally test this using the following equation:

$$Y_{hst} = \beta * Treat_{hst} + \delta_{st} + \mu_{hs} + \epsilon_{hst}$$

Where:

- Y_{hst}: Proportion of students from high school h, in sample s, and at time t attending Sciences Po;
- $Treat_{hst}$: Dummy equal to 1 if high school h is treated at time t;
- δ_{st}: Time-sample fixed effects;
- μ_{hs}: Unit-sample fixed effects.

Estimating this equation leads to the results presented in Table 4. The introduction of the affirmative action program results in 6.55 additional students

per 1,000 enrolling at Sciences Po, 5.73 additional low-SES students per 1,000 and 29.54 additional high-achieving low-SES students. For all those samples, the effect is statistically significant at a 1% significance level. It is also large in magnitude: only 1.5‰of all students in my sample enroll into Sciences Po and 0.7 ‰of low-SES students do.

I estimate the following equation to test for the absence of pre-trend in enrollment:

$$Y_{hst} = \sum_{j=-4}^{4} \beta_j * Treat_{hst}(t = k + j) + \delta_{st} + \mu_{hs} + \epsilon_{hst}$$

Where:

- Y_{hst}: Proportion of students from high school h in sample s and at time t attending Sciences Po;
- $Treat_{hst}$: Dummy equal to if high school h will ever be treated;
- k: Time at which the treatment is switched on in high school h;
- δ_{st}: Time-sample fixed effects;
- μ_{hs}: Unit-sample fixed effects.

Testing the absence of pre-trends is equivalent to testing the following hypothesis! $H_0 : \beta_j = 0, \forall j < 0$. Figure 5 shows the point estimates and the confidence intervals on those β_j. There is no evidence of pre-trends in my data: I cannot reject the null hypothesis that β_j is equal to zero for any of the time periods preceding the introduction of the treatment.

The affirmative action program has therefore been successful in increasing the recruitment of students from treated high schools, including low-SES students.

VI. Impact of the affirmative action program on applications to other selective colleges.

The model predicts that the program will lead to a decrease in applications to other selective colleges and that this decrease will be sharper for low-SES students.

My dataset only contains information about applications to college in 2016. A cursory look at observable characteristics between treated and non-treated high schools (Table 3) highlights that the affirmative action program targeted high-schools with a poorer academic record and a larger proportion of low-SES students. Therefore, a simple OLS regression comparing the application behavior of students in treated and untreated high schools is likely to produce biased estimates of the impact of the treatment on applications to selective colleges.

I use a Propensity Score Matching strategy and build a comparable control group of high schools to address this selection bias.

I use data on high school and postcode characteristics in 2006 to estimate the probability that each high school signs an agreement with Sciences Po at any point

after this year. High schools which have been treated before 2006 are excluded from my sample.

I build this propensity score using the following logit regression:

$$Prob(Treat_{hp,t>=2006} = 1) = \alpha + \beta * W_{h,2006} + \gamma * Z_{p,2006} + \epsilon_{hp,2006}$$

Where:

- $Treat_{hp,t>2006}$: Dummy equal to 1 if high school h, in postcode p, is covered by the affirmative action treatment at any time after 2006;
- $W_{hp,2006}$: Set of high school characteristics in 2006;
- $Z_{hp,2006}$: Set of postcode characteristics in 2006.

Table 5 reports those first stage estimates. Unsurprisingly, high schools are more likely to be treated if they have a higher proportion of low-SES students and are located closer to Paris. Treated high schools are also located in cities with larger unemployment rates and larger proportions of immigrants. I use those estimates to predict the propensity score of each high school and use a greedy matching algorithm to form a comparison group which matches each treated high school to five control high schools.

This algorithm allows me to match 25 treated high schools to 125 untreated high schools. Table 6 shows that the resulting sample is balanced on pre- and post-treatment observables.

I then estimate the following equation:

$$Y_{shm} = \alpha + \beta_1 Treat_{sh} + \beta_2 LowSES_{shm} + \beta_3 LowSES \times Treat_{hsm} + \gamma Z_{shm} + \mu_m + \epsilon_{shm} \quad (1)$$

Where:

- Y_{shm}: Outcome variable;
- $Treat_{sh}$: Dummy equal to 1 if student s is enrolled in a treated high school;
- $LowSES_{shm}$: Dummy equal to 1 if student s is a low-SES student;
- Z_{shm}: Student characteristics;
- μ_m: Matched groups fixed effects;
- ϵ_{shm}: Standard errors clustered at the high school level.

To assess the validity of the matched groups in my sample, I run equation (1) using enrollment into Sciences Po in 2016 as an outcome variable and compare those estimates to the DiD estimates of the previous section. The relevant comparison is between column 2 of Table 4 and column 1 of Table 7. It shows that both methodologies yield comparable results: the DiD regression estimates that the affirmative action program allowed 5.7‰additional low-SES students to enter Sciences Po between 2009 and 2016, while the PSM analysis brings this estimate to 5.3‰extra low-SES students enrolling into Sciences Po in 2016.

I now turn to estimating the impact of the affirmative action treatment on students' propensity to apply to a selective program. My model predicts that the affirmative action program would affect students' behavior through two channels: (1) a mechanical channel which reduces the propensity of low and high-SES students to apply to other selective colleges by increasing the returns to an application to Sciences Po and (2) a behavioral channel which affects low-SES students more by increasing the salience of existing social inequalities in access to selective colleges. Testing the relevance of the first channel is equivalent to testing the following hypothesis: $H_0 : \beta_1 = 0$ vs. $H_A : \beta_1 < 0$ in equation (1). Testing $H_0 : \beta_3 = 0$ vs. $H_A : \beta_3 < 0$ will allow me to assess the importance of the second channel.

I present those results in Table 8. My preferred specification in column (2) controls for students' gender, age, grades and major at the Baccalauréat and a dummy equal to one if the student was born in France. Those estimates offer evidence for the importance of the second, behavioral channel, but not for the first channel. The coefficient on the treatment dummy is not significantly different from zero, suggesting that high-SES students are not less likey to apply to other selective programs when they are enrolled in a treated high school. On the other hand, the coefficient on the interaction between the treatment dummy and a dummy for low-SES is negative and statistically significant at 5%. Low-SES students in treated high schools are 2.5 percentage point less likely to apply to a selective university other than Sciences Po than low-SES students in the comparison group. This is a relatively important effect: 12.5% of the mean outcome variable.

Table 4 had shown that the affirmative action program has disproportionately benefited low-SES high-achievers: overall, attending a treated high schools increases the likelihood that an average low-SES student enrolls in Sciences Po by 0.57pp but high achievers attending a treated high school see their chances of attending Sciences Po increase by 2.95pp. I therefore expect the mechanical channel to be particularly important for those students. Table 9 presents the results of equation (1) estimated within a sample restricted to high-achievers. The sample size shrinks to 5,937 observations and does not provide the statistical power needed to deliver precise estimates. However, the estimates in column (2) suggest the presence of a very small negative mechanical effect and a null impact of the behavioral channel on high-achievers' applications to selective colleges.

How to reconcile the results from Tables 8 and 9? Only 22.3% of students in my sample are actually high-achievers and receive a large positive shock to their chances of admission to Sciences Po. The mechanical effect is only binding for high-achievers and disappears in the overall sample. The results from both sets of regressions show that the opposite is true for the behavioral channel: it only affects non-high-achievers.

VII. Impact of the affirmative action program on enrollment to selective colleges.

I then estimate how this change in application strategy translates into a change in educational outcomes. To do so, I use data on college enrollment. This dataset does not cover enrollment in engineering or management schools but includes Sciences Po. Table 10 presents those regression results. The outcome variable being a dummy equal to 1 if the student is enrolled in a selective college in September 2016. Columns (1)-(3) present the results for enrollment in all selective programs in my sample, columns (4)-(6) exclude enrollment in Sciences Po. Those regressions find a zero effect of the affirmative action treatment on enrollment in a selective program, for both low-SES and non-low-SES students. Those zero results suggest that the behavioral channel mostly affected students who had little chances of getting accepted and enrolling into a selective program.

Table 11 shows those results for a sample restricted to high-achievers. The estimates are larger in magnitude than the estimates for the full sample but remain statistically insignificant, due to a smaller sample size. Comparing Table 11's estimates of the impact of the treatment on high-achievers' enrollment in selective colleges including (column (2)) and excluding (column (5)) Sciences Po suggests that the affirmative action led to more enrollment in selective colleges overall, but that this increase was only driven by an increase in enrollment in Sciences Po: high-income high-achievers in treated high-schools were 2.7 pp. more likely to enroll in a selective program but 0.9 pp. less likely to enroll in a selective program different than Sciences Po. Column (5) suggests that low-SES high-achievers are 1.9pp more likely to enroll to a selective college different than Sciences Po if they are in a high school covered by the affirmative action program. This estimate is statistically insignificant, but relatively large in magnitude as it represents 9.5% of the outcome variable. There are two potential explanations for this increase. The first explanation is that students in partner high schools are better prepared to apply to other selective institutions. The affirmative action program contains a tutoring element: students in partner high schools receive extra training from their teachers to prepare for Sciences Po's exam. The second explanation is that colleges prefer recruiting students from high schools covered by Sciences Po's affirmative action program: partnering with Sciences Po may be perceived as a signal of the quality of education provided by those high schools.

The structure of higher education in France allows me to provide some suggestive evidence to disentangle the role of those two channels. Students enrolled in a

selective college are either attending a Grande Ecole, which recruits students on the basis of a selective entrance exam, or a CPGE, which recruits students based on an assessment of their academic merits in high schools and this subjective assessment can be influenced by a student's high school.

Table 12 separates the impact of the treatment between enrollment in Grandes Ecoles (columns (1)-(3)) or CPGE ((4)-(6)) for all students. My preferred specifications in columns (2) and (5) suggest that the affirmative action treatment had, on aggregate, no effect on the enrollment of low-SES students in both types of selective institutions. Restricting this analysis to high-achievers casts some light on the results of table 11. Comparing the estimates of columns (2) and (5) of table 13 suggests that the treatment has boosted low-SES high-achievers's enrollment in Grandes Ecoles other than Sciences Po more than their enrollment in CPGE. Being part of an high school which is part of Sciences Po's affirmative action program increases the probability that a low-SES student passes the entrance exam of another Grande Ecole by 3pp or 50% of the mean, whereas it decreases the probability that a low-SES student enrolls in a CPGE by 1.2pp. or 8.45% of the mean. Note that those effects are not statistically significant but offer some support to the hypothesis that the extra tutoring included in the design of the affirmative action program has boosted low-SES high-achievers's preparedness. There is no evidence to suggest that graduating from a high school which is part of the affirmative action program has a signalling value for CPGE and that they prefer recruiting students from those high schools.

VIII. Conclusion

This paper has studied the impact of group stereotypes on human capital decisions. First, it has documented a large social gap in college application strategies: a very high-achiever from a low-SES background is 12pp. less likely to apply to a selective program than a high-SES student of equal academic merit. Second, this paper studied how low and high-income students' college application strategies have adjusted to the presence of a large-scale affirmative action program designed to remedy large social inequalities in higher education enrollment in France. It has provided evidence that stereotypes exacerbating existing social inequalities may discourage low-income students from applying to selective colleges and further deepen the social gap in academic achievement. Indeed, low-income students enrolled in high schools covered by the affirmative action program apply disproportionately less to other selective colleges than high-income students. I argue that this difference is driven by the affirmative action program's emphasis put on social inequalities in college attendance and that it leads low-SES students to under-estimate their chances of admission to a selective college. Third, this paper documents that this effect does not affect high-achieving low-SES students and does not discourage them from applying to other selective colleges. Fourth, it finds suggestive, but statistically insignificant evidence, that the tutoring component of the affirmative action program has better prepared high-achieving low-SES

students to pass entrance exams at other selective colleges.

Overall, my findings can inform the design of optimal affirmative action strategies to address social inequalities in higher education. Students, especially if they come from groups which are under-represented in higher education, have wrong beliefs regarding their chances of admission. Those beliefs are distorted by existing social inequalities. It provides support for the importance of intervention such as that tested by Hoxby and Turner (2013) in the US which provided students with individualized information about their chances of admission to certain colleges to correct distorted beliefs. In addition, low-SES students, even high-achievers, may be less prepared than their high-SES peers for the entrance requirements of selective colleges, and benefit from tutoring tailored to the demands of higher education.

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Tables

Table 1—: Higher Education in France

	University	Grandes Ecoles Preparatory course (GE/CPGE)
2014 High School graduates enrolling (%)	62.2	12.4
2014 High-achieving high-school graduates enrolling (%)	37	40
High-SES among students, 2014	30 %	49.5%
Obtained at least a Master degree 6 years later (2008 Cohort)	41.35%	66%
No degree, no further studies (2008 cohort)	13.825%	8%
Public spending, per student and per year (2015 Euros)	10,580	15,050

Note: Characteristics of students who enroll in a University or a Grande Ecole / Preparatory course in the year immediately following their high school graduation. High-achievers are considered as such if they have achieved the highest ("Très Bien") or second highest ("Bien") distinction in the Baccalauréat.
Source: DEPP-RESR 2017.

Table 2—: Summary Statistics

	All students		Low-SES students		High-SES students		
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	
CEP high school	0.054	(0.2254)	0.072	(0.258)	0.0322	(0.1764)	***
Female	0.564	(0.496)	0.599	(0.490)	0.5289	(0.4992)	***
Age	18.0854	(0.6619)	18.1523	(0.6955)	17.9888	(0.6005)	***
Low-SES	0.548	(0.498)					
Eligible to a need-based scholarship	0.64	(0.48)	0.80	(0.403)	0.3978	(0.4894)	***
Foreign born	0.055	(0.227)	0.064	(.244)	0.0372	(0.0361)	***
Passed bac	0.905	(0.293)	0.882	(0.322)	0.9375	(0.2421)	***
Bac with distinction	0.526	(0.4993)	0.445	(0.4969)	0.6287	(0.4832)	***
Parents same city	0.8221	(0.382)	0.8276	(0.378)	0.8188	(0.385)	***
Number of siblings in higher education	0.356	(0.582)	0.306	(0.546)	0.4357	(0.6244)	***
One valid application	0.994	(0.080)	0.9928	(0.0847)	0.9948	(0.0717)	***
Number of applications	7.653	(6.1801)	6.81	(5.3195)	8.7038	(6.965)	***
Distance from home to place of application	70.58	(113.7)	64.755	(101.5)	77.7613	(126.5)	***
Applied to a selective program	0.306	(0.4608)	0.223	(0.4165)	0.4097	(0.4918)	***
Received one valid offer	0.996	(0.0625)	0.996	(0.0666)	0.9968	(0.057)	
Accepted offer from a selective program (GE/CPGE)	0.161	(0.3678)	0.095	(0.2932)	0.2416	(0.4281)	***
N	262424		143753		118671		

Significance level of a t-test of the equality of means of High and Low-SES samples: $^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source:: APB'Stat, 2016

Table 3—: Summary Statistics - high schools

	No Affirmative action		Affirmative action		
	Mean	Std. Dev	Mean	Std. Dev	
Low-SES students	0.58	0.17	0.64	0.14	***
Foreign born students	0.06	0.08	0.07	0.07	**
Female students	0.54	0.14	0.58	0.07	***
Average number of siblings	1.30	0.31	1.39	0.30	***
Applied to university	0.99	0.05	0.99	0.02	
Bac pass rate	0.90	0.10	0.88	0.07	***
Bac with distinction	0.50	0.17	0.47	0.14	***

Significance level of a t-test of the equality of sample means: $^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source:: APB'Stat, 2016

Table 4—: Effect of the treatment on student enrollment at Sciences Po.

	Students enrolling at Sciences Po (‰)		
	(1) All	(2) Low-SES	(3) High-achieving low-SES
Treatment dummy	6.55 ***	5.73 ***	29.54 ***
	(0.796)	(0.470)	(2.720)
Time-sample FE	YES	YES	YES
Sample-unit FE	YES	YES	YES
N	99096	98912	98912
R-squared	0.281	0.264	0.177
Mean outcome variable	1.496	0.763	3.807

$^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: SISE- MEN-DEPP, 2009–2016.

A high school is "treated" if it has signed a CEP with Sciences Po. A separate sample is built for each high school cohort treated in a given year, with a comparison group containing all control high schools and previously untreated high schools until they are treated. Those samples are then centered around the time of treatment and stacked.

Table 5—: Building a Propensity Score, estimates from a logit regression.

High School signs a bilateral agreement with Sciences Po after 2006	
High school characteristics	
Distance to Paris (km)	-0.00552 ***
	(0.0014)
Bac pass rate, 2006	-4.1882
	(4.6136)
Bac average grade, 2006	-0.3004
	(0.6337)
Proportion of female students, 2006	1.8201
	(2.1583)
Proportion of low-SES students, 2006	5.8465 ***
	(2.0035)
Proportion of foreign students, 2006	-7.1622
	(6.6627)
Proportion of students repeating grade, 2006	2.3559
	(3.1252)
Number of students, 2006	0.00352
	(0.00273)
Students enrolled in a CPGE, 2006 (%)	-0.9334
	(1.0988)
Postcode characteristics	
Unemployment rate, 2006	0.1300 *
	(0.0667)
Immigrant population, 2006 (%)	0.0603 **
	(0.0306)
Total population, 2006 (in 1,000)	-0.0028
	(0.0049)
N	1216
N control high schools	1166
N treated high schools	50

$^{*}p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Source: MEN-DEPP and INSEE.

Table 6—: Covariate balance

	Control	Treatment
Distance to Paris (km)	146.8	156.8
	(138.6)	(157.3)
Bac pass rate, 2006	0.8056	0.0872
	(0.7908)	(0.0614)
Bac average grade, June 2006	10.6985	10.7038
	(0.7870)	(0.5815)
Proportion of female students, 2006	0.5841	0.5943
	(0.1016)	(0.0649)
Proportion of low-SES students, 2006	0.7299	0.7293
	(0.1122)	(0.1118)
Proportion of foreign students, 2006	0.0281	0.0199
	(0.0383)	(0.0216)
Number of students, 2006	170.1	176.7
	(89.7178)	(82.5539)
Percentage of students enrolled in a GE/CPGE, 2006	6.8293	6.1496
	(3.8846)	(2.7585)
Unemployment rate, 2006	9.0279	8.5602
	(2.9452)	(2.7103)
Percentage of immigrant population, 2006	10.8703	9.4037
	(7.3186)	(5.6798)
Total population, 2006	41849.5	39490.4
	(45136.6)	(57889.9)
Bac pass rate, 2016	0.8663	0.8626
	(0.1089)	(0.0749)
Proportion got bac with distinction, 2016	0.4331	0.4222
	(0.1412)	(0.1031)
Proportion of low-SES students, 2016	0.6554	0.6678
	(0.1212)	(0.1275)
Proportion of female students, 2016	0.5579	0.5832
	(0.1107)	(0.0726)
Proportion of foreign born students	0.0557	0.0564
	(0.0488)	(0.0420)
Average number of siblings, 2016	1.3926	1.3473
	(0.2959)	(0.1495)
Proportion students eligible for a scholarship, 2016	0.7129	0.7177
	(0.1250)	(0.0793)
Special attention high school, 2016	0.072	0.04
	(0.2595)	(0.2000)

Table 7—: PSM estimates of the impact of the affirmative action treatment on students' probability of enrolling in Sciences Po.

Student enrolled in Sciences Po.	(1)	(2)	(3)
Treatment dummy	0.0096 **	0.0100 ***	0.0100 ***
	(0.004)	(0.004)	(0.004)
Low-SES dummy	-0.0020 ***	-0.0006	-0.0007
	(0.001)	(0.001)	(0.001)
Low-SES × treatment dummy	-0.0043	-0.0047	-0.0047
	(0.004)	(0.004)	(0.004)
Academic characteristics	NO	YES	YES
Demographic characteristics	NO	YES	YES
Peer characteristics	NO	NO	YES
N	32642	32642	32642
Mean outcome variable	0.0024	0.0024	0.0024
R-squared	0.004	0.011	0.011

$^{*}p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: SISE- MEN-DEPP, 2016.

A high school is "treated" if it has signed a CEP with Sciences Po.

Standard errors are clustered at the high school level.

Academic characteristics : academic field, baccalauréat grades.

Demographic characteristics : gender, age, dummy if born abroad.

Peer characteristics : % low-SES, female and foreign-born peers.

Table 8—: Estimates of the impact of the affirmative action treatment on the probability of applying to a selective program.

Student applied to a selective college.	(1)	(2)	(3)
Treatment dummy	-0.008	0.015	0.016
	(0.02)	(0.02)	(0.02)
Low-SES dummy	-0.127 ***	-0.048 ***	-0.045***
	(0.01)	(0.01)	(0.01)
Low-SES ×	-0.026	-0.040 **	-0.037 **
treatment dummy	(0.02)	(0.02)	(0.02)
Academic characteristics	NO	YES	YES
Demographic characteristics	NO	YES	YES
Peer characteristics	NO	NO	YES
N	26623	26623	26623
Mean outcome variable	0.20	0.20	0.20
R-squared	0.032	0.267	0.267

*$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: APB'stat. 2016.

Sample restricted to matched control and treatment high schools

Standard errors are clustered at the high school level.

Academic characteristics : academic field, baccalauréat grades.

Demographic characteristics : gender, age, dummy for born abroad.

Peer characteristics : % low-SES, female and foreign-born peers.

Table 9—: Estimates of the impact of the affirmative action treatment on high-achievers' probability of applying to a selective program.

Student applied to a selective college.			
	(1)	(2)	(3)
Treatment dummy	-0.033	-0.012	-0.007
	(0.03)	(0.03)	(0.03)
Low-SES dummy	-0.140 ***	-0.094 ***	-0.089 ***
	(0.01)	(0.01)	(0.01)
Low-SES ×	0.021	0.003	0.006
treatment dummy	(0.04)	(0.04)	(0.04)
Academic characteristics	NO	YES	YES
Demographic characteristics	NO	YES	YES
Peer characteristics	NO	NO	YES
N	5937	5937	5937
Mean outcome variable	0.52	0.52	0.52
R-squared	0.028	0.139	0.142

*$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: APB'Stat, 2016.

Sample restricted to matched control and treatment high schools.

Standard errors are clustered at the high school level.

Academic characteristics : academic field, baccalauréat grades.

Demographic characteristics : gender, age, born abroad.

Peer characteristics : % low-SES, female and foreign-born peers.

Table 10—: Estimates of the impact of the affirmative action treatment on the probability of being enrolled in a selective program.

	Student enrolled in a selective college					
	All			Excluding Sciences Po.		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment dummy	0.000	0.010	0.011	-0.010	-0.001	0.000
	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.010)
Low-SES dummy	-0.059 ***	-0.023 ***	-0.020 ***	-0.058 ***	-0.023 ***	-0.019 ***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Low-SES × treatment dummy	0.003	-0.004	-0.004	0.008	0.002	0.002
	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)	(0.011)
Academic characteristics	NO	YES	YES	NO	YES	YES
Demographic characteristics	NO	YES	YES	NO	YES	YES
Peer characteristics	NO	NO	YES	NO	NO	YES
N	32642	32642	32642	32642	32642	32642
Mean outcome variable	0.090	0.090	0.090	0.087	0.087	0.087
R-squared	0.014	0.105	0.152	0.014	0.101	0.112

*$p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source: DEPP, 2016

Sample restricted to students graduating from matched control and treatment high schools.

Standard errors are clustered at the high school level.

Academic characteristics : academic field, baccalauréat grades.

Demographic characteristics : gender, age, born abroad.

Peer characteristics : % low-SES, female and foreign-born peers.

Table 11—: Estimates of the impact of the affirmative action treatment on high-achievers' probability of being enrolled in a selective program.

	Student enrolled in a selective college					
	All			Excluding Sciences Po.		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment dummy	0.016	0.027	0.025	-0.019	-0.009	-0.011
	(0.021)	(0.021)	(0.021)	(0.021)	(0.019)	(0.018)
Low-SES dummy	-0.051 ***	-0.020 ***	-0.018 ***	-0.048 ***	-0.018 ***	-0.015 ***
	(0.010)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)
Low-SES ×	0.024	0.016	0.017	0.036	0.028	0.029
treatment dummy	(0.028)	(0.025)	(0.025)	(0.029)	(0.024)	(0.024)
Academic characteristics	NO	YES	YES	NO	YES	YES
Demographic characteristics	NO	YES	YES	NO	YES	YES
Peer characteristics	NO	NO	YES	NO	NO	YES
N	8211	8211	8211	8211	8211	8211
Mean outcome variable	0.21	0.21	0.21	0.200	0.200	0.200
R-squared	0.008	0.080	0.101	0.007	0.082	0.104

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Source: DEPP, 2016

Sample restricted to students graduating from matched control and treatment high schools.

Standard errors are clustered at the high school level.

Academic characteristics : academic field, baccalauréat grades.

Peer characteristics : % low-SES, female and foreign-born peers.

Demographic characteristics : gender, age, born abroad.

Table 12—: Estimates of the impact of the affirmative action treatment on the probability of being enrolled in a selective program.

	Student enrolled in a selective college					
	Grande Ecole Excl. Sciences Po			CPGE		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment dummy	0.004	0.007	0.007	-0.015	-0.0071	-0.0070
	(0.009)	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)
Low-SES dummy	-0.020 ***	-0.009 ***	-0.009 ***	-0.038 ***	-0.010 ***	-0.011 ***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Low-SES × treatment dummy	-0.003	-0.004	-0.005	0.011	0.006	0.006
	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)	(0.009)
Academic characteristics	NO	YES	YES	NO	YES	YES
Demographic characteristics	NO	YES	YES	NO	YES	YES
Peer characteristics	NO	NO	YES	NO	NO	YES
N	32642	32642	32642	32642	32642	32642
Mean outcome variable	0.035	0.035	0.035	0.053	0.053	0.053
R-squared	0.009	0.032	0.032	0.008	0.086	0.087

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Source: DEPP, 2016

Sample restricted to students graduating from matched control and treatment high schools.

Standard errors are clustered at the high school level.

Academic characteristics : academic field, baccalauréat grades.

Peer characteristics : % low-SES, female and foreign-born peers.

Demographic characteristics : gender, age, born abroad.

Table 13—: Estimates of the impact of the affirmative action treatment on high-achievers' probability of being enrolled in a selective program.

	Student enrolled in a selective college					
	Grande Ecole Excl. Sciences Po			CPGE		
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment dummy	0.004	0.005	0.005	-0.024	-0.016	-0.013
	(0.014)	(0.014)	(0.014)	(0.015)	(0.013)	(0.014)
Low-SES dummy	-0.011	-0.004	-0.005	-0.037 ***	-0.011 ***	-0.013 ***
	(0.006)	(0.006)	(0.005)	(0.009)	(0.008)	(0.008)
Low-SES × treatment dummy	0.027	0.025	0.035	0.009	0.004	0.003
	(0.021)	(0.019)	(0.036)	(0.016)	(0.015)	(0.016)
Academic characteristics	NO	YES	YES	NO	YES	YES
Demographic characteristics	NO	YES	YES	NO	YES	YES
Peer characteristics	NO	NO	YES	NO	NO	YES
N	8211	8211	8211	8211	8211	8211
Mean outcome variable	0.06	0.06	0.06	0.142	0.142	0.142
R-squared	0.008	0.034	0.034	0.007	0.074	0.075

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Source: DEPP, 2016

Sample restricted to students graduating from matched control and treatment high schools.

Standard errors are clustered at the high school level.

Academic characteristics : academic field, baccalauréat grades.

Peer characteristics : % low-SES, female and foreign-born peers.

Demographic characteristics : gender, age, born abroad.

Figures

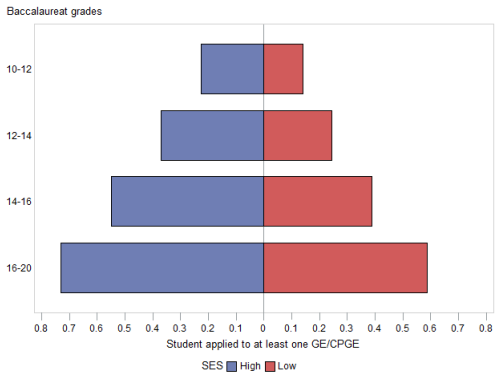

Figure 1. : Applications to selective programs

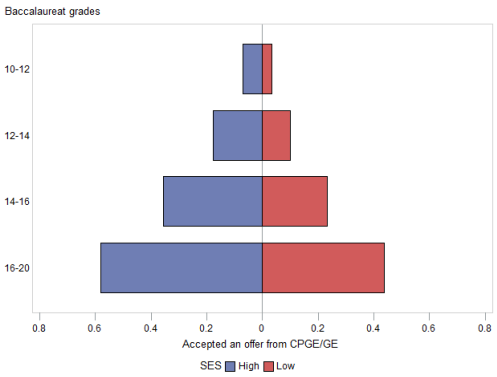

Figure 2. : Accepted an offer by a selective program

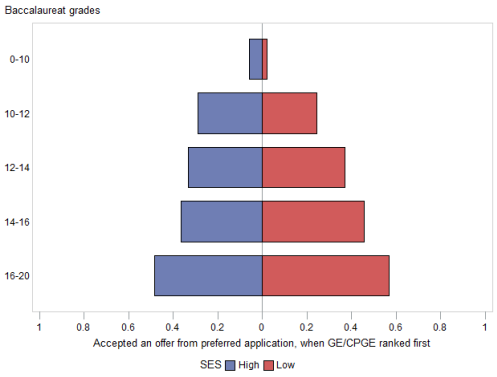

Figure 3. : Accepting offers from preferred application, conditional on ranking a selective program first.

Social gap in college applications.

Source: APB'Stat, 2016.

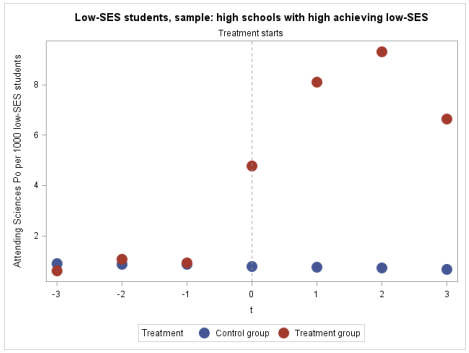

Figure 4.

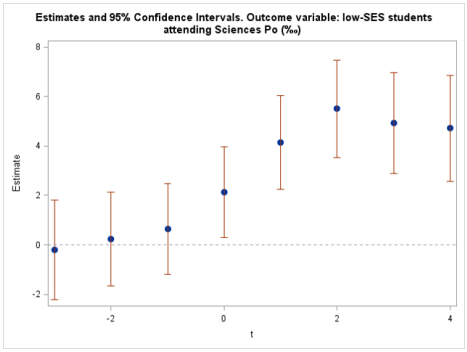

Figure 5.

Impact of the affirmative action program on enrollment at Sciences Po

Source: SISE- MEN-DEPP. Proportion of low-SES students in a public high school in continental France who enroll at Sciences Po. 2009-2016. A high school is "treated" if it has signed a CEP with Sciences Po. A separate sample is built for each high school cohort treated in a given year, with a comparison group containing all control high schools and previously untreated high schools until they are treated. Those samples are then centered around the time of treatment and stacked.