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RAISING ASPIRATIONS AND HIGHER EDUCATION: EVIDENCE FROM THE UK'S WIDENING PARTICIPATION POLICY °

by Lucia Rizzica*

Abstract

This paper investigates the relationship between aspirations and inequality in higher education participation. Using a regression discontinuity design, I evaluate the impact of a nationwide UK policy aimed at raising aspirations towards college education in pupils from disadvantaged backgrounds by involving them in outreach activities. I find that the policy successfully raised the aspirations of the target students and their participation in post compulsory education. However, its final effect on college enrolment was negligible overall and appears concentrated among students from the most affluent families and those in the central part of the ability distribution.

JEL Classification: J24, H52, I24.
Keywords: aspirations, tertiary education, evaluation of education reform.

Contents

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1 Introduction[*]

The post World War II decades have seen sharp increases in educational attainment and access to college in most developed countries: in the US the share of youths going to college rose from 10% in 1940 to 57% in 2012 (US Census Bureau, 2013), while in the UK participation in higher education took off from less than 5% in the 1950s to about 36% in 2012 (HEFCE, 2010). In most countries, however, the growth of the college student body has not been uniform across the population but rather concentrated among youths at the top of the income distribution, as documented, among others, by Deming and Dynarski (2009) for the US and Lindley and Machin (2012) for the UK.[1] In the UK, in particular, the proportion of 23-year-olds in the population holding a higher education degree was 6% for families in the bottom income quintile and 20% for those in the top income quintile in 1981, and by 1999 these proportions had risen to only 9% for the bottom income quintile against 46% for the top income quintile (Blanden and Machin, 2004).[2]

The desire to enlarge the student body by bringing in those generally left out has consequently attracted the attention of policy makers in the past fifty years: grants and low interest loans were introduced in the US in the 1960s, while most EU countries, including the UK, traditionally maintained a fully state funded higher education system.[3] Yet, most measures aimed at relaxing students' financial constraints have proved insufficient to eliminate the disparities in access to college (Kane, 1995; Dynarski, 2000; Nielsen et al., 2010; Dearden et al., 2014). In the light of these findings it becomes especially interesting to analyze the effects of policies aiming to include youths from low socioeconomic backgrounds in higher education by lever-

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[1]Some recent studies, nevertheless, have documented a stabilization of the educational gap: for the UK these show that the (small) increase in graduation rates that occurred between the 1970 and the 1975 cohorts was evenly distributed across family income groups (Blanden and Machin, 2008), while for Italy they document a decrease in inequality coupled, nevertheless, with an increased degree of polarization in educational opportunities (Checchi et al., 2013).

[2]The same pattern has been documented in terms of mobility across social classes: in 1990 students from social class 1-3(non manual) exhibited a rate of participation in higher education of 36.7%, while those from social class 3(manual)-5 a rate of 10.3% (Robertson and Hillman, 1997); by 1997 both numbers had increased substantially but the difference between the two had widened, with a 49% participation rate among students from social class 1-3(non manual) and an 18.4% among youths from lower social class (Connor et al., 1999).

[3]England introduced tuition fees for the first time in 1998, while in Sweden higher education is still free of charge for all Swedish and EU students.

aging non financial mechanisms. The vast and growing literature on the long term effects of early childhood development (Heckman and Carneiro, 2003; Heckman, 2011) probably represents the most significant contribution in this direction. But recent works (Bettinger et al., 2012; Oreopoulos and Dunn, 2013; Hoxby and Turner, 2015) have also shed light on the relevance of non financial constraints to higher education by showing that poor information about the application, selection and funding mechanisms may constitute a major barrier to access to college.

This paper contributes to the understanding of the role of non financial constraints and its interplay with financial constraints in determining inequalities in college participation by investigating the impact of adolescents' *aspirations* on their own schooling choices. Specifically, it aims to uncover whether low socioeconomic background pupils do not enroll in college because this is beyond their objectives and desires. Exploiting a recent UK policy, I manage to identify exogenous variations in pupils' stated desire to apply to college, my proxy for aspirations, and I evaluate their impact on actual participation in post compulsory and tertiary education.

Very few contributions have so far investigated the relationship between aspirations and educational choices of youths: Chiapa et al. (2012) evaluated the impact of a social program on the educational aspirations that parents have for their children; Wydick et al. (2013) documented large effects of international child sponsorship on children's educational attainment and argued that this is, at least in part, due to increases in children's aspirations; Beaman et al. (2012) reported a rise in the career aspirations and educational attainment of Indian girls residing in municipalities with female leaders; finally Heckman et al. (2013) showed that an early childhood program affected children's aspirations towards school with important consequences for adult life outcomes. I add to these papers in several ways: firstly, I analyze the impact of children's own aspirations on their educational attainment; secondly, I provide evidence from an advanced economy, rather than from a developing country, and with regard to higher, rather than basic, education; thirdly, I rely on a program which only aimed at nourishing aspirations, thus allowing me to isolate its effect from other confounding factors such as the distribution of cash transfers; finally, I provide evidence from a national scale program rather than an experiment.

Identification of the effect of adolescents' aspirations on their schooling choices is reached by exploiting the variation in aspirations induced by children's exposure to the UK *Widening Participation* (WP) policy. This prescribes that all colleges and higher education institutions in the country receive significant amounts of public funding to engage pupils from low socioeconomic background in outreach activities, such as summer schools, open days and meetings with graduate students. Through such activities pupils who have no familiarity with higher education are meant to get a taste of college life and possible professional outcomes and thus revise upwards their educational targets or aspirations. Children are targeted by WP if they live in areas in which the past rate of youths' participation in higher education, as recorded in the latest Census, falls in the bottom two quintiles of the national distribution. This design allows me to implement a Regression Discontinuity analysis to identify the effect of exposure to the policy on children's stated likelihood to apply to college, a proxy for aspirations, and on their actual schooling choices at age 16, the compulsory school leaving age, and 18, the age of college enrollment.

The results show that WP policy eligibility effectively increased the aspirations towards higher education of the target students, whose stated likelihood of going to college rose from 63.3% to 68.1%; this increase in aspirations translated in an increase of similar magnitude in the share of students who stayed on in education after the compulsory school leaving age of 16; the final effect of the policy on college enrollment was instead overall negligible. By inspecting heterogeneity in these results with respect to family income and previously accumulated cognitive skills, I provide evidence that the policy only seems to have increased college participation for pupils belonging to families at the top of the income distribution, and for those with medium ability so that it did not eventually prove successful in including the truly most disadvantaged ones. I discuss several mechanisms which may generate a similar pattern of results. These seem to be most consistent with the predictions of a model of schooling choice in which aspirations interact with individual cognitive skills and parental endowments to determine the child's level of educational attainment.

Taken together, the results suggest that a policy that raises aspirations for all students may not be optimal to the extent that there remain barriers in terms of financial resources or previously accumulated skills that are needed to attend college. It may instead be advisable to target only the students that are college-caliber, i.e., have sufficient skills to get into college, and to make sure that all of them have sufficient financial means to afford higher education.

The remainder of the paper is structured as follows: Section 2 introduces the WP policy, its political background and its design; Section 3 presents the datasets that will be employed and provides some descriptive statistics; Section 4 describes the empirical strategy; Section 5 is dedicated to the results; Section 6 provides a discussion of the underlying mechanisms; Section 7 presents some robustness checks and Section 8 concludes.

2 The UK's Widening Participation Policy

In the UK the difference in educational attainment between youths in the top and the bottom 20% of the family income distribution more than doubled between 1981 and 1999 (Blanden and Machin, 2004). On such premises the Kennedy (1997) and Dearing (1997) reports, commissioned by the government in preparation for a reform of the higher education system,[4] set the issue of "widening participation" in higher education at the center of the national political agenda establishing that "participation should be *widened* rather than just increased" (Kennedy, 1997) and that public funds should be distributed so as to reward "institutions which can demonstrate a commitment to *widening participation*" (Dearing, 1997). Inspired by the idea that "poverty of aspiration is what lies at the heart of the failure of the British education system to be world beating",[5] the resulting Widening Participation policy provided for: (i) the identification of a specific population of pupils who were "underrepresented" in higher education and should thus be targeted by the policy; (ii) the definition of the type of activities to carry out in order to attract the target students; (iii) the design of a mechanism of incentives to induce higher education institutions to invest on these activities.

2.1 WP target population

The goal of the WP policy is to increase participation in higher education of students from "under-represented" groups. Several criteria were initially adopted to identify these students: youths from low income households, those living in low participation neighborhoods, students in state schools, first generation entrants, pupils from certain ethnic minorities or those with disabilities (Moore et al., 2013). Starting from 2004/2005 the government adopted a specifically designed classification system called POLAR (Participation Of Local Areas) which was applied to all England to define the policy target population and allocate the WP funds accordingly.[6]

This system is based on the past rate of participation in higher education of youths living in each census ward;[7] for each 2001 census ward a local Young Participation Rate (YPR) was computed for students who were aged 18-21 in the period 1997-1999 (HEFCE, 2005, 2010); wards were then ranked according to this rate and children defined eligible for WP activities if they lived in wards with a YPR that fell in the two lowest quintiles of the distribution.[8] The POLAR system induced significant geographical variation in the distribution of WP funds within the country, Figure 1, for example, shows the target areas in London, distinguishing between those in the bottom quintile and those in the second one.

Universities put maximum effort in trying to target individual students rather than the whole school so as to maximize the effectiveness of their interventions. Schools, indeed, provide

[4]Following the recommendations of the Dearing report, in 1998 the government introduced for the first time up-front tuition fees to be paid by all UK and EU students (Wyness, 2010).

[5]Gordon Brown, speech at the university of Greenwich, 31 October 2007.

[6]The POLAR system adopted in 2004 has then been progressively improved and updated: POLAR2 was released in 2008, POLAR3 in 2012 and POLAR4 in 2017.

[7]England counts 8850 of them with an average adult population size of 4250 people per ward.

[8]See Section 3 for a more detailed description of the eligibility rule and Appendix Figure B.1 for a graphical representation of it.

information about their students, for instance their address or whether they are eligible for free school meals, so that higher education institutions can manage to involve in their outreach activities only, or at least primarily, the target students.

2.2 WP outreach activities

Each college[9] is free to define and implement its own WP agenda, on which it has to report each year to the government, in order to maximize its intake of target students.

The type of activities carried out by higher education institutions to recruit students from low participation neighborhoods typically include residential summer schools, open days, meetings with "students ambassadors" who shall be identified by the pupils as successful role models and also activities with parents to involve them in the decision and raise their awareness. Figure 2 shows the WP initiatives that colleges carry out more often as established by a survey among colleges WP administrators (Bowes et al., 2013).

According to the report by Moore et al. (2013) the most effective activities delivered by higher education institutions are campus visits, which would give learners an experience of what higher education is like; subject specific taster sessions and master classes, which would stimulate pupils' career interests in a specific subject area; summer schools, which would improve students' attainment and progression to higher education; and meetings with student ambassadors with whom target students can identify closely and who can potentially "disrupt and challenge pupils' gendered, raced and classed trajectories" (Gartland, 2012). Another recent survey (Harrison et al., 2015) confirmed that summer schools and campus visits are considered by WP practitioners the most successful types of activities both in view of raising aspirations towards higher education and of increasing college applications.

WP activities typically start in school year 8 (at age 12) but it is in year 12, when children are 16 years old, that the most relevant and effective activities are carried out. Appendix Figures B.2 and B.3 report the plan of WP initiatives that were carried out in 2012 by one of the largest universities in London and a description of some of the activities organized by the same university in school year 2008/2009. The latter gives a hint of how universities try to raise the aspirations of the WP target students.

It is important to stress that the policy does not introduce any exception to the admission rules, nor fee waivers or discounts. While it has not been conceived as an information campaign in which application, admission and funding mechanisms are explained to prospective college students, this type of information is often provided during some of the WP activities (for example the open days). Yet, it should be noted that in the UK all the information and guid-

[9]Following the definition adopted by HEFCE, in this work I generically refer to "colleges" or "higher education institutions" to indicate universities, higher education colleges and further education colleges; the latter provide mainly vocational curricula and are similar to the US Community Colleges.

ance of students through the application process is administered by a different institution, the Universities and Colleges Admissions Service (UCAS), that targets all schools and students in the country. The main goal of WP is instead to give pupils who have no familiarity with higher education a taster of the type of activities and professional outcomes of college students so as to induce them to revise upwards their awareness and their educational targets.[10] It is indeed suggestive that one of the largest WP initiatives, which brought together a wide range of colleges and schools, was called "AimHigher".

2.3 Incentives for colleges

In response to the recommendations contained in the 1997 Government reports it was established that the allocation mechanism of public funds to colleges would be revised so as to reward those colleges which proved more successful in recruiting students from disadvantaged backgrounds, as defined through the POLAR system.

The government decided to distribute the funds for WP through the Teaching Grant, which represents the main source of public funding for colleges and which, until 1998/1999 was simply proportional to the number of (full time equivalent) students enrolled. From 1998/1999 the formula for the allocation of the teaching grant was modified so that students from underrepresented groups would carry a larger weight. In 2007/2008, for example, a college recruiting exclusively students from the most disadvantaged areas (wards falling in the two lowest quintiles of the POLAR score distribution) would receive over 10% more funds than one which did not recruit any student from the target group, even if they had the same student population size (HEFCE, 2007).

The amount of resources devoted to the initiative has been substantial and rose from £20 million in 1999/2000 to over £400 million in 2016/2017 for an average number of about 200,000 target students per year (Figure 3).[11] About a third of the total amount of funds given for Widening Participation each year is explicitly dedicated to *widening access* to college.[12]

On top of receiving public funds as a reward for the results obtained through their outreach activities, colleges typically manage to attract further resources from private donors willing to sponsor their widening participation agenda. Indeed, higher education institutions generally make their commitment to widening participation a point of pride and this is recognized by a number of highly advertised awards.[13]

[10] See for example the University of London taster courses.

[11] Data on the amount of funds are taken from the HEFCE yearly publication "Recurrent Grants for ...: Revised Allocations"; while the number of students is calculated as the average yearly size of the 18-year-old cohort in the target areas from the figures in HEFCE (2005).

[12] The remaining two thirds are for retention of students from underrepresented groups and for access and progression of disabled students.

[13] A well known example are the London Education Partnership Awards, which "recognize and build on a well-established tradition among London's education providers in offering higher education opportunities to a

Finally, every year the Higher Education Statistics Agency (HESA) publishes detailed data on the intake of WP target students by each higher education institution in England thus creating an effective and transparent mechanism of grassroots monitoring of the effort made by each institution.[14]

2.4 Take-up and compliance

Bowes et al. (2013) report that the POLAR classification was used by more than 80% of the surveyed institutions, yet, many colleges also used other criteria to identify their WP target population, for example they chose to target all children from state schools. Similarly, Harrison et al. (2015) surveyed a sample of college WP managers and found that the use of "low participation neighborhoods as markers of disadvantage was ubiquitous", being used by over 90% of them to identify WP target students.

Yet, almost no evidence is available about how many target students actually participated in WP activities and how intensively. The available information reveals large heterogeneity in the actions taken for WP across institutions and a substantial lack of coordination amongst them (Harrison et al., 2015). Moreover, one may imagine that the take-up rate varied significantly across activities: while almost all target students likely participated in meetings organized in the school, very few will have attended the residential summer schools. An approximate estimate of the take-up rate for summer schools would be at most 35%.[15]

3 Data and descriptive statistics

This paper exploits a wide range of data to test the impact of the WP initiatives, combining information about the funding received by colleges and the activities carried out to attract WP target students, with information about the students' family background and their schooling decisions.

Data on college funding for WP come from the Higher Education Funding Council of England (HEFCE). These provide the average Young Participation Rate for the 1997-1999 cohorts for all England census wards and their POLAR classification which is computed accordingly.[16]

wide range of learners raising the aspirations of young people to help them achieve their full potential".

[14]In 2017, for example, the University of Sunderland had over 30% of students residing in POLAR bottom quintile neighborhoods, while Oxford and Cambridge around 3% only. Overall the national average was 11.3%.

[15]This is imputed by computing the average amount of WP funds per summer school place across universities using the information available from a subsample of institutions, and then dividing the total amount of WP funds received by each institution by that number. Then, the estimated number of summer school places is added over all institutions (N=127,743), multiplied by 0.8 (the share of universities using POLAR as main criterion for WP targeting), and finally divided by the average number of 18 year-olds living in Q1 and Q2 areas.

[16]For each cohort, the Young Participation Rate (YPR) is computed by HEFCE as the ratio between the number of young people from each area who enter HE aged 18 or 19 and the corresponding estimated cohort population in

Information on students' careers, instead, is taken from the Longitudinal Study of Young People in England (LSYPE), a panel dataset that followed a sample of about 15,000 pupils born in 1989/1990 since when they were 13 years old.[17] The LSYPE is merged with the HEFCE data through the home address of the child's family linking each household to the corresponding Census ward and hence YPR and WP eligibility status.

The LSYPE brings a number of advantages to the researcher in that it contains very detailed information about pupils' family backgrounds, their schooling achievements, including grades, and, most importantly, their attitudes and aspirations. These are captured by some questions about the child's plans for the future; in this paper I mainly exploit the answers to a question that asks them to state how likely they feel it is that they will apply to college. The variable is coded on a four points scale ("not at all likely", "not very likely", "fairly likely" and "very likely") with a mean value of 2.8 (Table 1) but a marked difference in the distribution between WP eligible and non eligible pupils (Figure 4).

Table 1 also contains descriptive statistics for a number of individual and household characteristics including ethnicity, the household's location and parents' income and educational attainment. Clearly, as highlighted in column 4, WP eligible students come from poorer and less educated households, which are mainly located in urban settings.[18] Looking at the schooling variables, it appears that the overall proportion of students who stay on in full time education after 16 is around 70%, while the share of those who get into college is just below 40%. These numbers are in line with the government official figures for the corresponding cohorts. According to the Department for Education (2010) at the end of 2007 the share of 17-year-olds in full time education was 64.9%, while estimates for higher education participation report that in school year 2008/2009 37% of students aged between 17 and 20 entered college (Department for Business, Innovation and Skills and Office for National Statistics, 2015). The difference between WP eligible and non eligible students detected in the LSYPE is very large in both schooling variables and amounts to about 15 percentage points.[19]

In Section 7, then, I further use the UK Quarterly Labour Force Survey (QLFS) to corroborate the robustness of the main results.[20] The QLFS is a household based survey that contains information on a wide range of topics such as employment status, education choices and per-

that area. The POLAR classification is based on the average YPR for the 1997-1999 cohorts, i.e., the 1997/1998, 1998/1999 and 1999/2000 school years. The final YPR ranges from 4.2% to 145%, with a mean value of 35%, that is slightly above the actual national average rate of college enrollment (Appendix Figure B.1).

[17]Longitudinal Survey of Young People in England (LSYPE). University College London. UCL Institute of Education. Centre for Longitudinal Studies (2018). UK Data Service. SN: 5545.

[18]HEFCE (2005), among others, documents that participation in higher education in England is lowest in the cities of the North East region, Durham, Newcastle upon Tyne and Sunderland.

[19]The difference in college enrollment at age 18 between pupils living in POLAR Q1 and those living in POLAR Q5 areas is 28.9 percentage points in the LSYPE sample and 29.4 percentage points in the administrative figures for the same cohort (Department for Education, 2017).

[20]Quarterly Labour Force Survey (QLFS), 2006-2009. Office for National Statistics. Social Survey Division, Northern Ireland Statistics and Research Agency. Central Survey Unit (2017). UK Data Service.

sonal characteristics of household members. It contains approximately 60,000 households per wave and is available on a quarterly basis. From this, I build a sample of individuals who have been in secondary school for at least one year during the WP POLAR system; these are individuals who reached college entry age between 2005 and 2009 and were older than 18 at the time of the survey. For these students I create an indicator variable to reflect whether they stayed on in full time education after the compulsory school leaving age of 16 and another indicator to reflect whether they then went to college at age 18. Appendix Table B.1 shows some descriptive statistics computed from the QLFS sample. These appear very similar, in levels and patterns, to those in Table 1 computed on the LSYPE.

4 Empirical Strategy

4.1 Identification

Identification of the impact of aspirations on educational outcomes and schooling choices presents major challenges in that children with lower aspirations are also more likely to come from a disadvantaged socioeconomic background and therefore simultaneously face aspirations, ability and income constraints in accessing higher education. Indeed, recent empirical contributions which have tried to estimate a causal relationship between aspirations and educational investments using experimental settings could not clearly disentangle the effect of raising aspirations from that of relaxing credit constraints (Chiapa et al., 2012; Wydick et al., 2013), or improving cognitive skills (Hahn et al., 1994). A convincing identification strategy would need to rely on some exogenous source of variation of aspirations that should not affect either the subject's economic conditions or her ability.[21]

In this paper I exploit the design of the Widening Participation policy which stimulates the pupils' aspirations without providing them with any form of financial aid or academic tutoring, thus allowing me to overcome the endogeneity problem described above. Let S_{ict} be a binary variable indicating whether child i, living in census ward c, goes to college after leaving compulsory school; A_{ict} be the child's aspirations when still at school, measured as the child's stated likelihood of applying to college; and WP_c be an indicator function for whether the census ward c where the child lives is a WP target area. Then, I obtain a system of simultaneous equations of the type below, where β is the structural parameter of interest, i.e., the effect of aspirations

[21] Heckman et al. (2013) move in this direction and exploit changes in personality traits that are experimentally induced by the Perry Preschool program to analyze their impact on schooling outcomes. Their finding is that the stimulation of personality traits, including motivation towards education, during early childhood has a sizable and significant impact on the individual's achievements until adulthood.

on schooling:

$$\begin{aligned} S_{ict} &= \alpha + \beta A_{ict} + \epsilon_{ict} \\ A_{ict} &= a + b\, WP_c + u_{ict} \end{aligned} \tag{1}$$

In the equations above the two error terms, ϵ_{it} and u_{it}, are correlated because exposure to treatment is not random. Yet, I can exploit the fact that the assignment rule of individuals to WP policy interventions is known exactly to overcome this problem. Indeed, the deterministic function that assigns children to the group of the WP target students is:

$$WP_c = \begin{cases} 1 & \text{if } YPR_c \leq Q_2 \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

where YPR_c is the *Young Participation Rate* in higher education described in Section 3 and Q_2 denotes the second quintile of its distribution. Children therefore are targeted if they reside in areas where the participation rate in higher education of older cohorts is equal or below the 40^{th} percentile.

Knowledge of this assignment rule allows me to use a *Regression Discontinuity Design* (RD) as introduced by Thistlethwaite and Campbell (1960). The running variable determining assignment to treatment will be YPR_c and the resulting estimating equations:

$$\begin{aligned} S_{ict} &= f(YPR_c) + \gamma\, WP_c + \upsilon_{ict} \\ A_{ict} &= g(YPR_c) + c\, WP_c + u_{ict} \end{aligned} \tag{3}$$

where $f(\cdot)$ and $g(\cdot)$ are unknown functions of the running variable YPR_c whose form will be discussed in the following paragraph. Estimation of the conditional expectations of the outcome variables on the two sides of the cut-off Q_2 will return unbiased estimates of the two reduced form parameters γ and c. The relationship between the estimated and the structural parameters will be the following:

$$\begin{aligned} \hat{\gamma}_{RD} &= \lim_{YPR_c \to Q_2^+} E\,(S_{ict}|YPR_c = ypr_c) - \lim_{YPR_c \to Q_2^-} E\,(S_{ict}|YPR_c = ypr_c) = (\widehat{\beta \times b}) \\ \hat{c}_{RD} &= \lim_{YPR_c \to Q_2^+} E\,(A_{ict}|YPR_c = ypr_c) - \lim_{YPR_c \to Q_2^-} E\,(A_{ict}|YPR_c = ypr_c) = \hat{b} \end{aligned} \tag{4}$$

The empirical design just described thus allows me to retrieve unbiased estimates of the effects of the policy on aspirations ($\hat{c}$) and on schooling ($\hat{\gamma}$) for individuals living in neighborhoods where YPR is close enough to the 40^{th} percentile. The elasticity of schooling to aspirations will be $\hat{\beta} = \frac{\hat{\gamma}}{\hat{c}}$.

The estimates obtained will need to be interpreted as a *Local Intention To Treat* (ITT) effect. Indeed, while we have exact information on the criteria which determine WP eligibility, we know little about the actual administration of the treatment, as discussed in Section 2. The lack of perfect compliance does not allow the researcher to estimate the actual effect of the treatment, but only the effect of *eligibility to treatment*. This can be considered a lower bound of the real treatment effect, the magnitude of the latter ranging between the estimated parameter and almost three times as much if one considers the policy take-up rate computed in Section 2. Moreover, the ITT parameter can give particularly precious information to policy makers on the effectiveness of the policy design in a context like this one in which program participation cannot be forced upon students and thus perfect compliance is not achievable (i.e an encouragement design as defined in Duflo et al. 2008).[22]

4.2 Estimation

The main estimates of c and γ will be based on a non parametric specification, which allows me to relax most of the assumptions required by the parametric models. Following Hahn et al. (2001), I employ a non parametric *Local Linear Regression* (LLR) to approximate the functions $f(\cdot)$ and $g(\cdot)$ as the forcing variable approaches the cut-off point;[23] the difference between the two functions at the cut-off point will provide the estimate of the treatment effect.

The LLR on the two sides of the cut-off is estimated using Triangular Kernel weights so that observations which are closer to the cut-off point will carry a larger weight: Fan and Gijbels (1996) proved that Triangular Kernel weighted local linear regression performs optimally at the window boundary and thus also at the cut-off where the RD requires most precision.

As for the bandwidth, I will use the optimal one as derived by Imbens and Kalyanaraman (2010) through a plug in method which minimizes the Expected Squared Error Loss around the cut-off point. Moreover, for robustness, results will always be shown for a bandwidth equal to half and double the optimal level, while graphical analysis will be used to explore the sensitivity of the estimated coefficients to the chosen bandwidth (Section 7).

Finally, for all specifications, standard errors will be clustered at the census ward level (where assignment to treatment varies), so as to allow for the possibility that error terms may be correlated among individuals living in the same ward. For regressions based on the pooled panel dataset, standard errors will be clustered at the individual level.

[22] Indeed, while participation in some outreach activities (e.g. school visits) may be thought as compulsory, most of them, such as mentoring or summer schools, are optional.

[23] I allow the $f(\cdot)$ and $g(\cdot)$ to be different on the two sides of the cut-off, so that I effectively approximate $f_l(\cdot)$ and $g_l(\cdot)$ below the 40^{th} percentile and $f_r(\cdot)$ and $g_r(\cdot)$ above it.

5 Results

5.1 Aspirations

I first proceed with the estimation of the parameter c as in Equation (3) and I use, as a measure of aspirations, the stated likelihood of applying to college. As explained in Section 3, in each wave of the LSYPE, pupils are asked to state how likely it is that they will apply to university and they are given four options: "very likely", "fairly likely", "not very likely" and "not at all likely". This question is asked every year until they reach age 18 and their answers show a good variability over time, getting more polarized as they grow older (Figure 5). To estimate Equation (3), I reshape this "aspirations" variable as a dichotomous one, assigning it value one if pupils state they are either very or fairly likely to apply to college and zero if they say they are not very or not at all likely to apply.

The estimated effect is first graphically illustrated in the first panel of Figure 6. The vertical dashed line shows the threshold for WP eligibility, students to the left of the line are WP target, students to the right are not. The horizontal axis reports the level of YPR_c in the ward where the student lives, i.e., the running variable. The relationship between the forcing and the outcome variable is shown over a ± 0.3 window around the cut-off. The figure shows that aspirations increase as the level of educational attainment of the area where the child lives gets higher. The shape of the fitted line, with a slight upturn just below the threshold, suggests that the policy affected the eligible pupils who were closer to the cut-off determining an upward shift of their aspirations away from the trend. On the other hand, children living in areas with lower participation rates do not seem to have been affected by the policy. At the WP cut-off a statistically significant discontinuity in the probability of individuals stating they are likely to apply to college appears. Results in Table 2 show that this difference amounts to 4.8 percentage points over a baseline probability of 63.3%, the estimate being robust to the use of a bandwidth larger than the optimal one.

These results are comparable to those of Emmerson et al. (2006) who employ similar proxies for educational aspirations and find that exposure to a previous WP initiative, the AimHigher: Excellence Challenge program, increased pupils' stated likelihood of leaving full time education at age 20 or more, by about 4 percentage points over a baseline of 33%. If aspirations automatically translated into actual schooling choices the magnitude of this effect would be very large: comparing it to the estimates of Dearden et al. (2014), a similar increase in the probability of enrollment would be equivalent to that generated by a grant of over £1,100 to each target student.[24]

The results on aspirations are robust to the use of different measures of the outcome. First, in Table 3, I report the results obtained by considering all the thresholds of the original four

[24] Also, similar magnitudes are found by Fack and Grenet (2015) for France.

point scale variable: column 1 is the effect on the probability of stating to be at least "not very likely" (against "not at all likely"); column 2 is the baseline result on the probability of stating to be at least "fairly likely"; and column 3 the effect on the probability of being "very likely". All the three coefficients are positive and statistically significant showing that the policy essentially shifted the whole distribution of the variable. In columns 4-6, instead, I test the baseline model by school year and find that the effect remains substantially constant over time, more precisely estimated in the first years.[25,26]

In Table 4, then, I use different variables collected in the LSYPE to proxy for aspirations towards higher education. In the first column I report the results on parents' aspirations, defined as the main parent's stated likelihood that her child will go to university at age 18. I find a 2.6 percentage points increase in the probability of answering "fairly likely" or "very likely" over a baseline share of 66.5%, that is not, though, statistically significant. In column 2 I exploit a question of the survey in which children are asked to state whether they believe that "most of their friends will stay on in full time education at age 16". Here I find a small but statistically significant effect of about one percentage point over a very high baseline probability of 96.8%. In column 3, then, aspirations are proxied by a variable that measures the share of children who believe that "most of their friends are planning to go to university". In this case, the estimated coefficient and the baseline probability are very similar to those of estimates in Table 2, i.e., a 5.4 percentage points increase over a baseline probability of 64.3%. Finally, in column 4, I consider the effect on the likelihood of thinking "people like me do not go to university". Coherently with the previous results, this probability is significantly reduced by almost 3 percentage points over a baseline of 14.5%. All in all, the estimates in Table 4 thus confirm that exposure to the policy increased children's aspirations about going to college but hardly had any impact on their parents' beliefs.[27]

5.2 Post compulsory education

I estimate the effect of aspirations on actual schooling choices both at age 16, when students have to decide whether to drop out of school or stay on in full time education and prepare to get into college, and at age 18 when they enroll in college.[28] The advantage of looking at the choices made by students when they are 16 is that there are no barriers for them to stay in education at that time: education is still free and they do not need to gain admission as they

[25] See Appendix Figures B.4 and B.5 for a graphical representation of this set of results.

[26] In year 13 students may have already submitted their application for college admission. In this case they are not anymore asked their likelihood of applying to college. If I include these individuals in the estimates (assigning them $A_{it} = 1$) I obtain an estimate of $\hat{\beta}_{RD} = 0.050^{**}$ over a baseline of 64.5%.

[27] See Appendix Figure B.6 for a graphical representation of this set of results.

[28] After 16, having passed their GCSE examinations, students can either stay in education and obtain the A-levels which will allow them to get into university, or obtain a degree of further education, or drop out of full time education.

do for college, with the UK higher education system being highly selective. I thus estimate a version of Equation (3) in which the outcome is a binary variable that equals one if the student stays on in full time education after age 16 and 0 if she drops out.

The estimate of the effect of the WP policies obtained through regression discontinuity reveals a positive and statistically significant increase in the probability of staying on in education after age 16. This is graphically represented in the second panel of Figure 6 and then detailed in Table 2. The latter shows that the effect of WP exposure at the cut-off amounts to about 4.5 percentage points from a baseline of 69.8%. Compared to the evidence in Emmerson et al. (2006), these effects are larger and more precisely estimated. As in the case of aspirations, the shape of the fitted line suggests that the policy mainly affected pupils who were closer to the cut-off and did not affect those in the lowest tail of the YPR distribution.

Following Equation (4), I retrieve an estimate of the structural parameter β by dividing the coefficient by the estimated increase in aspirations. This allows me to conclude that the elasticity of drop out at 16 to aspirations is just below unit suggesting that aspirations do translate into actual behavior in an effective way, at least at this stage.

5.3 College enrollment

The final outcome of interest, the target of the WP policies, is enrollment in full time college at age 18. As shown in the last panel of Figure 6, the discontinuity generated by the policy on this outcome is small and not statistically significant. The jump is estimated to be around 1.9 percentage points from a baseline of 40.6%. In terms of the structural parameter of interest, this would translate in a 4 percentage points increase in the probability of going to college for an increase of 10 percentage points in aspirations.

While the overall average effect was negligible, the limited size of the sample not allowing us to distinguish the estimated coefficient from a null one, enrollment in college did increase in a statistically significant way among some subgroups of the target population, namely non white students and girls.[29] The latter, in particular, increased their participation in higher education by about 5 percentage points following an increase in aspirations of almost 8 percentage points. This higher responsiveness of girls to the policy is in line with the findings of several previous works such as Angrist et al. (2009); Angrist and Lavy (2009); Lindo et al. (2010); Carrell and Sacerdote (2017).

The lack of a general significant increase in higher education participation, though, casts a shadow on the final effectiveness of the WP policies and on the potential of aspirations in shaping educational choices: it shows that increased aspirations do translate into a lower rate of drop out at age 16, but do not automatically generate an equally significant increase in

[29]Detailed results are reported in Appendix Table B.2.

college attendance. It is therefore reasonable to expect there to be other factors that interact with low aspirations in hampering the participation in higher education of pupils from low socioeconomic backgrounds.

6 Analysis and discussion of the mechanisms

So why did the increase in aspirations and in post compulsory education that the policy generated not translate in a similar increase in the rate of participation in higher education? How can the WP policy design be modified to maximize its effectiveness?

The interpretation of the results described in Section 5 is non trivial for several reasons. First, because the policy prescriptions given by the UK government were very general and left large margins of discretion to higher education institutions in designing the set of outreach activities to propose, i.e., the exact treatment to administer to target students. Second, from a more theoretical point of view, because of the lack of a consolidated theory of how aspirations shape the behavior of economic agents. Indeed, whereas the role of ambitions and aspirations has been extensively analyzed in the psychology (Gutman and Akerman, 2008) and sociology (Biddle, 1979; Flynn and Lemay, 1999) literature, economists have rarely introduced similar concepts in a formal general model of agents' behavior.

6.1 WP as an information provision

With regard to the first aspect, i.e., the type of treatment administered to target students, one may argue, for instance, that outreach activities should be seen as information campaigns in the spirit of the works of Bettinger et al. (2012), Oreopoulos and Dunn (2013), Hoxby and Turner (2015) and McGuigan et al. (2016). Yet, as discussed in Section 2, the main objective of WP was to give pupils a taster of the activities carried out in colleges and the possible professional outcomes rather than providing them with information on college application, selection and funding mechanisms. This type of support is instead generally provided by UCAS to all schools, notwithstanding the students' eligibility to WP.

To assess whether the channel through which the policy worked was the provision of information, I estimated the treatment effect on the students' stated usefulness of the information about the application and selection mechanisms that they received either inside the class or outside. Results are reported in the first two columns of Table 5 and show no significant effect of WP.

6.2 Aspirations in a prospect theory framework

On the other hand, because the stated objective of WP was to raise aspirations, it seems more appropriate to approach the analysis from this point of view, trying to pin down the role that aspirations may have in shaping individuals' behavior in an economic setting.

Students' choices may thus be framed in terms of "prospect theory" as originally formulated by Kahneman and Tversky (1979). Aspirations would then be reference points that shape the preferences of individuals in such a way that marginal utility increases below the reference point and decreases above it, i.e., individuals have large utility gains when getting close to their aspirations and, once they reach their target, feel satisfied and have low marginal utility gains.[30] A recent notable contribution expanded the theory on reference points formalizing the way aspirations are formed and deriving implications in terms of growth, inequality and poverty traps (Genicot and Ray, 2017). In a similar framework, the WP interventions may be seen as an instrument to move the reference points of pupils upwards so that they would then naturally put more effort in to reach said reference points and would not feel satisfied with lower levels of education and income. Their effort, though, would fall if the induced reference point was too far from their starting point or their rise in aspirations so large to generate frustration.

To explore this hypothesis I analyze heterogeneity in the results depending on family background as proxied by family income. Figure 7 clearly shows that the distribution of household income among target students is shifted to the left relative to that of non target students, but that there is common support between the two groups. I thus estimate the effect of WP eligibility dividing the sample in three subgroups defined by the tercile in which the household income falls. Results are reported in Figure 8 and Table 6. In the latter, I use both the non-parametric specification and also a parametric one with second order polynomial approximation of the smoothing function. This allows me to also test the pairwise difference between the subsamples' coefficients. In the bottom rows of each panel of the table I report the corresponding p-values.

The results show that the rise in aspirations was similar in all three income groups, so that everyone revised upwards their targets. The reported p-value of the test of the pairwise differences between the estimated coefficients are all very high so that the hypothesis of equality is not rejected. In terms of effort in education, I find that the rise in participation in post compulsory education was also substantially constant across the three groups, larger, though not significantly, for those in the bottom tercile. Therefore, in contrast with the predictions of (Genicot and Ray, 2017) model, there is no evidence of decreases in educational effort for

[30] A similar behavior has been empirically validated in a work by Camerer et al. (1997) which showed that New York taxi drivers were choosing how many hours of labor to supply every day following a daily earnings target maximization. Other than this work, very few empirical tests of the prospect theory have been provided since its original formulation (Barberis, 2013).

those who start farther away from the induced reference point, i.e., those in the bottom income quantile. Looking, finally, at the increase in college enrollment generated by the policy, I find an interesting pattern of heterogeneities. The WP policy seems to have been successful in increasing college participation for children coming from the most affluent families, with a large estimated increase of 11 to 14 percentage points, depending on the specification chosen. The coefficient for the top income quantile is also different from that of the middle quantile at 5% level of significance but is not different in statistical terms from that of the bottom quantile.

All these estimates should be taken with caution because, being based on considerably smaller sample sizes, are generally less precise than those of the baseline specification. In particular, one may be concerned to run into a problem of multiple hypothesis testing (Savin, 1984) and hence erroneously reject a null hypothesis of equality between coefficients. To overcome this concern one may consider the Bonferroni adjusted p-values to evaluate the pairwise difference between coefficients (Bonferroni, 1936; Cameron and Trivedi, 2005). Compared to the unadjusted p-values, the latter are slightly larger, but confirm the same pattern of statistical significance. Specifically, the difference between the top and the middle income tercile remains significant, while that between the middle and the bottom does not.

Finally, to better understand the pattern of heterogeneity of the results along the income distribution, in Figure 9 I estimate the effect of the policy on progressively smaller subsamples made of individuals whose family income is above the values reported on the horizontal axis. Of course, the precision of the estimates declines as the sample shrinks (moving to the right) but the pattern of the point estimates seems to confirm that the effect remains constant in the cases of aspirations and post compulsory education and, instead, increases with family income when we consider college enrollment.

6.3 Aspirations as non-cognitive skills

An alternative explanation of how a policy like WP and the activities in which it involves pupils can affect their behavior and induce them to spend more time in education lies in the theory of skill formation as formulated by Cunha and Heckman (2007) and Heckman (2011). In this spirit, one may see the WP activities as nourishing a set of non cognitive skills which include openness to experience and conscientiousness together with self confidence. These traits would increase motivation towards school, as in Heckman et al. (2013).[31] Indeed, evidence reported in columns 3 and 4 of Table 5 shows that WP significantly increased pupils' self confidence measured as the stated likelihood of being admitted in a higher education institution if applied

[31]Openness to experience and conscientiousness are two of the Big Five personality traits identified in the psychology literature. Openness to experience is defined as the curiosity an individual has towards novel experience. Conscientiousness, instead, is the personality trait of being careful and thus implies a desire to do a task well. Conscientious people exhibit a tendency to show self-discipline, act dutifully, and aim for achievement; they are generally hard-working and reliable.

and their general attitude towards school.[32]

Following the scheme of the models by Cunha and Heckman (2007) and Cunha et al. (2010), one can assume that non cognitive skills combine with cognitive skills and family endowments to determine human capital accumulation. This ability production function can be plugged into a two-period model of schooling choice in the spirit of Lochner and Monge-Naranjo (2012) in which individuals, being endowed at the beginning of their lives with a certain level of family income and skills, invest in schooling when young and work when adults.[33] In a similar setting a policy like WP would induce an exogenous increase in non cognitive skills with a final effect on schooling that would depend on whether children can rely on a sufficient level of pre-accumulated cognitive skills and parental endowments and on their access to credit. As shown in Table 6, parental income does indeed seem to play a role, whereby only those in the top family income quantile increase their rate of participation in higher education in a significant way. This is compatible both with a situation in which families are credit constrained and thus can only afford to send their child to college if they have sufficient family resources, and with a situation in which lower parental endowments translate in inadequate levels of skills.[34]

To shed light on this second hypothesis I further explore the role of cognitive skills. A model of skill formation like the one described above requires that cognitive and non cognitive skills are acquired together, so that a rise in only one of the two dimensions cannot translate in an increase of human capital unless the level of the other type of skills is sufficiently high. To test whether this is the case, I analyze heterogeneity in the effects of the policy depending on pre-accumulated cognitive skills. Figure 10 shows that the distribution of cognitive skills, as measured before the policy intervention, specifically at age 11 (Key Stage 2),[35] in the two sub populations has common support so that the target population does include some college-caliber students, i.e., students with sufficiently high cognitive skills (Bulman, 2015) but is also skewed to the bottom amongst WP eligible students.

Heterogeneous results by Key Stage 2 (KS2) score quantile are shown in Figure 11 and detailed in Table 7. First, I show how the effect on aspirations changes depending on the score

[32]This is a composite measure constructed in the LSYPE from the individual responses to 12 questions that were asked in waves 1-4. Children were asked whether they agreed with the following statements: (1) I am happy when I am at school; (2) school is a waste of time for me; (3) school work is worth doing; (4) most of the time I don't want to go to school; (5) people think my school is a good school; (6) on the whole I like being at school; (7) I work as hard as I can in school; (8) in a lesson, I often count the minutes till it ends; (9) I am bored in lessons; (10) the work I do in lessons is a waste of time; (11) the work I do in lessons is interesting to me; (12) I get good marks for my work. Students could answer on a four point scale score, where higher scores show more positive attitudes. The results in Table 5 use a standardized version of the score with zero mean and unit variance.

[33]The model is outlined in detail in Appendix A.

[34]These two cases correspond to Proposition 2 and Proposition 1, case 1.2, respectively, in Appendix A.

[35]In the English and Welsh education systems Key Stage 2 corresponds to the four years of schooling normally known as Year 3, Year 4, Year 5 and Year 6, when the pupils are aged between 7 and 11 years. At the end of this period pupils take a nationally standardized test that covers English and Mathematics.

that children obtained at their KS2 examinations. It appears that the increase in aspirations is concentrated among children with the lowest test scores, the corresponding coefficient being statistically different from zero and from the coefficients estimated in the other two subgroups. Second, I look at the probability of staying on in full time education at age 16, and I find a generally uniform effect across the three subgroups. The difference between one another is indeed never statistically significant. Finally, I consider the probability of college enrollment and find evidence that the policy increased college enrollment mostly for those who were in the central part of the ability distribution rather than for those whose level of cognitive skills was either too low (these will likely be never takers) or too high (these will likely be always takers).

To support this finding, in Figure 12, I plot the estimated coefficients for regressions estimated on subsamples made of individuals with a KS2 score equal or above the percentile specified on the horizontal axis. The estimation subsamples are thus progressively smaller in size and made of children with higher skills as one moves right. The estimated coefficients do not show clear patterns with the exception of the case of aspirations where, coherently with the results of Table 7, the coefficients become progressively smaller as we exclude children with lower scores.

Additional evidence on the pattern of the policy impact along the skills distribution is provided in Table 8. There, I show how the effect on post compulsory education attendance and college enrollment varies across quantiles of different measure of pre-accumulated cognitive skills: Key Stage 3 examinations are taken at age 14, Key Stage 4 ones at 16, Key stage 5 at 18 and represent the main criterion of selection for college admission. Using these measures, I find that both for post 16 education and for college enrollment the impact of the policy was generally significantly larger for children in the central part of the skills distribution.

Taken together, these findings are thus compatible with a model of schooling in which human capital accumulation is determined jointly by parental endowments but also pre-accumulated cognitive skills, so that only those with sufficiently high levels of both can effectively increase their participation in higher education.

Note that the model described above is based on the assumption that an exogenous increase in non cognitive skills does not per se generate an increase in cognitive skills too. This is what Cunha et al. (2010) define as "cross productivity effects" providing evidence that these are quite significant at early ages (6-9 year-olds) and then progressively decrease so that at ages 10 to 13 the estimated cross productivity effects between non cognitive and cognitive skills are essentially null. I rule out the presence of such effects in this context by estimating the impact of WP on pupils' test scores at age 18. Results are reported in the last two columns of Table 5 and show indeed no significant impact.

In conclusion, while no single mechanism can be clearly identified as driving the results, the estimates obtained appear to be consistent with a setting in which raising aspirations can improve participation in higher education, but only if children carry with them a sufficient baggage of skills and parental endowments. The first is needed to successfully accumulate human capital. The latter can be crucial in several ways: it makes the idea of going to college more feasible for children, so that their raised aspirations are not considered out of reach; it allows them to overcome possible credit constraints, which would make any desire of attending college unachievable; it represents a higher level of parental investment in the children's human capital, thus contributing to their skill formation. All these aspects suggest that, in order to maximize the effectiveness of the policy, one may prefer to target specifically the identified marginal students, i.e., those whose family income is sufficiently high and whose skills are neither too low nor too high or, alternatively, to target those who are college-caliber in terms of pre-accumulated skills, and provide them with adequate financial resources to afford the costs of higher education.

7 Specification and robustness checks

The first battery of checks discussed in this section aims at assessing the validity of the RD design in this context. This empirical strategy has been proved to yield consistent estimates as long as the counterfactual conditional distribution of the outcome variable is smooth in the running variable, i.e., if aspirations and the probability of enrolling in post compulsory or higher education, in the absence of the policy, are "continuously" related to the Young Participation Rate of the census ward of residence.

While this assumption cannot be tested directly, it is common practice to assess its feasibility by checking that other variables which are usually associated to the outcome of interest do not also vary discontinuously at the threshold (Imbens and Lemieux, 2008). Estimates of the discontinuities for the most relevant observable characteristics are reported in the last column of Table 1 and none of them is statistically different from zero.

Secondly, one may be concerned that the results of the RD exercise are driven by some "manipulation" of the forcing variable such that individuals would self select into the eligible group in order to benefit from the policy intervention. If this was the case, the RD results would be biased and likely overestimate the impact of the policy (under the assumption that those who deliberately self selected into the eligible group were the most sensitive to the policy intervention). In the case of the WP policies, nevertheless, it seems quite unlikely that individuals selected, i.e., physically moved, into wards just below the threshold so as to be eligible for the WP policy interventions because the eligibility rules were not announced and explained to the public; moreover, households could not manipulate the forcing variable of their ward of residence because this value was defined on the basis of the behavior of older cohorts. Formally, I verify the absence of any manipulation of the forcing variable using the test designed by McCrary (2008). This is based on estimating the discontinuity at the cut-off in the density function of the running variable through LLR techniques with triangular Kernel weights. Figure 13 shows the estimated discontinuity in the density of the forcing variable. The test rejects the presence of any mass of density just below the WP threshold.

As for the robustness of the baseline results, in Table 9 I consider different specifications of the model described by Equation (3). First, I re-estimate the baseline regressions employing the survey sampling weights. As discussed in Solon et al. (2015), the use of sampling weights in a similar setting risks to bias the estimates to the extent that the sample is not stratified along the dimension of heterogeneity exploited in the empirical analysis (in this case, the Young Participation Rate of the ward of residence). On the other hand, weighting may be advisable to improve the reliability of the estimates in the population. The results reported in Table 9 using weights, largely confirm those of the main specification thus reassuring us on their robustness from this point of view. Secondly, I resort to the RD model with covariates developed by Calonico et al. (2018). The set of control variables included are ethnicity, an indicator for living in a urban area, and mother's education. The results, despite being slightly smaller in magnitude, maintain the same pattern of the baseline ones. Finally, I report the results obtained with a parametric, second order polynomial, approximation. The coefficients are equally significant and slightly larger in magnitude than those of the baseline non parametric specification, thus confirming that the choice of the functional form to adopt does not affect the results obtained.[36]

Another concern may relate to the choice of the bandwidth to use in the non parametric specification. All the results reported were based on the bandwidth selected through the methodology developed by Imbens and Kalyanaraman (2010). In Figure 14, I show how the estimated coefficients vary for varying values of the bandwidth. The vertical dashed lines are the optimal values used in the baseline specification. The figures show that, while the estimates are very unstable for very low values of the bandwidth, they become substantially constant as they approach the optimal one and remain constant for any larger value.

To ensure that the results obtained are not generated by random variation, I then consider hypothetical perturbations of the threshold and estimate the relative discontinuities. In Figure 15 I show the results obtained at different hypothetical cut-offs. Specifically, I consider perturbations of the real cut-off (the dashed vertical lines) of ± 0.02 in a window of 0.2 width. The graphs generally show no significant discontinuities at the false cut-offs, with yet more variability and some negative point estimates at the left of the discontinuity. To get a better sense of the magnitude of the baseline estimates relative to those of the falsification exercise, in Figure 16 I show the distribution of the RD coefficients estimated in the same window of 0.2 width but at many more thresholds (±0.001 perturbations of the real cut-off). The dashed vertical lines

[36] Detailed results from parametric estimation are reported in Appendix Figure B.7 and Table B.3. There I show results for linear, quadratic and cubic specifications (Gelman and Imbens, 2017) with the slope and the concavity of the smoothing function allowed to change independently on each side of the cut-off.

represent the coefficients estimated in the baseline regressions. These appear to fall in the upper tail of the distribution, specifically above the 90^{th} percentile in the case of aspirations and full time education after 16, and above the 75^{th} for college enrollment. This test reassures us that the relationship over which we are estimating the discontinuity is sufficiently smooth and the identified jump not just due to chance.

As a final proof of robustness, I replicate the main estimations using alternative data sources. As mentioned in Section 3, I first resort to the UK Quarterly Labour Force Survey (QLFS) for the schooling outcomes at age 16 and 18. Table 10 reports the results obtained with both non parametric and parametric specifications. These results confirm that the probability of staying on in full time education at age 16 is indeed affected by the policy, the rate of participation in post compulsory education increasing at the cut-off by about 3 to 4 percentage points over a baseline rate of about 68% to 69%. Reassuringly, these figures are very similar to the effects estimated on the LSYPE sample. When I look at the effects of the policy on the rate of college enrollment, in particular, I find again no significant discontinuities at the cut-off, as the estimated coefficients are not only not statistically significant but also very close to zero. The fact that even with a considerably larger sample size the estimated impact of the policy on college enrollment is still not different from zero suggests that the non significant positive coefficient estimated in Section 5 is effectively to be considered a null effect (Abadie, 2018).
In Table 11, finally, I add the results obtained using the data from the most recent release of the POLAR classification (POLAR4). These are aggregate measures at the ward level of the rate of participation in higher education of residents who were 18 or 19 years old between 2009/2010 and 2014/2015.[37] They thus refer to youths who had been targeted by WP initiatives under the first phase of the policy implementation, the one considered in this paper. Appendix Figure B.9 shows a very smooth relationship between the old and the new rate of higher education participation and no significant discontinuity at the WP cut-off, as confirmed by the results in Table 11.

8 Conclusions

In a world of growing inequality, access to higher education represents one of the most powerful leverages of social mobility. Most policies aimed at promoting access to higher education by youths from low socioeconomic background have tackled the financial barriers that these students may face. Still little is known, instead, about the role of non financial constraints in shaping youths' educational careers. This paper contributes to this literature by investigating

[37]The rate is computed by HEFCE as the number of those who entered college between the academic years 2009-10 and 2013-14, if they entered aged 18, or between 2010-11 and 2014-15 if they entered aged 19, divided by the corresponding estimated cohort size.

the effects of a policy intervention in the UK which aimed at widening participation in higher education by raising the aspirations of youths from disadvantaged backgrounds.

The UK Widening Participation policy offers a unique setting in that it solely focuses on raising youths' aspirations without modifying any other mechanism of access to higher education. Indeed it neither changed the criteria of selection of students by colleges, nor provided special grants to the eligible students. The sole scope of the WP policy is that of engaging students living in the most disadvantaged communities in outreach activities such as summer schools, open days in college and meetings with student ambassadors in order to inspire them to pursue higher education.

The paper investigates the effects of the policy empirically by means of a regression discontinuity estimation strategy. The results reveal that the policy effectively increased youths' desire to apply to college: the share of target students that declared they were likely to apply to college increased by 7 to 8 percent. This increased willingness to apply to college translated in a decrease in the share of those who drop out of school at the compulsory school leaving age of similar magnitude. Yet, the final effect of the policy on the share of target students who eventually enrolled in college was on average negligible.

Analysis of heterogeneity across individual characteristics provided evidence that participation in higher education increased only for pupils belonging to the most affluent families and for those with medium levels of pre-accumulated skills. While these results are to be taken with caution because of the loss in precision determined by the reduced sample size, they provide useful insights into the underlying mechanisms. Several possible theories are discussed in the paper to rationalize these findings. The preferred interpretation is that educational attainment is determined through a model of human capital accumulation in which aspirations enter as a particular type of non cognitive skill and are complementary with cognitive skills and family endowments, and in which individuals may be credit constrained. In this setting only college-caliber students, i.e., those with sufficiently high cognitive skills and family endowments, would enroll in college in response to the rise in aspirations and those with no sufficient economic means would be left out.

The paper contributes to the understanding of the role of non financial barriers to education, being the first attempt to estimate the impact of a rise in aspirations towards education on youths' schooling choices and its interaction with financial constraints and skills. The external validity of the results obtained is strengthened by the possibility to rely on a national scale program rather than an experiment. On the other hand, effects may be different across the population and the design exploited in this paper only allows estimating a *local* effect around the threshold.

In regard to the policy analyzed, the findings of this paper cast a shadow on the effectiveness of the UK WP policy and its current design. As it is the policy employs large financial resources to target a very broad population, about 40% of students. The results obtained show that only a small and specific part of the target population is responsive to the intervention, suggesting that there may be room to improve the way target students are identified. While practitioners claim that the system of indicators currently employed may not be the most accurate to identify the truly disadvantaged students, the findings of this paper rather suggest that any socio-economic indicator should be coupled with other types of information, namely that on previously accumulated skills, in order to maximize the intake of students from disadvantaged backgrounds. Moreover, coordination between institutions should be improved so as to increase the total number of students involved in outreach activities. An effective monitoring system, finally, should not only look at the final intake of target students by the different institutions but also at the effort made by each of them, i.e., the activities carried out and the resources employed. Better information on these aspects would allow the government to assess the effectiveness of the different activities and thus direct towards them the effort made by the various institutions.

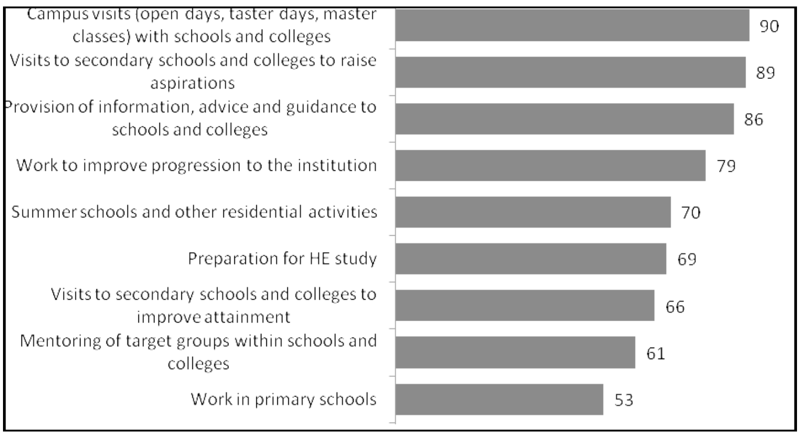
From a general policy perspective, finally, the significant rise in aspirations and decrease in school drop out rates generated by the Widening Participation policy seem to suggest that there is scope for policy makers to increase participation in higher education among teenagers from disadvantaged backgrounds by "manipulating" their non cognitive traits. Nevertheless, the results obtained in this paper clearly highlighted that barriers to widening participation also include other factors so that the most effective widening participation policy would be one that manages to target students who are college-caliber in terms of pre-accumulated skills and provide them with sufficient financial means to afford the costs of higher education. For the others, on the other hand, policy interventions should be anticipated at earlier stages so as to provide them with the means, in terms of skills, to be truly able to aim higher and achieve their aspirations.

Figures and Tables

Figure 1: London Target Areas by Young Participation Rate quintile.

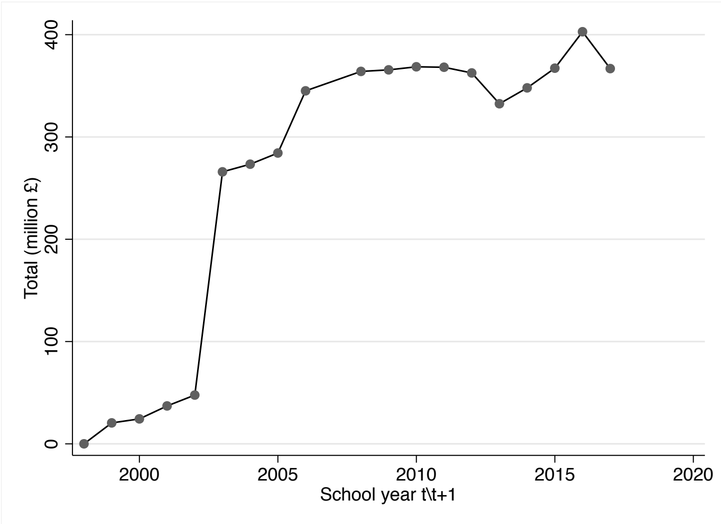
Notes: The Young Participation Rate is computed by HEFCE on the basis of the 2001 Census, POLAR classification.

Figure 2: Widening Participation activities.



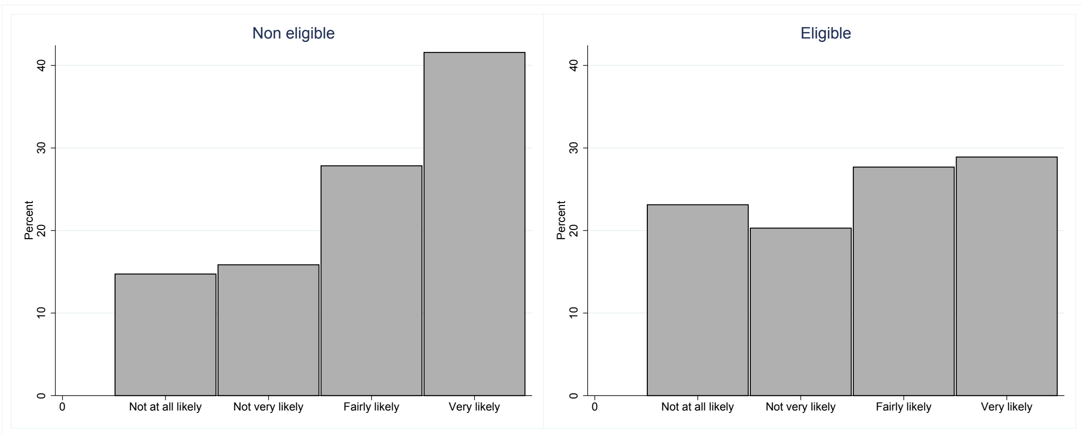
Notes: The figure is taken from (Bowes et al., 2013). The numbers on the right indicate the share of colleges that report carrying out the specified type of outreach activity.

Figure 3: HEFCE funding for Widening Participation.



Notes: Total WP funds include funds for widening access and for improving retention. Source: Recurrent grants for $t\backslash t+1$: Revised allocations. HEFCE.

Figure 4: Likelihood of applying to university at age 18 by WP eligibility.



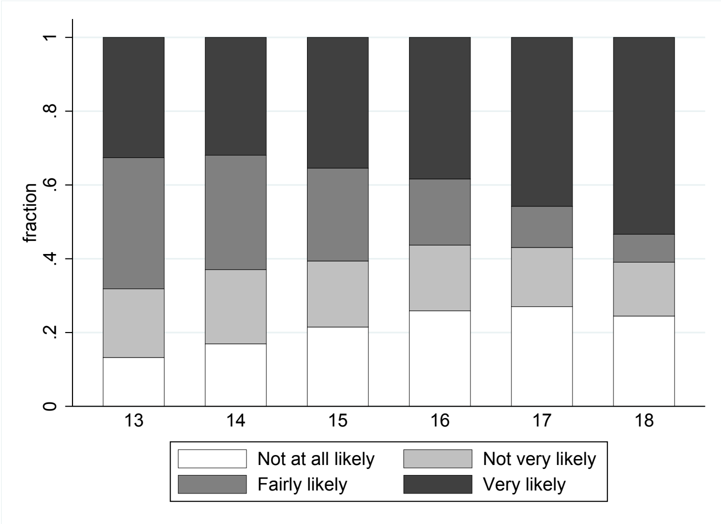
Notes: Fraction of students by answer to question "How likely is it that you will apply to university?" and by WP eligibility.

Table 1: Descriptive statistics and test of continuity in the distribution of covariates.

	(1) Full Sample	(2) Eligible	(3) Non Eligible	(4) (2)-(3)	(5) $\hat{\beta}_{RD}$
Female	0.491	0.498	0.484	0.014	0.031
	(0.500)	(0.500)	(0.500)	[0.008]	[0.021]
White	0.670	0.667	0.673	-0.091	0.066
	(0.470)	(0.471)	(0.469)	[0.007]	[0.072]
Urban	0.846	0.930	0.762	0.168***	0.015
	(0.361)	(0.254)	(0.426)	[0.006]	[0.037]
London	0.190	0.134	0.245	-0.111***	0.026
	(0.392)	(0.341)	(0.430)	[0.006]	[0.061]
Parental Income > median	0.493	0.394	0.589	-0.196***	0.015
	(0.500)	(0.489)	(0.492)	[0.009]	[0.037]
Father went to college	0.100	0.047	0.154	-0.107***	0.001
	(0.300)	(0.212)	(0.361)	[0.005]	[0.015]
Mother went to college	0.095	0.049	0.140	-0.091***	0.002
	(0.293)	(0.217)	(0.347)	[0.005]	[0.012]
N_1	15,756	7,863	7,893		
Likelihood of applying to university (1-4)	2.792	2.625	2.957	-0.332***	0.116***
	(1.117)	(1.130)	(1.079)	[0.009]	[0.040]
N_2	60,023	29,810	30,213		
Post 16 education	0.700	0.620	0.773	-0.152***	0.045*
	(0.458)	(0.485)	(0.419)	[0.008]	[0.025]
N_3	11,071	5,306	5,765		
Higher education	0.397	0.310	0.471	-0.161***	0.019
	(0.489)	(0.463)	(0.499)	[0.007]	[0.025]
N_4	17,998	8,321	9,677		

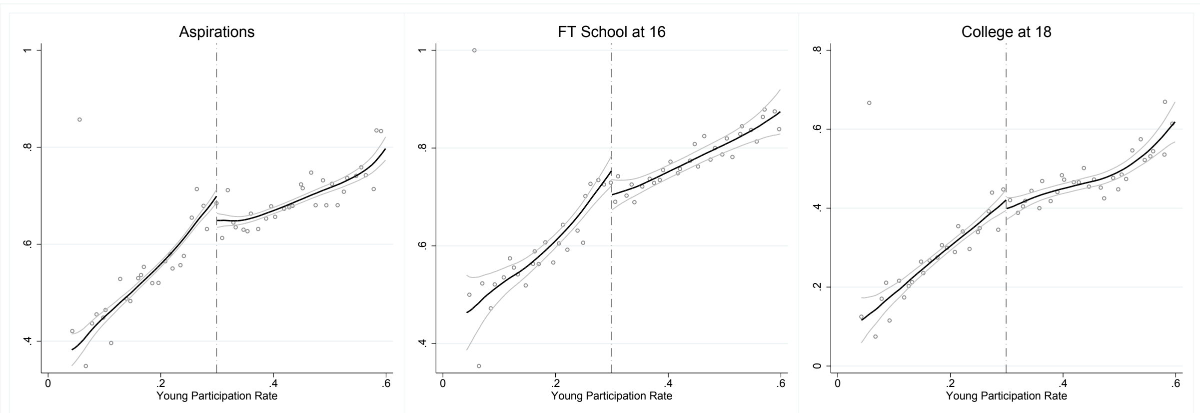
Notes: Columns (1)-(3) report mean values with standard deviations in parentheses. N_1 is the sample size for variables: Female, White, Urban, London, Parental Income, Father went to college, Mother went to college (wave 1 only); N_2 is the sample size for likelihood of applying to college (waves 1-5); N_3 is the sample size for Post 16 education (wave 4 only): N_4 is the sample size for Higher education (waves 6-7). Column (4) reports the coefficients of a t-test of the difference between column (2) and (3) with standard errors in brackets. Column (5) reports the coefficients of regression discontinuity estimates with local linear approximation with triangular Kernel weights and bandwidth computed following Imbens and Kalyanaraman (2010), standard errors are reported in brackets. Estimates in columns (4) and (5) are clustered at the census ward level. Only for Likelihood of applying to university and for Higher education variables, standard errors are clustered at the individual level. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure 5: Likelihood of applying to university at age 18 by age.



Notes: Fraction of students by answer to question "How likely is it that you will apply to university?" and by age at the beginning of the school year. For waves 5 and 6 (ages 17, 18) "very likely" includes those who already applied for university, and for wave 6 (age 18) also those who were already enrolled in university.

Figure 6: Regression Discontinuity Results. Effect of WP on aspirations and schooling.



Notes: The horizontal axis reports the Young Participation Rate. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target census wards, observations to the left of the cut-off correspond to students living in WP target census wards. The graphs show Local Linear Regression estimates with Triangular Kernel weights of (i) the probability of stating to be fairly likely or very likely to apply to college at ages 14-17; (ii) the probability of being in full time education at age 16; (iii) the probability of being enrolled in college at age 18. The bandwidth employed is the optimal one as reported in Table 2. The gray lines are the estimated 95% level confidence intervals. The dots of the underlying scatterplots show the mean outcome in bins of 0.01 width.

Table 2: Regression Discontinuity Results. Effect of WP on aspirations and schooling.

	(1)	(2)	(3)
		Aspirations	
ITT	0.048***	0.021	0.051***
	(0.018)	(0.025)	(0.013)
Bandwidth	0.134	0.067	0.268
Observations	60,023	60,023	60,023
Baseline (RHS)	0.633	0.626	0.646
		FT School at 16	
ITT	0.045*	0.029	0.036*
	(0.022)	(0.027)	(0.018)
Bandwidth	0.149	0.074	0.298
Observations	11,071	11,071	11,071
Baseline (RHS)	0.698	0.702	0.702
		College at 18	
ITT	0.019	0.016	0.012
	(0.026)	(0.036)	(0.019)
Bandwidth	0.126	0.063	0.251
Observations	17,998	17,998	17,998
Baseline (RHS)	0.406	0.400	0.398

Notes: ITT is the estimated regression discontinuity coefficient for WP eligibility. Estimates in column (1) are obtained employing the optimal bandwidth computed following Imbens and Kalyanaraman (2010). Estimates in column (2) are obtained using half the optimal bandwidth and estimates in column (3) using double the optimal bandwidth. Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4). Non parametric specification is Local Linear Regression with triangular Kernel weights. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3: Regression Discontinuity Results. Effect of WP on aspirations, detailed results.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Aspirations by threshold			Aspirations by grade				
	> 1	> 2	> 3	Year 9	Year 10	Year 11	Year 12	Year 13
ITT	0.031***	0.048***	0.037***	0.043**	0.055***	0.045*	0.038	0.047
	(0.011)	(0.018)	(0.013)	(0.019)	(0.020)	(0.026)	(0.024)	(0.034)
Bandwidth	0.205	0.134	0. 235	0.215	0.263	0.146	0.219	0.223
Observations	60,023	60,023	60,023	14,735	12,760	11,831	11,029	5,845
Baseline (RHS)	0.814	0.633	0.332	0.724	0.678	0.683	0.641	0.391

Notes: Aspirations by threshold > 1 is the probability that a child answers that she is at least "not very likely" to apply to university; > 2 is the probability that she answers that she is at least "fairly likely" to apply to university; > 3 is the probability that she answers that she is "very likely" to apply to university. ITT is the estimated regression discontinuity coefficient for WP eligibility. Bandwidth is computed following Imbens and Kalyanaraman (2010). Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. Standard errors are clustered at the individual level for Aspirations by threshold (waves 1 to 5) and at the census ward level for Aspirations by grade. Specification is Local Linear Regression with triangular Kernel weights. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 4: Regression Discontinuity Results. Effect of WP on other proxies of aspirations.

	(1)	(2)	(3)	(4)
	Parents' aspirations	Friends FT edu at 16	Friends College at 18	People "like me" don't go to uni
ITT	0.026	0.008**	0.054*	-0.029**
	(0.017)	(0.004)	(0.029)	(0.013)
Bandwidth	0.159	0.403	0.154	0.320
Observations	25,225	29,785	10,103	10,402
Baseline (RHS)	0.665	0.968	0.643	0.145

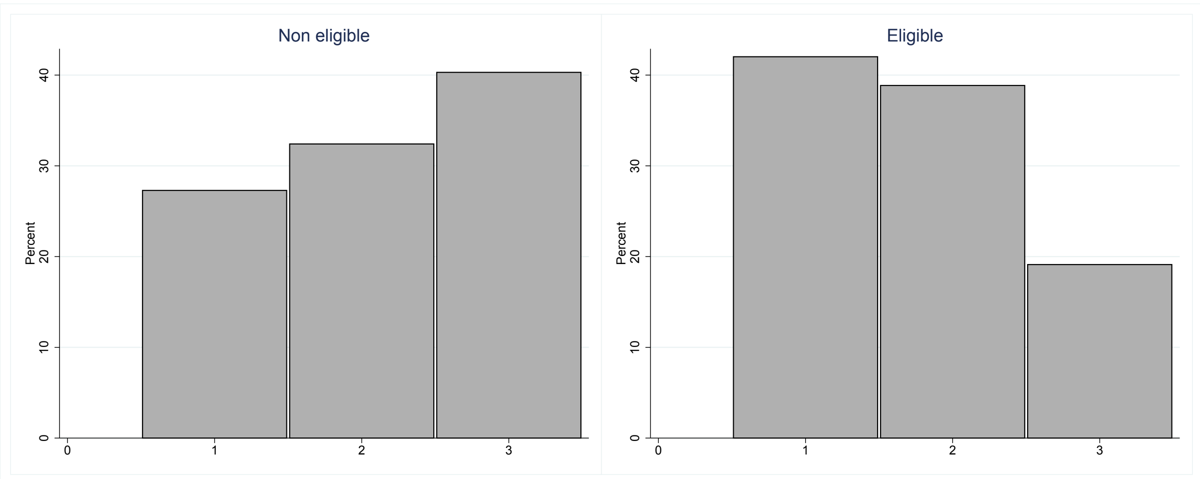
Notes: Parents' aspirations is the probability that the main parent believes it is "fairly likely" or "very likely" that her child will go to college at 18. Friends FT education at 18 is whether the child believes that "Most of her friends will stay on in full time education at 16"; Friends College at 18 is whether the child believes that "Most of her friends are planning to go to university"; People "like me" don't go to uni is whether the child agrees with the statement "People like me do not go to university". ITT is the estimated regression discontinuity coefficient for WP eligibility. Bandwidth is computed following Imbens and Kalyanaraman (2010). Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. Standard errors are clustered at the individual level for Parents' aspirations (waves 1 to 5) and for Friends FT edu at 16 (waves 1-3) and at the census ward level for the other two variables variables (wave 4). Specification is Local Linear Regression with triangular Kernel weights. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5: Regression Discontinuity Results. Effect of WP on other outcomes.

	(1)	(2)	(3)	(4)	(5)	(6)
	Information		Attitudes		Cognitive skills	
	Inside class	Outside class	Self-confidence	School Attitude	A levels	KS5 points
ITT	0.032	0.010	0.032***	0.049**	0.054	0.002
	(0.022)	(0.032)	(0.012)	(0.025)	(0.247)	(0.076)
Bandwidth	0.174	0.095	0.144	0.113	0.124	0.114
Observations	13,065	9,070	31,747	51,747	5,832	5,832
Baseline (RHS)	0.543	0.403	0.845	0.019	6.157	-0.095

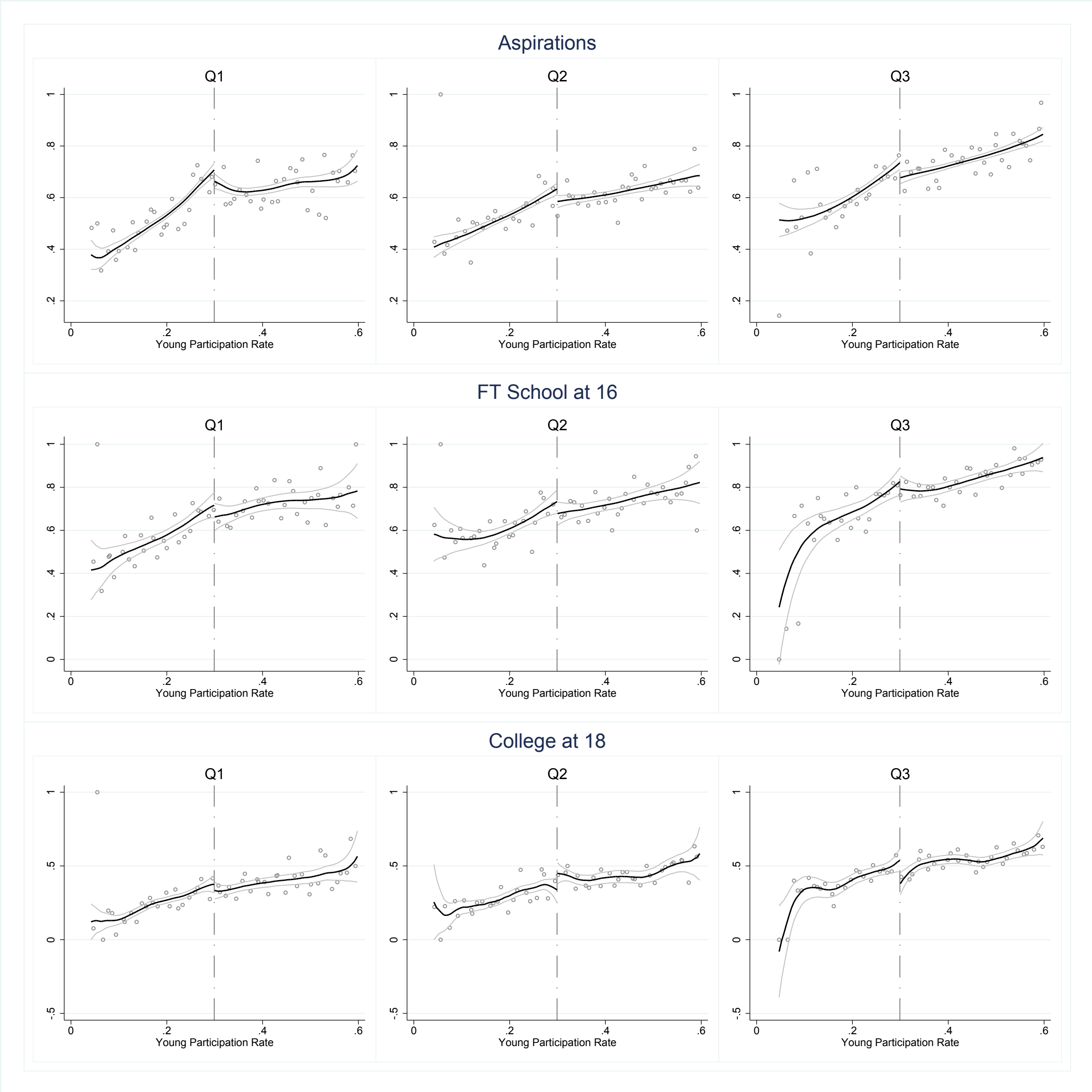
Notes: The Information variables measure whether the child received useful information about college application from teachers and other professionals inside or outside the class. Self confidence is the reported probability of being accepted in college if applied, school attitude measures the child's overall attitude towards school and is standardized with zero mean and unitary variance; A levels is the number of A levels equivalent examinations that the child took at Key Stage 5 (age 16-18), and KS5 Points is the relative standardized score. ITT is the estimated regression discontinuity coefficient for WP eligibility. Bandwidth is computed following Imbens and Kalyanaraman (2010). Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. Standard errors are clustered at the census ward level for the Information outcomes (wave 1), at the individual level for the attitudes variables (waves 1-3 and waves 1-4) and at the census ward level for cognitive skills outcomes (wave 6). Specification is Local Linear Regression with triangular Kernel weights. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure 7: Distribution of family income by WP eligibility.



Notes: Distribution of students' parental income (terciles) by WP eligibility.

Figure 8: Regression Discontinuity Results. Effect of WP on aspirations and schooling by family income tercile.



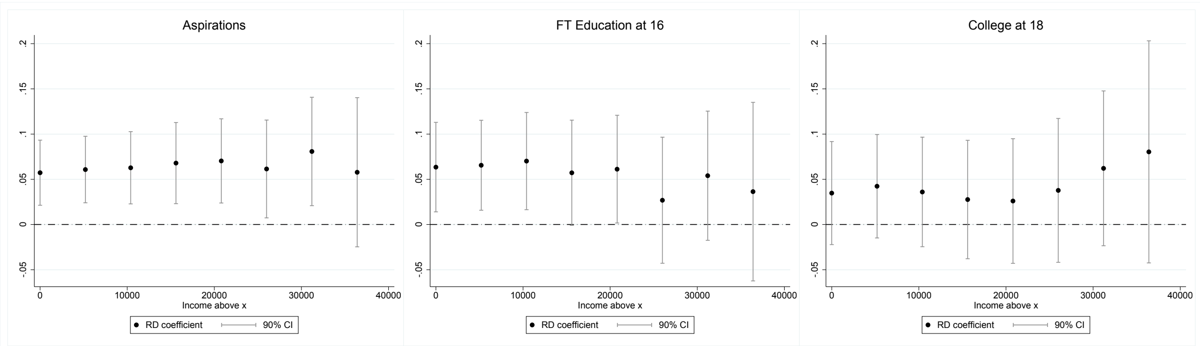
Notes: The horizontal axis reports the Young Participation Rate. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target census wards, observations to the left of the cut-off correspond to students living in WP target census wards. Q1, Q2, Q3 are family income terciles. The graphs show Local Linear Regression estimates with Triangular Kernel weights of (i) the probability of stating to be fairly likely or very likely to apply to college at ages 14-17; (ii) the probability of being in full time education at age 16; (iii) the probability of being enrolled in college at age 18. The bandwidth employed is the optimal one as reported in Table 6. The gray lines are the estimated 95% level confidence intervals. The dots of the underlying scatterplots show the mean outcome in bins of 0.01 width.

Table 6: Regression Discontinuity Results. Effect of WP on aspirations and schooling by family income tercile.

	(1)	(2)	(3)	(4)	(5)	(6)
	Q_1	Q_2	Q_3	Q_1	Q_2	Q_3
	Aspirations					
ITT	0.038	0.046	0.062*	0.031	0.048	0.089**
	(0.032)	(0.028)	(0.030)	(0.035)	(0.039)	(0.041)
Specification	np	np	np	p	p	p
Bandwidth	0.119	0.201	0.207	0.2	0.2	0.2
Observations	17,302	17,164	14,412	15,113	14,856	10,995
Baseline (RHS)	0.627	0.576	0.671	0.672	0.594	0.672
$\beta(Q_i) - \beta(Q_{i-1})$					0.7503	0.4710
$\beta(Q_i) - \beta(Q_{i-2})$						0.2854
Joint significance						0.0705
	FT School at 16					
ITT	0.059	0.045	0.032	0.081*	0.065	0.044
	(0.045)	(0.042)	(0.045)	(0.049)	(0.048)	(0.048)
Specification	np	np	np	p	p	p
Bandwidth	0.116	0.138	0.116	0.2	0.2	0.2
Observations	3,412	3,810	3,034	2,977	3,255	2,272
Baseline (RHS)	0.665	0.672	0.761	0.646	0.686	0.787
$\beta(Q_i) - \beta(Q_{i-1})$					0.8059	0.7507
$\beta(Q_i) - \beta(Q_{i-2})$						0.5934
Joint significance						0.1976
	College at 18					
ITT	0.055	-0.138*	0.142**	0.046	-0.048	0.114**
	(0.056)	(0.076)	(0.072)	(0.045)	(0.051)	(0.057)
Specification	np	np	np	p	p	p
Bandwidth	0.126	0.126	0.126	0.2	0.2	0.2
Observations	5,944	5,507	5,167	5,197	4,679	3,845
Baseline (RHS)	0.324	0.449	0.444	0.319	0.444	0.423
$\beta(Q_i) - \beta(Q_{i-1})$					0.0859	0.0243
$\beta(Q_i) - \beta(Q_{i-2})$						0.4982
Joint significance						0.0721

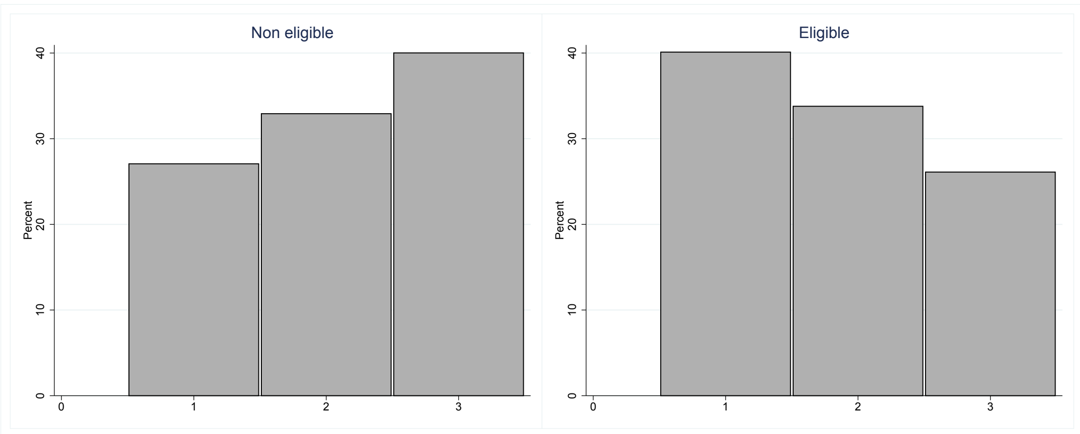
Notes: Q_i refers to the $i-th$ tercile of family income distribution. ITT is the estimated regression discontinuity coefficient for WP eligibility. Specification is non parametric Local Linear Regression with triangular Kernel weights if "np", parametric with second order polynomial approximation if "p". Optimal bandwidth for non parametric estimation is computed following Imbens and Kalyanaraman (2010). Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. $\beta(Q_i) - \beta(Q_{i-1})$ is the p-value of a χ^2 test of difference between the coefficients. Joint significance is the p-value of the test of joint significance of the coefficients. Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure 9: Regression Discontinuity Results. Effect of WP on aspirations and schooling by family income.



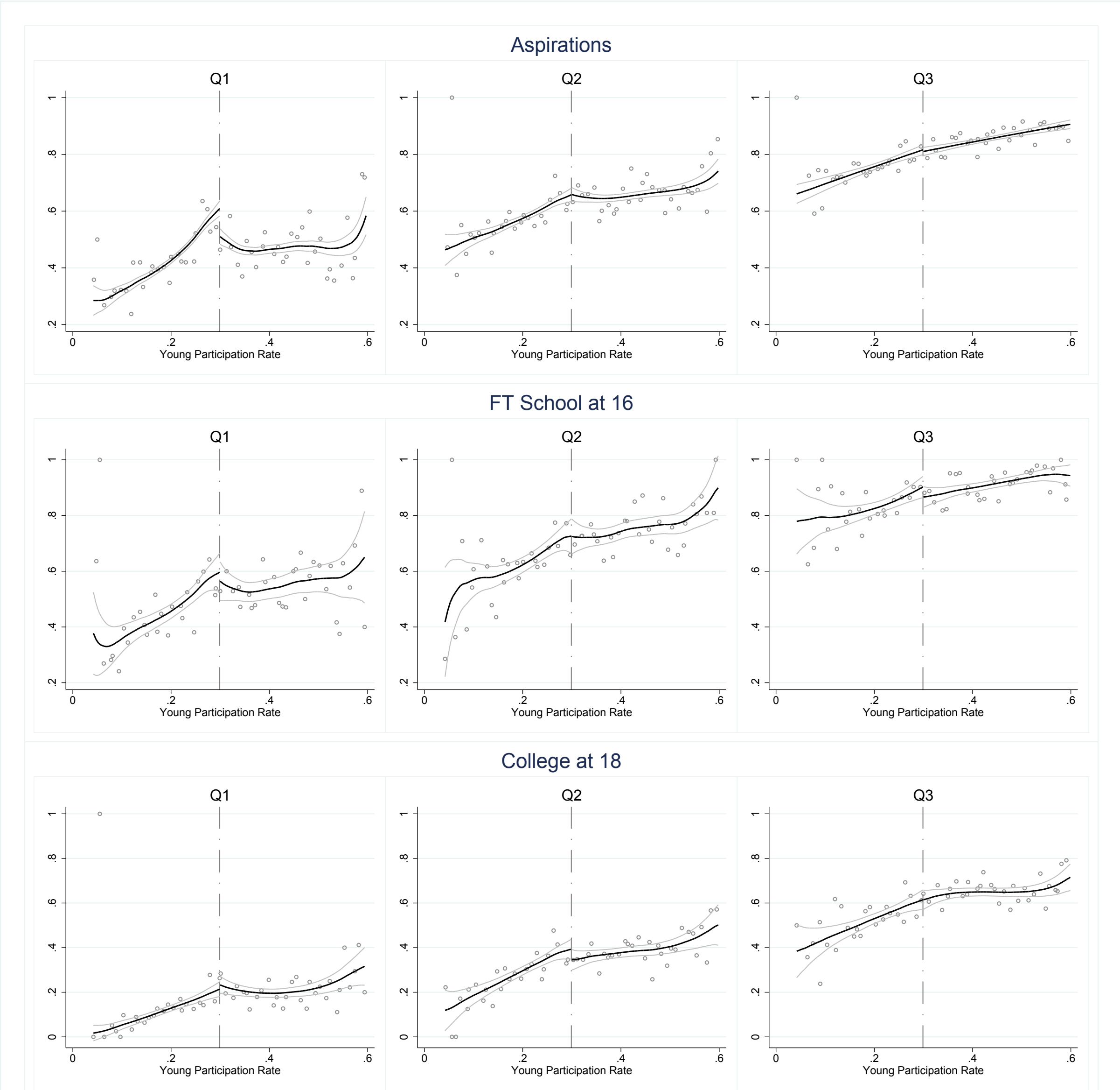
Notes: Each dot represents the point estimate of the effect of WP eligibility for students whose family income is equal or above the value specified on the horizontal axis. The lines represent the corresponding 90% confidence interval. Specification is non parametric Local Linear Regression with triangular Kernel weights and optimal bandwidth computed following Imbens and Kalyanaraman (2010). Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4).

Figure 10: Distribution of KS2 scores by WP eligibility.



Notes: Distribution of students' Key Stage 2 scores (terciles) by WP eligibility.

Figure 11: Regression Discontinuity Results. Effect of WP on aspirations and schooling by KS2 score tercile.



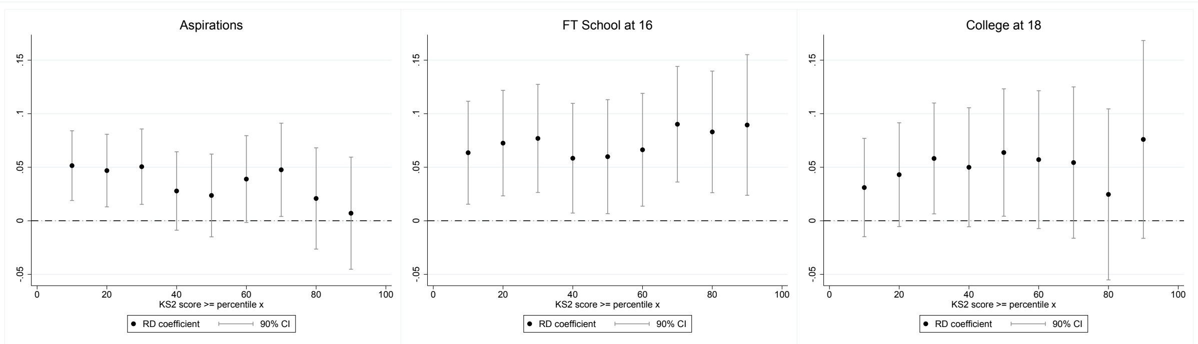
Notes: The horizontal axis reports the Young Participation Rate. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target Census Wards, observations to the left of the cut-off correspond to students living in WP target Census Wards. Q1, Q2, Q3 are KS2 score terciles. The graphs show Local Linear Regression estimates with Triangular Kernel weights of (i) the probability of stating to be fairly likely or very likely to apply to college at ages 14-17; (ii) the probability of being in full time education at age 16; (iii) the probability of being enrolled in college at age 18. The bandwidth employed is the optimal one as reported in Table 7. The gray lines are the estimated 95% level confidence intervals. The dots of the underlying scatterplots show the mean outcome in bins of 0.01 width.

Table 7: Regression Discontinuity Results. Effect of WP on aspirations and schooling by KS2 score tercile.

	(1)	(2)	(3)	(4)	(5)	(6)
	Q_1	Q_2	Q_3	Q_1	Q_2	Q_3
	Aspirations					
ITT	0.103***	-0.002	0.002	0.105***	0.001	0.017
	(0.034)	(0.029)	(0.019)	(0.035)	(0.035)	(0.031)
Specification	np	np	np	p	p	p
Bandwidth	0.113	0.151	0.426	0.2	0.2	0.2
Observations	15,113	14,856	10,995	17,575	16,040	13,613
Baseline (RHS)	0.473	0.637	0.813	0.510	0.660	0.805
$\beta(Q_i) - \beta(Q_{i-1})$					0.0351	0.7238
$\beta(Q_i) - \beta(Q_{i-2})$						0.0615
Joint significance						0.0278
	FT School at 16					
ITT	0.022	-0.002	0.039	0.052	0.037	0.048
	(0.055)	(0.046)	(0.029)	(0.054)	(0.051)	(0.035)
Specification	np	np	np	p	p	p
Bandwidth	0.141	0.141	0.141	0.2	0.2	0.2
Observations	3,396	3,472	3,489	2,980	2,931	2,764
Baseline (RHS)	0.529	0.708	0.866	0.563	0.716	0.864
$\beta(Q_i) - \beta(Q_{i-1})$					0.8327	0.8542
$\beta(Q_i) - \beta(Q_{i-2})$						0.9555
Joint significance						0.3896
	College at 18					
ITT	-0.015	0.048	-0.003	-0.021	0.062	0.013
	(0.034)	(0.042)	(0.040)	(0.043)	(0.048)	(0.049)
Specification	np	np	np	p	p	p
Bandwidth	0.172	0.137	0.158	0.2	0.2	0.2
Observations	5,079	5,649	6,168	4,448	4,793	4,859
Baseline (RHS)	0.198	0.350	0.635	0.243	0.335	0.603
$\beta(Q_i) - \beta(Q_{i-1})$					0.1971	0.4748
$\beta(Q_i) - \beta(Q_{i-2})$						0.5990
Joint significance						0.5806

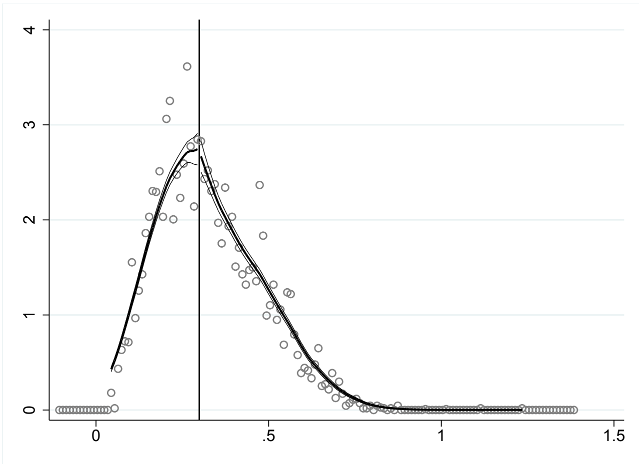
Notes: Q_i refers to the $i-th$ tercile of the Key Stage 2 score distribution. ITT is the estimated regression discontinuity coefficient for WP eligibility. Specification is non parametric Local Linear Regression with triangular Kernel weights if "np", parametric with second order polynomial approximation if "p". Optimal bandwidth for non parametric estimation is computed following Imbens and Kalyanaraman (2010). Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. $\beta(Q_i) - \beta(Q_{i-1})$ is the p-value of a χ^2 test of difference between the coefficients. Joint significance is the p-value of the test of joint significance of the coefficients. Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure 12: Regression Discontinuity Results. Effect of WP on aspirations and schooling by KS2 score.



Notes: Each dot represents the point estimate of the effect of WP eligibility for students whose KS2 score is equal or above the percentile specified on the horizontal axis. The lines represent the relative 90% confidence interval. Specification is non parametric Local Linear Regression with triangular Kernel weights and optimal bandwidth computed following Imbens and Kalyanaraman (2010). Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4).

Figure 13: Distribution of the forcing variable in the sample. McCrary test.



Notes: Distribution of Young Participation Rate in the sample; each dot represents the frequency of observations within bins of 0.01 width.

Table 8: Regression Discontinuity Results. Effect of WP on schooling by KS3, KS4 and KS5 score tercile.

	(1)	(2)	(3)	(4)	(5)	(6)
	Q_1	Q_2	Q_3	Q_1	Q_2	Q_3
	FT School at 16					
ITT by KS3	-0.036	0.097**	0.027	-0.031	0.129***	0.023
	(0.049)	(0.038)	(0.024)	(0.054)	(0.048)	(0.029)
Specification	np	np	np	p	p	p
Observations	3,441	3,539	3,560	3,064	3,014	2,781
$\beta(Q_i) - \beta(Q_{i-1})$					0.0119	0.0532
$\beta(Q_i) - \beta(Q_{i-2})$						0.3724
Joint significance						0.0257
ITT by KS4	-0.021	0.048	0.021	-0.012	0.072	0.035
	(0.042)	(0.041)	(0.041)	(0.052)	(0.045)	(0.031)
Specification	np	np	np	p	p	p
Observations	3,602	3,597	3,511	3,171	3,026	2,786
$\beta(Q_i) - \beta(Q_{i-1})$					0.2026	0.4926
$\beta(Q_i) - \beta(Q_{i-2})$						0.4465
Joint significance						0.2825
	College at 18					
ITT by KS3	-0.038	0.064	-0.001	-0.037	0.054	0.011
	(0.036)	(0.041)	(0.036)	(0.038)	(0.047)	(0.047)
Specification	np	np	np	p	p	p
Observations	4,984	5,789	6,351	4,453	4,931	4,955
$\beta(Q_i) - \beta(Q_{i-1})$					0.1334	0.5159
$\beta(Q_i) - \beta(Q_{i-2})$						0.4332
Joint significance						0.5115
ITT by KS4	-0.041	0.060*	-0.076	-0.044	0.088*	-0.060
	(0.028)	(0.036)	(0.048)	(0.028)	(0.047)	(0.046)
Specification	np	np	np	p	p	p
Observations	5,157	5,933	6,315	4,559	4,983	4,995
$\beta(Q_i) - \beta(Q_{i-1})$					0.0160	0.0246
$\beta(Q_i) - \beta(Q_{i-2})$						0.7659
Joint significance						0.0540
ITT by KS5	-0.071	0.123***	0.043	-0.064	0.147**	0.074
	(0.059)	(0.058)	(0.056)	(0.061)	(0.065)	(0.071)
Specification	np	np	np	p	p	p
Observations	1,915	1,956	1,954	1,626	1,585	1,451
$\beta(Q_i) - \beta(Q_{i-1})$					0.0178	0.4493
$\beta(Q_i) - \beta(Q_{i-2})$						0.1377
Joint significance						0.0627

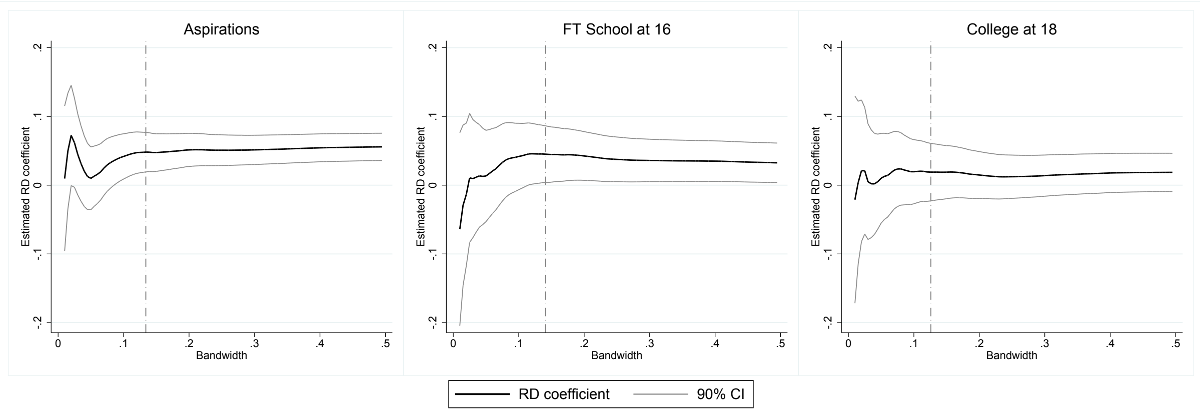
Notes: Q_i refers to the $i-th$ tercile of the Key Stage 3, Key Stage 4 and Key Stage 5 scores distribution. ITT is the estimated regression discontinuity coefficient for WP eligibility. Specification is non parametric Local Linear Regression with triangular Kernel weights if "np", parametric with second order polynomial approximation if "p". Optimal bandwidth for non parametric estimation is computed following Imbens and Kalyanaraman (2010). Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. $\beta(Q_i)-\beta(Q_{i-1})$ is the p-value of a χ^2 test of difference between the coefficients. Joint significance is the p-value of the test of joint significance of the coefficients. Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4). $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 9: Robustness checks.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Aspirations			FT School at 16			College at 18		
ITT	0.044**	0.033**	0.049**	0.045*	0.034	0.064**	0.010	0.010	0.031
	(0.020)	(0.016)	(0.024)	(0.027)	(0.024)	(0.029)	(0.022)	(0.026)	(0.028)
Bandwidth	0.151	0.134	0.2	0.148	0.141	0.2	0.211	0.126	0.2
Observations	60,023	57,051	50,426	11,068	10,538	9,210	17,998	17,122	14,910
Baseline (RHS)	0.631		0.652	0.698		0.703	0.399		0.390
Specification	np	np	p	np	np	p	np	np	p
Sampling weights	y	n	n	y	n	n	y	n	n
Controls	n	y	n	n	y	n	n	y	n

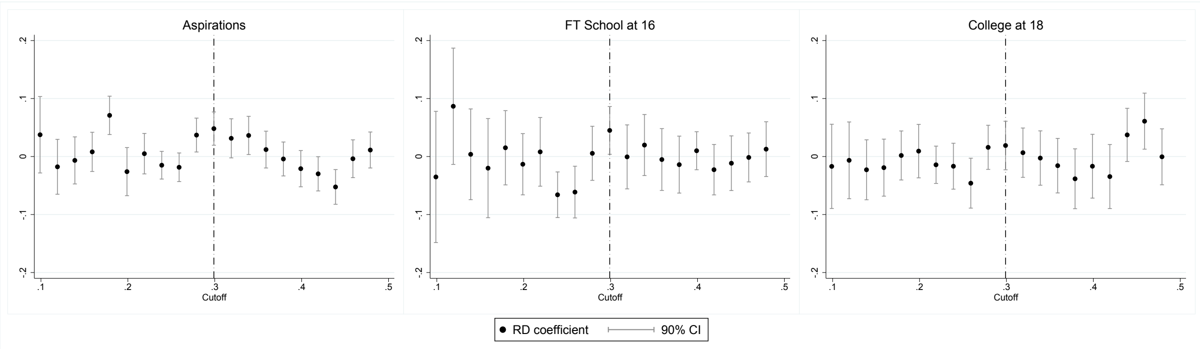
Notes: ITT is the estimated regression discontinuity coefficient for WP eligibility. Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. Specification is non parametric Local Linear Regression with triangular Kernel weights if "np", parametric with second order polynomial approximation if "p". Optimal bandwidth for non parametric estimation is computed following Imbens and Kalyanaraman (2010). Controls are: ethnicity, residence in a urban area, and mothers education. Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure 14: Regression Discontinuity Results by bandwidth.



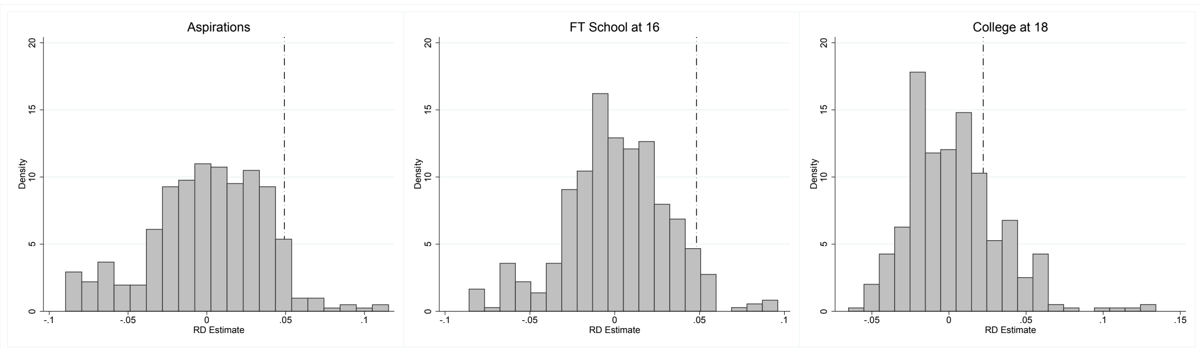
Notes: The graph shows the estimated coefficient and its 90% confidence interval for varying values of bandwidth. The dashed vertical line indicates the optimal bandwidth as used in Table 2. Specification is non parametric Local Linear Regression with triangular Kernel weights. Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4).

Figure 15: Falsification exercise, cut-off perturbations.



Notes: Each dot represents the point estimate of the effect of WP eligibility for varying hypothetical cut-offs. Hypothetical cut-offs c_n are obtained as $c_n = c^* \pm n \times 0.02$ for $n \in [1, 10]$. The dashed vertical line is the point estimate corresponding to the real WP eligibility cut-off c^*. The lines represent the relative 90% confidence interval. Specification is non parametric Local Linear Regression with triangular Kernel weights and optimal bandwidth computed following Imbens and Kalyanaraman (2010). Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4).

Figure 16: Distribution of coefficients from falsification exercise, cut-off perturbations.



Notes: Distribution of point estimates of the effect of WP eligibility for varying hypothetical cut-offs. Hypothetical cut-offs c_n are obtained as $c_n = c^* \pm n \times 0.001$ for $n \in [1, 200]$. The dashed vertical line is the point estimate corresponding to the real WP eligibility cut-off c^*. Specification is non parametric Local Linear Regression with triangular Kernel weights and optimal bandwidth computed following Imbens and Kalyanaraman (2010).

Table 10: Regression Discontinuity Results. Effect of WP on schooling. QLFS.

	(1)	(2)	(3)	(4)	(5)	(6)
	FT School at 16					
ITT	0.032*	0.016	0.022	0.040*	0.038*	0.036*
	(0.020)	(0.028)	(0.015)	(0.021)	(0.023)	(0.027)
Specification	np	np	np	p-1	p-2	p-3
Bandwidth	0.150	0.075	0.299	0.1	0.2	0.3
Observations	25,365	25,365	25,365	12,162	21,426	24,360
Baseline (RHS)	0.695	0.696	0.684	0.685	0.682	0.680
	College at 18					
ITT	0.004	0.003	0.006	0.007	-0.003	-0.007
	(0.027)	(0.038)	(0.019	(0.027)	(0.029)	(0.033))
Specification	np	np	np	p-1	p-2	p-3
Bandwidth	0.127	0.064	0.255	0.1	0.2	0.3
Observations	29,210	29,210	29,210	13,923	24,444	27,965
Baseline (RHS)	0.383	0.378	0.393	0.393	0.396	0.400

Notes: ITT is the estimated regression discontinuity coefficient for WP eligibility. Specification is non parametric Local Linear Regression with triangular Kernel weights if "np", parametric with $i-th$ order polynomial approximation if "p-i". Optimal bandwidth for non parametric estimation is computed following Imbens and Kalyanaraman (2010). Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. Standard errors clustered at the census ward level in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 11: Regression Discontinuity Results. Effect of WP on schooling. POLAR4.

	(1)	(2)	(3)	(4)	(5)	(6)
	POLAR4 Young Participation Rate					
ITT	0.005	0.000	0.006	0.005	0.006	0.007
	(0.521)	(0.728)	(0.388)	(0.005)	(0.006)	(0.007)
Specification	np	np	np	p-1	p-2	p-3
Bandwidth	0.108	0.054	0.215	0.1	0.2	0.3
Observations	7864	7864	7864	3637	6325	7414
Baseline (RHS)	0.335	0.303	0.375	0.356	0.357	0.357

Notes: ITT is the estimated regression discontinuity coefficient for WP eligibility. Specification is non parametric Local Linear Regression with triangular Kernel weights if "np", parametric with $i-th$ order polynomial approximation if "p-i". Optimal bandwidth for non parametric estimation is computed following Imbens and Kalyanaraman (2010). Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. Standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

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Appendices

A A model of schooling choice with aspirations

I consider a standard two-period model as in Lochner and Monge-Naranjo (2012) where individuals invest in schooling in the first period (youth) and work in the second (adulthood). Preferences are time separable and represented by:

$$U = u(c_0) + \beta\, u(c_1) \tag{5}$$

where c_t is consumption in periods $t \in \{0, 1\}$, $\beta > 0$ is a discount factor, and $u(\cdot)$ is strictly increasing and concave and satisfies standard Inada conditions.

In this model each individual is endowed in period 0 with a certain level of family income y_0 and ability a; during their youth individuals choose how much time (effort) to spend in school, h, rather than working;[38] time in school entails both a direct cost $\tau > 0$ (e.g. tuition fees) and an opportunity cost $w_0 \geq 0$ given by the wage rate for a young unskilled worker, while it increases adult labor income y_1. Indeed I shall assume that the market pays a price w_1 for accumulated human capital k and that ability increases the returns to education so that $y_1 = w_1 ak$. Finally, I assume that the level of accumulated human capital k depends (positively) on time in school h and ability a and that the two inputs present a positive degree of complementarity, i.e., $k = f(h, a)$, where $f(\cdot)$ is positive, strictly increasing and concave in both arguments, and $\frac{\partial^2 f}{\partial h \partial a} > 0$.

While young, individuals can borrow (or save) an amount d which they will then repay when they are adults at a gross interest rate R. Consumption levels in the two periods will therefore be:

$$\begin{aligned} c_0 &= y_0 + w_0(1 - h) - \tau h + d \\ c_1 &= w_1\, a\, f(h, a) - Rd \end{aligned} \tag{6}$$

To complete the model, I finally assume that ability a is a function of the current levels of cognitive and non cognitive skills (respectively θ_c and θ_n) and parental endowments, which I shall again proxy for with parental income y_0; I model this function as a CES where the magnitude of the elasticity of substitution s is ex-ante unknown.

$$a = \left[a_c \theta_c^{\frac{s-1}{s}} + a_n \theta_n^{\frac{s-1}{s}} + a_0 y_0^{\frac{s-1}{s}} \right]^{\frac{s}{s-1}} \tag{7}$$

The ability production function chosen here recalls the formulation introduced by Cunha and Heckman (2007) as it includes parental environment as an input for skills formation but

[38] The model abstracts from decisions on leisure.

differs from it significantly in that it disregards the dynamic process of skill accumulation allowing individuals to invest in human capital only in one period, generically labeled as youth. Indeed while Cunha and Heckman (2007) focus on the time complementarities between investments in early childhood and later on, this model rather looks at the complementarities between cognitive and non cognitive skills and parental endowments to explain the effects of an exogenous shift in only one of these inputs.

A.1 Solution and predictions in the case of perfect credit markets

If we assume that there are perfect credit markets then individuals will be free to borrow (or save) *any* amount d while young as long as they manage to repay it during adulthood at the gross interest rate R. Individuals thus maximize utility in Equation (5) with respect to both h and d subject to the conditions (6). The resulting optimality condition for investment in human capital h will be:

$$\frac{w_1 \; a \; f'(h^*, a)}{w_0 + \tau} = R \tag{8}$$

This condition states that the individual chooses investment in human capital so as to maximize the present value of her net lifetime income, equating the net marginal return to schooling (on the left-hand side) to the return to the financial asset R.[39]

At the same time, d^* will be chosen so as to smooth consumption and satisfy a standard Euler Equation:

$$u'(y_0 + w_0(1-h) - \tau h + d^*) = \beta \, R \, u'(w_1 \; a \; f(h,a) - Rd^*) \tag{9}$$

In this setting the impact of a rise in a non cognitive trait, in this case aspirations, on the attained level of schooling will be given by:

$$\frac{\partial k^*}{\partial \theta_n} \equiv \frac{\partial f(h^*, a)}{\partial \theta_n}$$

where $f(h^*, a)$ is the level of schooling attained when choosing the optimal level of investment in human capital h^*.

Applying a simple chain rule we obtain that:

$$\begin{aligned} \frac{\partial f(h^*, a)}{\partial \theta_n} \equiv \frac{\partial f^*}{\partial \theta_n} &= f_h' \frac{\partial h^*}{\partial \theta_n} + f_a' \frac{\partial a}{\partial \theta_n} = \\ &= f_h' \frac{\partial h^*}{\partial a}\frac{\partial a}{\partial \theta_n} + f_a' \frac{\partial a}{\partial \theta_n} = \\ &= \frac{\partial a}{\partial \theta_n}\left[f_h' \frac{\partial h^*}{\partial a} + f_a' \right] \end{aligned} \tag{10}$$

[39]Note that in this case the optimal level of investment in human capital, h^* depends on parental income y_0 only “indirectly” through the effect of the latter on ability.

The sign of this term will eventually depend only on the sign of the first partial derivative, i.e., on the elasticity of substitution of the ability production function. Indeed $f(\cdot)$ is strictly increasing in both h and a ($f'_h > 0, f'_a > 0$) by assumption, while $\frac{\partial h^*}{\partial a}$ is positive if we allow for complementarities between effort and ability in the production of human capital, i.e., $\frac{\partial^2 f}{\partial h \partial a} > 0$ (see Section A.3 for proof). I thus obtain the following result:

Proposition 1 *In the case of perfect credit markets the effect of an exogenous increase in aspirations (θ_n) will depend on the elasticity of substitution between inputs in the ability production function and on the levels of pre-accumulated cognitive skills and family income. In particular, for:*

Case 1.1 *Substitutable inputs ($s > 0$):*

$$\frac{\partial a}{\partial \theta_n} > 0 \quad \Rightarrow \quad \frac{\partial f^*}{\partial \theta_n} > 0 \quad \textit{for all individuals}$$

Case 1.2 *Leontief production function ($s \to 0$):*

$$\frac{\partial a}{\partial \theta_n} = \begin{cases} a_n & a_n\theta_n \leq \min\{a_c\theta_c, a_0y_0\} \\ 0 & \textit{otherwise} \end{cases}$$

$$\Rightarrow \quad \frac{\partial f^*}{\partial \theta_n} \begin{cases} > 0 & \textit{for individuals with high cognitive skills } \theta_c \textit{ and high family income } y_0; \\ = 0 & \textit{for individuals with low cognitive skills } \theta_c \textit{ or low } y_0; \end{cases}$$

This means that raising aspirations will always generate an increase in human capital as long as non cognitive skills can, even partially, substitute for deficiencies in cognitive skills or parental endowments. On the other hand, if the inputs of the ability production function are perfect complements to each other the intervention will generate a positive effect only among those who already have high enough cognitive skills and come from an affluent enough family.

Note that this model relies on the assumption that an exogenous shift in non cognitive abilities does not affect the level of cognitive abilities, i.e., that there are no cross-productivity effects of non cognitive skills on cognitive skills. Cunha and Heckman (2010) claim that such effects exist and are quite significant but also show that they fade out as children grow older, so that when the child is 12-13 years old the cross-productivity effect is essentially null. I tested empirically if this assumption holds in the case of WP policies and found no evidence of cross productivity effects.

A.2 Solution and predictions in the case of binding credit constraints

I extend the model above by relaxing the assumption that individuals can borrow *any* amount d^* when they are young as long as they manage to pay it back once they are adults. Suppose therefore that some individuals cannot borrow as much as they would like but that there is a maximum level of borrowing allowed $\bar{d} < d^*$ for a fraction of the population. As d^* is decreasing in family income y_0 (from Equation 9) it turns out that it is the poorest individuals who are credit constrained. In the case of binding credit constraints individuals will just choose how much time to invest in education h, while they will borrow the maximum available amount $\bar{d}$; the only first order condition is thus:

$$-u'(y_0 + w_0\,(1 - h^*) - \tau\, h^* + \bar{d}) \;+\; \beta u'(w_1\; a\; f(h^*, a) - R\bar{d})\; w_1\; a\; f'_h \;= 0 \tag{11}$$

As in the case of perfect credit markets, the effect of an exogenous increase in the level of non cognitive abilities will be given by:

$$\frac{\partial f^*}{\partial \theta_n} \;=\; \frac{\partial a}{\partial \theta_n}\left[f'_h \frac{\partial h^*}{\partial a} + f'_a\right] \tag{12}$$

where one needs to determine the sign of the term $\frac{\partial h^*}{\partial \theta_n}$. By the implicit function theorem, defining F as the term on the left-hand side of Equation 11, I obtain that:

$$\frac{\partial h^*}{\partial a} \;=\; -\,\frac{\partial F/\partial a}{\partial F/\partial h^*} < 0$$

because the sign of the term $\frac{\partial h^*}{\partial a}$ now turns out to be negative (see Section A.4 for proof), i.e., an increase in the level of ability generates a decrease in the amount of time pupils invest in education. The rationale for this finding is that because individuals are not able to smooth consumption as they would like to, when they become "more efficient" in learning, i.e., they can accumulate as much human capital as before even with less investment in education (because $f'_a > 0$ and $f''_{ha} > 0$), they prefer to reduce the amount of time invested in human capital accumulation and work more during their youth to increase their level of consumption at period 0. Yet, the final sign of the term in brackets in Equation 12 may still be positive if:

$$-\,\frac{\partial h^*}{\partial a} \;<\; \frac{f'_a}{f'_h} \tag{13}$$

in which case the magnitude of the (negative) effect described above is smaller than that of the relative marginal productivity of ability with respect to that of time in the production of human capital, i.e., the higher the marginal productivity of ability relative to that of time in education, the more likely that the individual will still end up with a higher level of accumulated human capital even if she is investing less time in it. In turn I obtain that:

Proposition 2 *In the case of imperfect credit markets the effect of an exogenous increase in aspirations (θ_n) will depend on the elasticity of substitution between inputs in the ability pro-*

duction function and on the pre-accumulated levels of cognitive skills and family income. In particular, for:

Case 2.1 *Substitutable inputs* ($s > 0$)*:*

$$\frac{\partial f^*}{\partial \theta_n} > 0 \quad \textit{for individuals with high family income } y_0 \textit{ (not credit constrained), irrespectively of their cognitive skills } \theta_c;$$

$$\frac{\partial f^*}{\partial \theta_n} \gtrless 0 \quad \textit{for individuals with low family income } y_0 \textit{ (credit constrained), irrespectively of their cognitive skills } \theta_c;$$

Case 2.2 *Leontief production function* ($s \to 0$)*:*

$$\frac{\partial f^*}{\partial \theta_n} > 0 \quad \textit{for individuals with high cognitive skills } \theta_c \textit{ and high family income } y_0;$$

$$\frac{\partial f^*}{\partial \theta_n} = 0 \quad \textit{for individuals with low cognitive skills } \theta_c \textit{ or low } y_0;$$

In summary, the model I have described predicts heterogeneous effects of an exogenous increase in the level of non cognitive skills on the level of accumulated human capital, depending on the level of cognitive skills and family income. Furthermore, such effects will be different in the cases in which the economy exhibits perfect or imperfect credit markets and depending on whether or not the inputs in the ability production function are substitutable.

A.3 Proof that $\frac{\partial h^*}{\partial a} > 0$ in the case of perfect credit markets

Let:

$$F \equiv \frac{w_1 \ a \ f'(h,a)}{w_0 + \tau} - R$$

By implicit function theorem:

$$\frac{\partial h^*}{\partial a} = -\frac{\partial F/\partial a}{\partial F/\partial h^*} = \frac{\frac{1}{a} f'_h + f''_{ha}}{-f''_{hh}} > 0$$

where both terms in the numerator are positive, while $f''_{hh} < 0$ by concavity of $f(\cdot)$.

A.4 Proof that $\frac{\partial h^*}{\partial a} < 0$ in the case of binding credit constraints

Let:

$$F \equiv -u'(y_0 + w_0 \, (1 - h^*) - \tau \, h^* + \bar{d}) \ + \ \beta u'(w_1 \ a \ f(h^*, a) - R\bar{d}) \ w_1 \ a \ f'_h$$

i.e., the left-hand side of the first order condition defined in Equation 11.

By implicit function theorem:

$$\frac{\partial h^*}{\partial a} = -\frac{\partial F/\partial a}{\partial F/\partial h^*}$$

I first study the sign of $\frac{\partial F}{\partial a}$:

$$\frac{\partial F}{\partial a} = \beta u'(c_1)\ [w_1\ a\ f''_{ha}\ + w_1\ f'_h]\ +\ \beta u''(c_1)\,[w_1\ a\ f'_a + w_1 f(h,a)]\,w_1\ a\ f'_h$$

this will be positive if:

$$-\frac{u'(c_1)}{u''(c_1)} > \frac{a\ f'_a + f(h,a)}{a\ f''_{ha}\ +\ f'_h} w_1\ a\ f'_h$$

I assume, to simplify the expression above, that:

$$u(\cdot) = \log(\cdot) \quad \text{and} \quad f(h,a) = a^{\alpha}\ h^{(1-\alpha)}$$

(the results hold for any CES ability production function.)

Under such assumptions and after simplifying, the condition above becomes:

$$c_1 > f(h,a)\ w_1\ a \quad \Leftrightarrow$$
$$\Leftrightarrow \quad f(h,a)\ w_1\ a - Rd\ >\ f(h,a)\ w_1\ a$$

which is never satisfied because $d > 0$. Therefore:

$$\frac{\partial F}{\partial a}\ <\ 0 \qquad \text{for all credit constrained individuals}$$

I now assess the sign of $\frac{\partial F}{\partial h^*}$:

$$\frac{\partial F}{\partial h^*}\ =\ u''(c_0)(w_0 + \tau)^2\ +\ \beta u''(c_1)\,(w_1 a f'_h)^2\ +\ w_1\ a\ f''_h\ \beta\ u'(c_1)$$

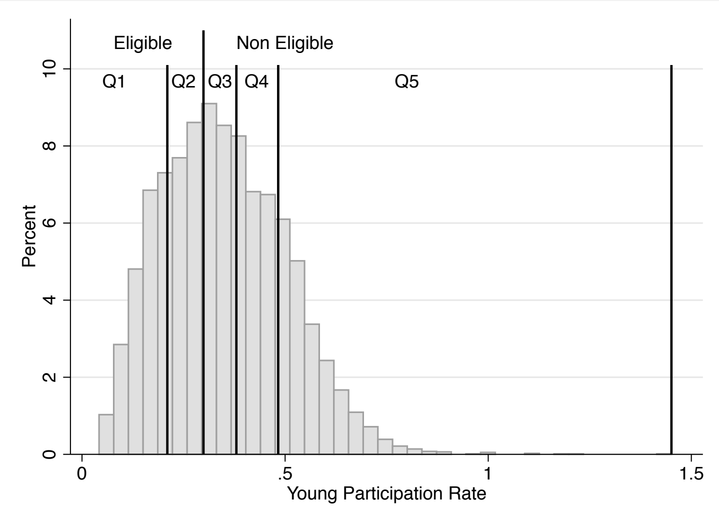
which is also negative because of the concavity of the utility and of the production function.

It thus follows that:

$$\frac{\partial h^*}{\partial a}\ =\ -\frac{\partial F/\partial a}{\partial F/\partial h^*}\ <\ 0 \qquad \text{for all credit constrained individuals, Q.E.D.}$$

B Additional Figures and Tables

Figure B.1: Distribution of the Young Participation Rate across 2001 census wards.



Notes: Q_i denotes the $i-th$ quintile of the distribution. Wards in Q1 and Q2 are WP target (Eligible), wards in Q3, Q4 and Q5 are not (Non Eligible). The Young Participation Rate is computed by HEFCE through the POLAR classification as the ratio between the number of young people from each area who enter HE aged 18 or 19 and the corresponding estimated cohort population in that area. The POLAR classification is based on the average YPR for the 1997-1999 cohorts, i.e., the 1997/1998, 1998/1999 and 1999/2000 school years. Its values range between 0.042 and 1.451 (HEFCE, 2005).

Figure B.2: Timeline of WP activities carried out by a major London University in 2011/2012.

	Primary	Years 7 and 8	Year 9	Year 10	Year 11	Year 12	Year 13	Teachers
Student Tutoring	✔	✔	✔	✔	✔	✔	✔	
Student Mentoring			✔	✔	✔	✔	✔	
Student Ambassadors	✔	✔	✔	✔	✔	✔		
Language Ambassadors	✔	✔	✔	✔	✔	✔		
Success Activities				✔	✔	✔	✔	
Visits to Schools and Colleges			✔	✔	✔	✔		
HEAD Days			✔	✔	✔	✔		
Looked after children activities	✔	✔	✔	✔	✔	✔	✔	
Insight into Medicine			✔	✔	✔			
Summer School					✔			
Extended Project Activities						✔	✔	
Taster Days						✔		
Masterclasses						✔		
Uni-link						✔		
Museums and Collections	✔	✔	✔	✔	✔	✔		
Schools and Colleges Conference								✔

Figure B.3: Description of main WP activities carried out by a major London University in 2008/2009.

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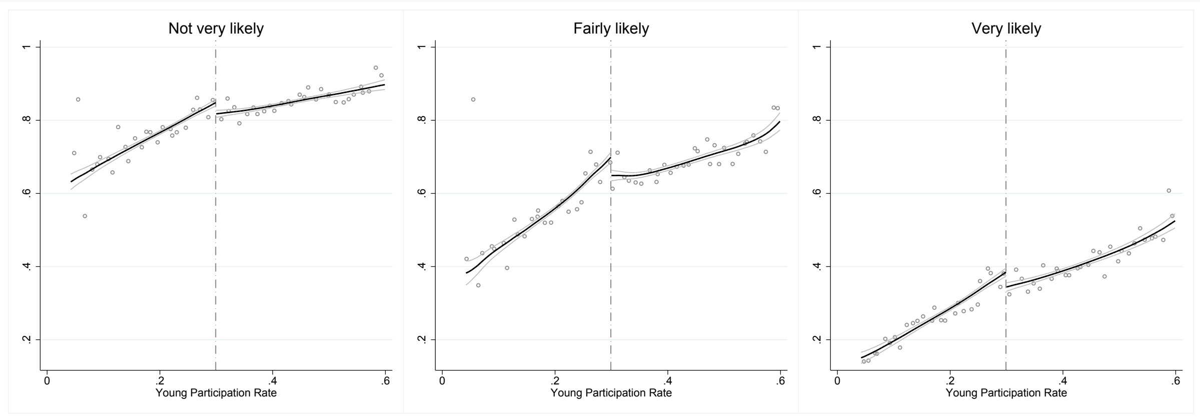
Table B.1: Descriptive statistics and test of continuity in the distribution of covariates. QLFS.

	(1) Full Sample	(2) Eligible	(3) Non Eligible	(4) (2)-(3)	(5) $\hat{\beta}_{RD}$
Female	0.497	0.500	0.495	0.005	0.014
	(0.500)	(0.500)	(0.500)	[0.004]	[0.014]
White	0.849	0.842	0.855	-0.013	0.041
	(0.358)	(0.364)	(0.353)	[0.003]	[0.029]
Urban	0.808	0.914	0.725	0.189***	0.037
	(0.394)	(0.280)	(0.446)	[0.004]	[0.028]
London	0.087	0.068	0.102	-0.034***	0.023
	(0.282)	(0.253)	(0.302)	[0.002]	[0.028]
log Parental Income	5.937	5.807	6.019	-0.212***	-0.057**
	(0.778)	(0.726)	(0.799)	[0.009]	[0.027]
Father post 18 education	0.214	0.123	0.274	-0.151***	0.010
	(0.410)	(0.328)	(0.446)	[0.004]	[0.011]
Mother post 18 education	0.186	0.098	0.240	-0.142***	-0.017
	(0.389)	(0.298)	(0.427)	[0.004]	[0.013]
Post 16 education	0.683	0.625	0.732	-0.107***	0.032*
	(0.465)	(0.484)	(0.443)	[0.005]	[0.019]
Higher education	0.352	0.337	0.363	-0.026**	0.004
	(0.352)	(0.473)	(0.481)	[0.005]	[0.26]
N	62,136	26,988	35,148		

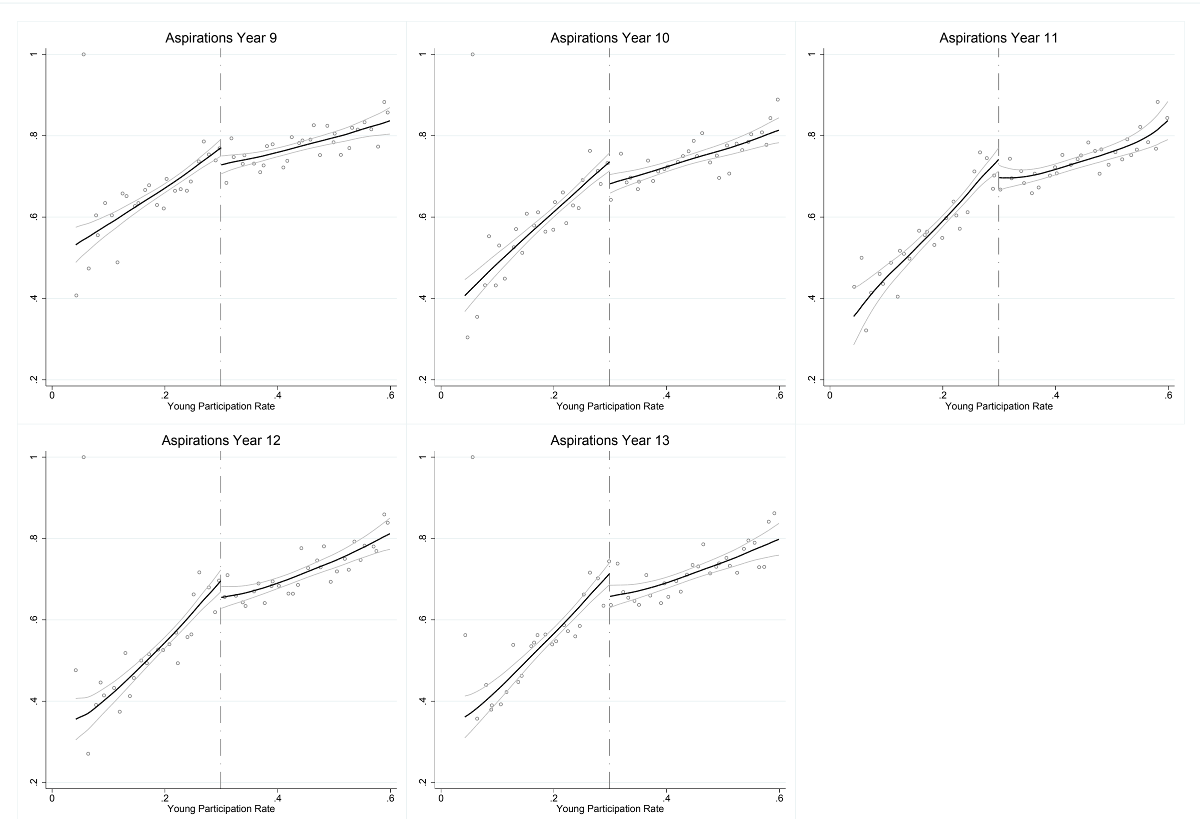
Notes: Columns (1)-(3) report mean values with standard deviations in parentheses. Column (4) reports the results of a t-test of the difference between column (2) and (3) with standard errors in brackets. Column (5) reports the coefficient of regression discontinuity estimates with local linear approximation with triangular Kernel weights and bandwidth computed following Imbens and Kalyanaraman (2010). Standard errors are reported in brackets. Estimates in columns (4) and (5) clustered at the census ward level. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure B.4: Regression Discontinuity results. Effect of WP on aspirations, by threshold.



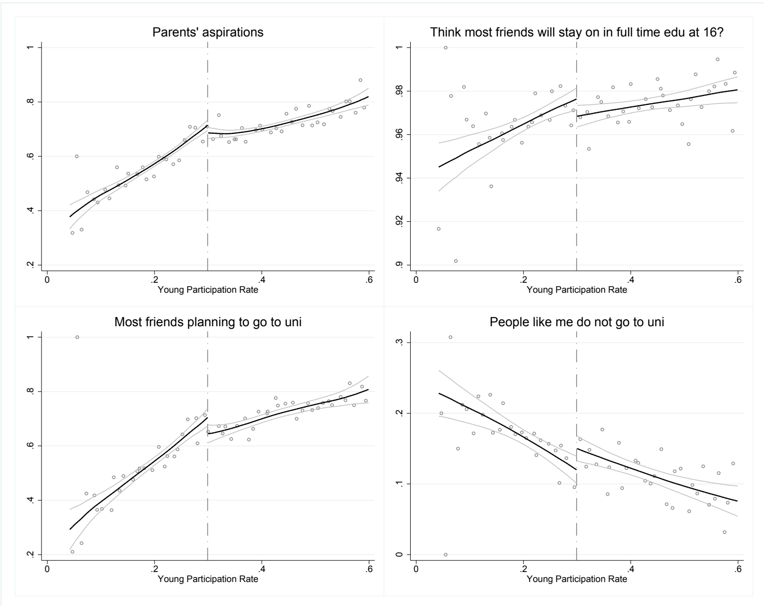
Notes: The horizontal axis reports the Young Participation Rate. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target census wards, observations to the left of the cut-off correspond to students living in WP target census wards. The dependent variables are (i) the probability of stating to be at least ”not very likely” to apply to university; (ii) the probability of stating to be at least ”fairly likely” to apply to university; (iii) the probability of stating to be ”very likely” to apply to university. The gray lines are the estimated 95% level confidence intervals. The dots of the underlying scatterplots show the mean outcome in bins of 0.01 width.

Figure B.5: Regression Discontinuity results. Effect of WP on aspirations, by grade.



Notes: The horizontal axis reports the Young Participation Rate. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target census wards, observations to the left of the cut-off correspond to students living in WP target census wards. The dependent variable is the probability of stating to be at least ”fairly likely” to apply to university. The gray lines are the estimated 95% level confidence intervals. The dots of the underlying scatterplots show the mean outcome in bins of 0.01 width.

Figure B.6: Regression Discontinuity results. Effect of WP on other proxies of aspirations.



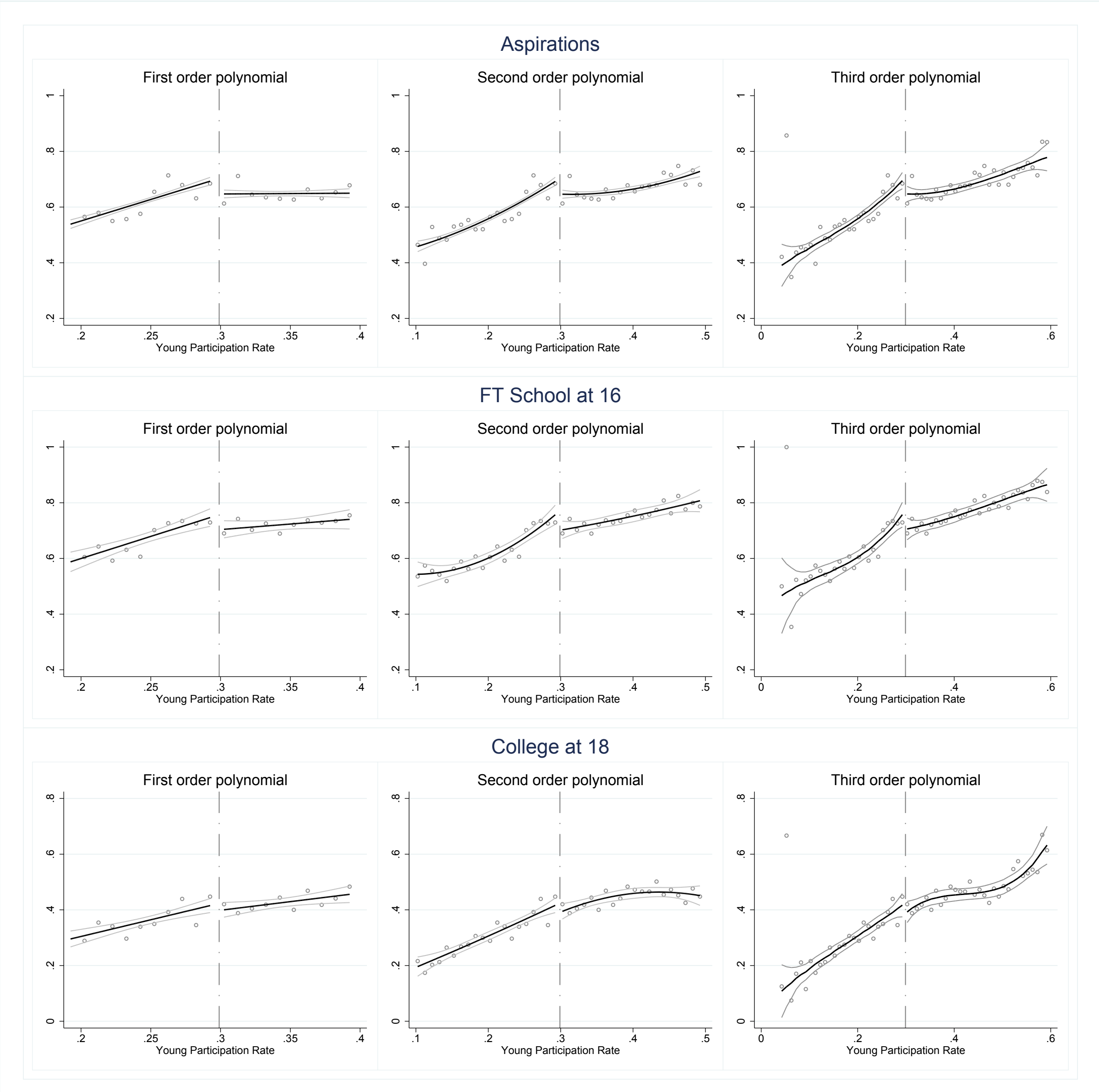
Notes: The horizontal axis reports the Young Participation Rate. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target census wards, observations to the left of the cut-off correspond to students living in WP target census wards. Parents' aspirations is the probability that parents believe it is "fairly likely" or "very likely" that their child will go to college at 18. Friends FT education at 18 is whether the child believes that "Most of her friends will stay on in full time education at 16"; Friends College at 18 is whether the child believes that "Most of her friends are planning to go to university"; People "like me" don't go to uni is whether child agrees with the statement "People like me do not go to university". The gray lines are the estimated 95% level confidence intervals. The dots of the underlying scatterplots show the mean outcome in bins of of 0.01 width.

Table B.2: Regression Discontinuity results. Effect of WP on aspirations and schooling. Heterogeneous effects.

	(1)	(2)	(3)	(4)	(5)	(6)
	Boys	Girls	White	Non-white	Urban	Non-urban
			Aspirations			
ITT	0.017	0.078***	0.041***	0.045***	0.039***	0.086**
	(0.017)	(0.016)	(0.015)	(0.015)	(0.012)	(0.036)
Observations	25,630	24,771	34,655	15,700	42,547	7,879
p-value Δ		0.1222		0.9054		0.4554
Joint significance		0.0137		0.0491		0.0633
			FT School at 16			
ITT	0.054	0.063	0.082**	0.031	0.057**	0.074
	(0.038)	(0.035)	(0.035)	(0.037)	(0.028)	(0.078)
Observations	4,683	4,524	6,339	2,895	7,720	1,490
p-value Δ		0.8756		0.3594		0.7928
Joint significance		0.1291		0.0738		0.1129
			College at 18			
ITT	-0.007	0.055*	0.000	0.071*	0.024	0.043
	(0.030)	(0.030)	(0.026)	(0.037)	(0.023)	(0.065)
Observations	7,273	7,637	10,268	4,623	12,451	2,459
p-value Δ		0.2626		0.2191		0.8308
Joint significance		0.3661		0.3072		0.6275

Notes: ITT is the estimated regression discontinuity coefficient for WP eligibility. Specification is parametric with second order polynomial approximation. p-value Δ is the p-value of a χ^2 test of difference between the coefficients in the subgroups. Joint significance is the p-value of the test of joint significance of the coefficients. Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure B.7: Regression Discontinuity results. Effect of WP on aspirations and schooling. Parametric estimates.



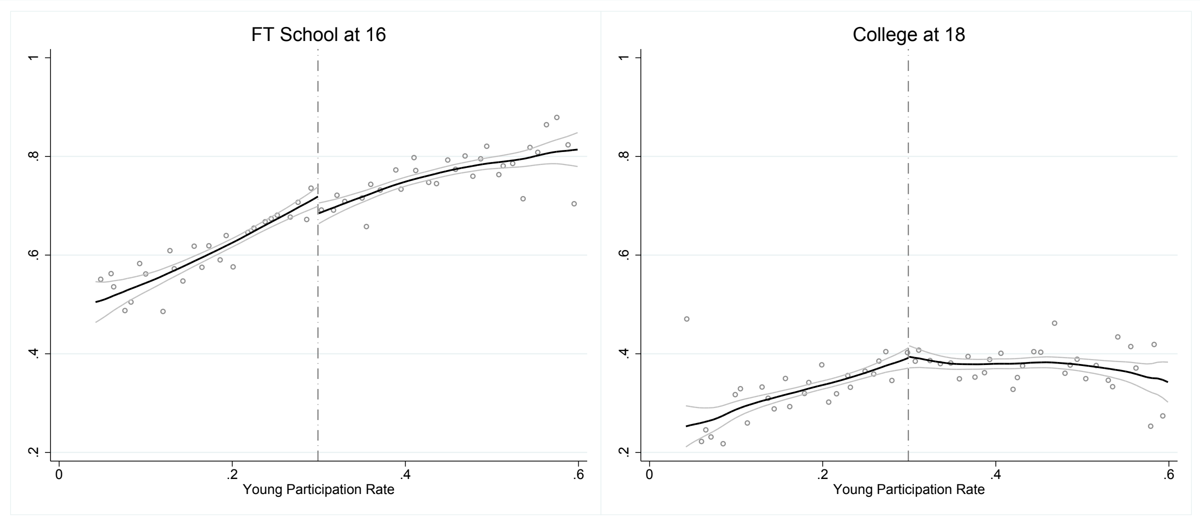
Notes: The horizontal axis reports the Young Participation Rate. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target Census Wards, observations to the left of the cut-off correspond to students living in WP target Census Wards. The graphs show the estimates of (i) the probability of stating to be fairly likely or very likely to apply to college at ages 14-17; (ii) the probability of being in full time education at age 16; (iii) the probability of being enrolled in college at age 18, based on first, second and third order polynomial approximations. The gray lines are the estimated 95% level confidence intervals. The dots of the underlying scatterplots show the mean outcome in bins of 0.01 width.

Table B.3: Regression Discontinuity results. Effect of WP on aspirations and schooling. Parametric estimates.

	(1)	(2)	(3)
	Aspirations		
ITT	0.052***	0.049**	0.055**
	(0.018)	(0.024)	(0.023)
Specification	p-1	p-2	p-3
Bandwidth	0.1	0.2	0.3
Observations	30,031	50,426	57,456
Baseline (RHS)	0.649	0.652	0.647
	FT School at 16		
ITT	0.050*	0.064**	0.063*
	(0.026)	(0.029)	(0.034)
Specification	p-1	p-2	p-3
Bandwidth	0.1	0.2	0.3
Observations	5,477	9,210	10,452
Baseline (RHS)	0.705	0.703	0.704
	College at 18		
ITT	0.023	0.031	0.036
	(0.026)	(0.028)	(0.033)
Specification	p-1	p-2	p-3
Bandwidth	0.1	0.2	0.3
Observations	8,934	14,910	17,102
Baseline (RHS)	0.398	0.390	0.386

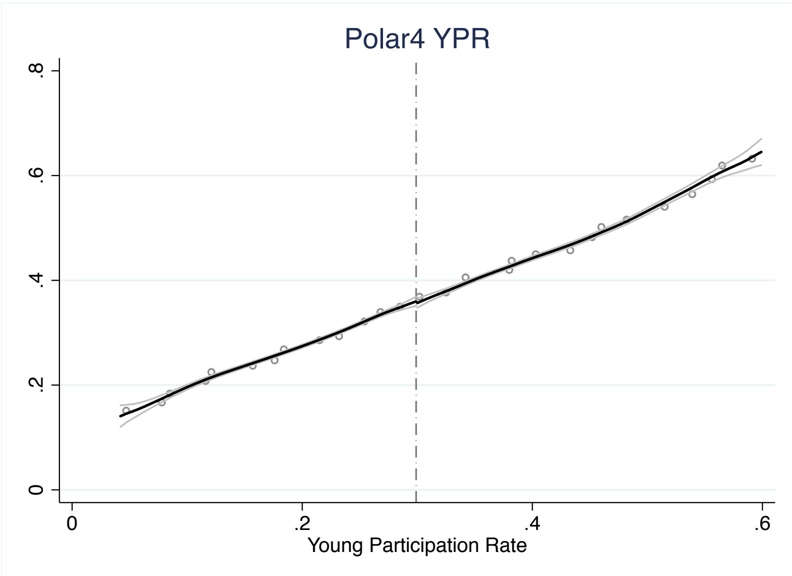
Notes: ITT is the estimated regression discontinuity coefficient for WP eligibility. Specification is parametric with $i-th$ order polynomial approximation if "p-i". Baseline is the level of the outcome variable at the discontinuity for non-eligible individuals. Standard errors are clustered at the individual level for Aspirations (waves 1 to 5) and for College at 18 (waves 6 and 7) and at the census ward level for Full time school at 16 (wave 4). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Figure B.8: Regression Discontinuity results. Effect of WP on schooling. QLFS.



Notes: The horizontal axis reports the Young Participation Rate. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target census wards, observations to the left of the cut-off correspond to students living in WP target census wards. The graphs show Local Linear Regression estimates with Triangular Kernel weights of the probability of being enrolled in college at age 18. The bandwidth employed is the optimal one as reported in Table 10. The gray lines are the estimated 95% level confidence intervals. The dots of the underlying scatterplots show the mean outcome in bins of 0.01 width.

Figure B.9: Regression Discontinuity results. Effect of WP on schooling. POLAR4.



Notes: The horizontal axis reports the Young Participation Rate computed through the POLAR classification. The dashed vertical line is the WP eligibility cut-off. Observations to the right of the cut-off correspond to students living in non WP target census wards, observations to the left of the cut-off correspond to students living in WP target census wards. The graphs show Local Linear Regression estimates with Triangular Kernel weights of the Young Participation Rate in 2009-2015 as computed through the POLAR4 classification. The bandwidth employed is the optimal one as reported in Table 11. The gray lines are the estimated 95% level confidence intervals.

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