University costs and university participation. Evidence from the UK.

Monica Langella*

Preliminary and incomplete, please do not circulate.

This version: February 2016

Latest Version

Abstract

This paper studies the sensitivity of pupils to the economic cost of enrolling at university when they face the choice of participating to higher education. The focus will be on the cost of universities that are closer to pupils' living area. The empirical analysis exploits time and geographical variation using English administrative data. Different cost measures will be constructed, accounting not only for tuition fees, but also for the cost of living close to university and the distance from pupils' hometown. The difference relies on the set of institutions accounted for in the construction of the indicator. Results suggest that a one standard deviation increase in these measures reflects into a 0.5 to 1 percentage points reduction in the probability of going to university. Results differ across income groups suggesting that liquidity constraints may play an important role in the choice.

1 Introduction

This paper studies how participation to university degrees is affected by its economic costs. In particular, the focus is on whether pupils are more sensitive to the cost of local universities rather than to the average cost or to the cost of top performing universities.

*Centre for Economic Performance, LSE and University of Verona. I am grateful to Esteban Aucejo, Giorgio Brunello, Sandra McNally, Jo Blanden, Alex Armand, Marco Bertoni, Claudia Hupkau, Felix Koening, Stephan Maurer, Jenifer Ruiz-Valenzuelas, Matteo Sandi, Camille Terrier and Gill Wyness for all the insightful comments and conversations. I thank NPD and HESA, and in particular Martin Johnson and Katie Martin for the support during the application process. I thank the seminar participants at University of Padova Department of Economics and at the CEP for all the useful comments. I thank the Centre for Economic Performance (LSE) for all the support during the project. Data have been used under the data request DR150522.02.

Starting from seminal works by Mincer (1958) and Becker (1964), and more recent work by Card (1999), an extended stream of literature has been devoted in assessing the impact of schooling on personal income, finding positive private returns to time investment in education.[1]

College degrees, in particular, show high positive returns, constantly increasing during the past decades (Bound and Turner, 2011, Goldin and Katz, 2009, Lange and Topel, 2006). Recent evidence studying the UK framework shows that the expansion of Higher Education has positive effects also on economic growth and productivity (Besley et al., 2013).

Participation to Higher Education is not compulsory and the cross country degree of variation is quite high even restricting the focus to Western countries. Eurostat data[2] show that, in 2014, the percentage of people aged 25-34 with some tertiary education degree goes from above 50% in countries as Norway and Lithuania, to around 25% in Italy and Romania. In United Kingdom this proportion is almost 46% in 2014, which is more than the double than 20 years ago[3]. A huge political debate surrounds the financing of Higher Education systems in Western countries. Expenses for HE may be a burden for already stressed government budgets. This has pushed some governments towards increasing the monetary cost for students and their families in terms of enrolment fees, as it is the case in England, for instance. Along with this, the concern that part of the population can be prevented from accessing to Higher Education because of liquidity constraints muddles even more the debate. A tightening on the liquidity constraint may induce sub-optimality in the choice, with a subsequent loss in wage premium and productivity. This has forced governments to set up policies to sustain Higher Education access through loans and maintenance grants. Economic evidence on the incidence of university fees on the university choice is mixed.

Tuition fees are not the sole component of the economic costs of going to university. Many students move from their parents' house and live in university residences or in houses rented through the private market, and this has a substantial incidence on the cost of going to higher education. Moreover, distance may matter on the total cost, due, for example, to transportation costs. In this paper the measures of cost will take into account all of these aspects.

In what follows, administrative data will be used to track students from the early school stages until university. The unique nature of the data allows to control for an extremely detailed set of pupils' school performance measures and enables to track pupils from primary education until post-compulsory education levels, enabling to track all school choices that pupils, and their parents, make during their education path, together with their performance at all stages.

[1] For an extensive review of the empirical literature on the subject see Meghir and Rivkin (2011)

[2] Source: Eurostat Statistical Database, 2015.

[3] It was 23.4% in 1995, according to Eurostat database (2015).

Findings show that costs matter for the decision, and that higher costs are related to a lower probability of going to university. Results also suggest that the effect of closest universities is higher than the effect of the average university, while the sensitivity to top-performing universities is practically null. The magnitude of this effect is, however, quite small, in particular if compared to the effect of other personal and area characteristics. A one standard deviation in the cost reflects in a decrease in the probability from 0.5 to 1 percentage point, depending on the specification.

Free-School Meal eligible pupils' are more sensitive than other pupils, this suggests that there is room for liquidity constraints in the university choice process.

The remainder of the paper is organised as follows. Section 2 illustrates the educational system in England and recent reforms to Higher Education. Section 3 describes the dataset. Section 4 illustrates the empirical setting and results. Section 5 concludes.

2 Institutional Framework

Broadly speaking, the English educational system is split in two parts, compulsory and non-compulsory education. Compulsory education lasts from primary school, which, in England, starts at the age of 5, until pupils are 16 years old. Compulsory education is divided into 4 Key Stages (KS), each of these finishing with a national level exam and teacher assessments, with some variation over time[4]. National level standardised tests cover Maths, English and Science from Key Stage 1 until Key Stage 3.

Key Stage 4 follows a different assessment mechanism. Besides core exams and depending on the school they attend, pupils can choose among a variety of subjects. Final examinations (General Certificates of Secondary Education - GCSEs) on the selected ones occur at the end of Year 11. All pupils seat for English, Maths and at least one Science GCSEs[5].

After compulsory education the choice is essentially threefold. Pupils can choose among going directly to the job market, picking a vocational education track, or going for an academic path. Academic and vocational tracks are not mutually exclusive and they can be combined. Vocational education in England is particularly heterogeneous, both in terms of the type of programmes offered and in terms of the length of the studies. Academic track, i.e. A-levels, is a more homogeneous path lasting, in general,

[4]Table 1 summarises the compulsory education system in England. The National level standardised tests have been subject to changes over time. For instance, no more standardised tests are to be taken by pupils in Key Stage 1 from 2003 onwards, and from 2008 onwards standardised tests have been eliminated also for Key Stage 3.

[5]Double Science GCSE and Triple Science GCSE are also offered. These are exams combining Chemistry, Biology and Physics in order to account for two an three GCSEs, respectively. Work by De Philippis (2015) investigates how changes in the offer of science subjects at the high school level affects the enrolment in STEM majors.

for two years. Pupils can choose among a broad set of A-levels. They sit for the final A-level exam at the end of the second year, and they take an intermediate exam (AS-levels) at the end of the first year. Pupils not only can freely choose which exams to take, but they can also choose the number of A-levels. In general, pupils going to University take 4 AS-levels in the first year and they carry on 3 A-levels at the end of the second year.

After Vocational and Academic tracks, pupils can choose to apply and enrol to Higher Education. In England, the system is dominated by publicly funded universities. In this paper, Higher Education refers to any full-time bachelor course at a publicly funded university[6].

The central government sets fee caps for universities. Table 2 summarises the history of fees in England. Following Browne (2010), at the end of 2010, the government set the cap to £9,000 per year, starting from the academic year 2012/13 [7], a level that is three times higher than the previous one and that made English universities jump up in the ranking of most expensive universities in the world [8].

Despite the huge increase in fees, the application and enrolment rate seem not to have deeply changed. UCAS (2013) and Wyness (2015) show that the application and enrolment rate, after a temporary drop, have continued to increase, following pre-reform trends. Recent evidence by Sá (2014) suggests instead that there has been a drop in both applications and attendance. This contrast may arise from the aggregate nature of data that does not allow for a full distinction among cohorts in the pool of each year entrants. The individual-level dataset[9] confirms UCAS (2013) and Wyness (2015) figures. It allows tracking English students and to distinguish among pupils who go to University straight after high school and pupils who delay the entrance by one year. Figure 1 shows that the drop in enrolment observed between academic year 2011/12 and 2012/13[10] derives mostly from an anticipation effect. A greater proportion of pupils from cohort 2009, in fact, enroled straight after high-school. The rationality of this change comes from the fact that this cohort was fully aware that tuition fees were going to increase and that, avoiding the gap year, they would have paid the lower fee for all years of the bachelor, saving almost £18,000 for a three-year programme.

[6]Private funded universities are not included in HESA dataset, but this is not likely to affect the generality of our results provided that only four universities in England can be defined as completely privately funded, namely University of Buckingham, Regent's University London, University of Law and BPP University. Participation in sub-degree programmes and Further Education colleges is not considered as Higher Education in this framework.

[7]The reform was announced by the end of 2010, and approved on 9 December 2010.

[8]According to OECD (2013) United Kingdom, after the increase in fees results as the third most expensive higher education system in the world.

[9]The dataset will be fully illustrated in Section 3

[10]The reform fully affected students finishing compulsory school from 2009/2010 onwards. Students finishing KS4 in year 2008/2009 were aware of the increase since their last year of high school, so they could anticipate it not taking one year gap. The increase in fees did not apply to students already at university at the time it entered into place.

3 Data

This analysis uses individual-level data linking information from three different administrative sources. The first data source is a census of all state school[11] which entails data from the National Pupil Database (NPD), containing detailed information on school performance during compulsory education and all A-levels and AS-levels results, and the Pupil Level Annual School Census (PLASC)[12], that contains information on geographical residence of pupils and variables related to background characteristics[13]. This information is linked to administrative data on all pupils enrolled at university from the Higher Education Statistics Agency (HESA) and to administrative data on all pupils enrolled in some publicly funded Further Education (FE - vocational) programme[14].

This dataset gives the opportunity to track pupils throughout their entire education path. Full information on School performances and census data is available for the cohorts of students who completed their compulsory education between school year 2002/03 and school year 2010/2011. These are the cohorts for which, at the time being, information on pupils can be retrieved from the beginning of compulsory school until the entrance to Higher Education. The final dataset comprise information on approximately 500,000 pupils for each cohort. Table 3 summarises the main information about the cohorts considered in the analysis.

For this analysis, individual level data is linked to aggregate data at the university and geographical level in order to construct a measure of the cost of going to university. First of all, time varying information on university fees is collected[15] so it is feasible to construct a measure of the annual standard fees required by each university. Moreover, information on the rental market in each local area in the UK is collected[16]. This enables to estimate the average monthly rental price for one room at the time pupils should enter at university in the university local area. Having information on the location where pupils lived during compulsory school, it is possible to construct the distance[17] between where pupils lived during compulsory education[18] and each English university. Additionally, as controls for economic conditions in the residential area, information on the median income in each Lower Super Output Area and on the Index of Multiple

[11] The census does not include information on pupils enrolled in independent institutions, that are a minority of the students population.

[12] Replaced in 2007 by the School Census

[13] In particular eligibility status for Free School Means and Special Education Needs Status.

[14] The NPD-HESA-ILR linked dataset has been made available to the author under the request DR150522_02.

[15] Source: Office for Fair Access, 2015.

[16] Source: Private Rental Market Statistics, Valuation Office Agency (2015).

[17] For sake of simplicity we focus, in this study, on linear distance. Gibbons and Vignoles (2012) show that the correlation between pupils to linear distance and distance along rail tracks is around 0.99 percent.

[18] The area of residence is registered when pupils were at the end of KS2

Deprivation at the same geographical level are collected and included in the setting[19].

Based upon these sources of data, the paper exploits different measures of university costs. All the measures are calculated as the average of sum of the annual cost of renting a room in the university neighborhood and the annual fee for enrolling, multiplied by the distance to university[20].

The measures differ on the basis of the universities considered to compute the average. Constructing different measures allows checking which university set matters the most in the decision to enrol[21]. The first measure accounts for the closest three, five and ten universities, the second measure accounts for the universities within 50 kilometers, the third averages the cost of all English universities and the last one accounts for the costs of the top 5 percent universities in terms of performances[22]. All costs measures are standardised to have mean zero and standard deviation of 1.

4 Empirical setting and results

The focus of the empirical analysis is on estimating how sensitive the probability of enrolling at university is to the monetary cost of studying. The aim is therefore to estimate the parameter β in the following regression.

$$HE_{icas} = \alpha + \beta Cost_{ica} + \gamma X_{iat} + \phi_c + \theta_s + \epsilon_{icas} \tag{1}$$

Where HE_{icas} is a dummy variable taking value one if the pupil i, belonging to cohort c, living in area a and going to school s[23] enrols in a Bachelor degree[24], $Cost_{ica}$ represents the cost measures, as described in Section 3, X_{iat} is a set of individual-level and area-level characteristics, ϕ_c represents cohort fixed effects, θ_s represents school fixed effects and ϵ_{ics} is the error term.

[19]Income information, source: Experian Demographic Dataset. Deprivation data, source: Department for Communities and Local Government. Lower Super Output Areas are designed upon census data. England has 32,482 LSOAs, according to 2001 Census, that cover a range of 1,000 to 3,000 people each.

[20]The idea is to represent the fact that the cost of studying is an increasing function of distance. Accounting for distance in a linear way does not seem to affect the results, and it requires assumptions on the per miles cost and on the average distance covered yearly by students.

[21]All cost measures exclude information on Scottish and Welsh universities, that are also available in the dataset. The reason for the exclusion relies on the concern that different Higher Education policies in those areas may affect the results. Robustness checks including information on pupils attending universities in those areas show similar results to the ones presented in the paper (available upon request), which is not surprising given that only 1.5% and 3.3% of English students enrol in Scottish and Welsh universities, respectively (Gibbons and Vignoles, 2012). The measures exclude universities offering post-graduate degrees only.

[22]University performances are measured through the annual level rankings from www.thecompleteuniversityguide.co.uk at the university-major level.

[23]The school refers, for instance, to the institution where pupils ended their compulsory programme.

[24]Only pupils enrolling at university 'on time' (on the third year after the GCSEs) are accounted as ones, this is to avoid asymmetries in the data due to the fact that for the last available cohort we do not observe pupils delaying the entrance to university.

Control variables X_{iat} include a set of dummy variables for pupils living in major English cities[25], the Index of Multiple Deprivation at the area level[26] a dummy for free-school meal eligibility at the age of 16, gender, a time-varying measure of the median wage in the LSOA where living at the end of compulsory school. Dummy variables for ethnicity and standardised test scores in Maths and English at the end of KS2 are also included. Table 4 shows descriptive statistics on the controls. Regressions include also cohort fixed effects. That aims at controlling for all changes in policies, in particular changes in tuition fees, that affected differently each of the cohorts considered. Finally, school-level fixed effects are accounted for to capture all unobserved characteristics related to the school path that may affect the probability of going to university. The school that pupils attended is likely to be correlated to the place they were living at the same age[27], the fixed effects are thus likely to capture unobserved time-invariant unobserved location effects.

Figure 2 shows the geographical distribution of the cost measure[28] associated to the three closest universities to the location where pupils lived at the age of 16 (end of KS4). The highest costs are registered in the London area, reflecting the high rent prices. Figure 3 shows instead the distribution of English public universities.

Table 5 shows the main results from the estimation of equation 1. The first column exploits the measure of cost based on the three closest universities. The probability of going to university is negatively affected by the cost of studying in closely located universities. The effect is quite small. One standard deviation increase in the cost of studying reflects in a 1 to 0.7 percentage point decrease in the probability of enrolling, depending on the inclusion of time and school fixed effects. This may be imputable to the fact that pupils are not affect by the cost of 'local' universities, as they are not affected by distance in choosing to go to university (Gibbons and Vignoles, 2012).

To test whether this is true, the strategy exploits other cost measures. Table 6 shows that including more universities in the definition does not change dramatically the results. Including in the cost measure the closest 5 and 10 universities make the effect increase to almost 0.8 percentage points (Columns 1 and 2). Exploiting a different closeness definition, therefore including in the cost measure all the universities within 50 miles from the living place at the age of 16, the effect comes back to 0.6 percentage points (Column 3). Column 4 accounts for all English universities in the measure. This more inclusive measure has an even lower effect on the probability of enrolling at university. When the measure accounts for top 5 percent performers universities, the cost turns out to have practically no effect on the probability of enrolling at university.

[25]London, Birmingham, Manchester, Liverpool and Leeds.

[26]The area refers to the Lower layer Super Output Area where pupils were living at the end of KS2. Full information on the IMD construction is available at The English Indices of Deprivation 2010, Department for Communities and Local Government.

[27]Information of the place of residence is available for KS2 only.

[28]The cost reported here refers to the linear version of the cost, this to make intervals more readable.

Having information only on actual enrolment at university in this framework we are not able to directly observe pupils' preferences towards higher education. School Fixed Effects may partially control for that, assuming that the school you attend at KS4 is a predictor of going to university. In Table 7 a further control aimed at capturing preferences for academic paths is added[29]. The inclusion of this control does not affect much the results. There may be some concern that this can be a 'bad control' (Angrist and Pischke, 2008). The fact that the results are not affected suggests that this is not the case. On top of that, fixed effects regressions of the control on costs confirm that the dummy is not significantly correlated with the costs[30]. Table 8 shows how different measures of the cost affect the probability of enrolling in one of the universities included in the cost definition, once conditioning on going at university. In this case too, pupils seem not much affected by the costs of studying in top performing universities, while they are more sensitive to closest universities.

The low magnitude of the effect of the cost may be interpreted in two ways. The more straightforward explanation may be that pupils and their families do not weight much the economic cost of studying in their choice function. An alternative explanation accounts instead for the loan policies in place in England in the time considered. When enrolling to university pupils can choose to apply for a loan that can fully cover the tuition fee charged by universities. The loan is not means-tested and is to be repaid when the pupil starts to work and earn more than the average level of earnings for job market graduated entrants[31]. Depending on pupils discount factor and on their expectations about future earnings, this policy may mitigate the impact of the cost on university enrolment. This dataset does not allow to test this comparing results in periods where loans policies where different. Further analysis will be required to shed light on this.

The second question this paper focuses on is whether Free School Meal eligible people are affected differently by the cost of different groups of universities. Table 9 shows regressions estimated separately by Free School Meal (FSM) eligibility. FSM eligible pupils seem to be much more sensitive to costs than non FSM eligible pupils, both in the case of 'local' costs (Columns 1 to 4) and in the case of 'average' costs (Column 5)[32].

[29]The control is a dummy variable indicating pupils attending A-levels not combined with any vocational education programme.

[30]Results are not reported for sake of brevity, but are available upon request. See **?** for a methodological reference.

[31]This threshold earning level was 21,000 gbp in 2012.

[32]Results for Top 5 universities are not reported in the table, results for this cost measure look similar to results for average costs.

5 Conclusions

Studying whether and to what extent the economic cost of going to university is affecting the decision to enrol, this paper finds that there is a negative effect on the probability of enrolling of the cost of going to universities close to home and of the average university cost.

The effect is rather small. A one standard deviation increase in costs reflects into a 0.5 to 1 percentage points decrease in the probability of enrolling. The effect is higher for Free School Meal eligible pupils, in line with the idea that some people may be prevented to go to university because of liquidity constraints.

The low overall effect may be explained by the fact that pupils and their families do not put much weight in their preferences on the cost of studying. Alternatively, it can also be explained by the fact that, over time, a sizeable share of the total cost can be deferred through loans, which have to be repaid when the pupil starts to earn more than the average earning for graduate job market entrants. If this is the case, high discount rates or low earnings expectations may explain why some groups of pupils are quite insensitive to costs. The different interpretations have different policy consequences, the study of this requires additional information on loans accessibility, and will be the subject of future research.

References

Angrist, J. D. and Pischke, J.-S. (2008). Mostly harmless econometrics: An empiricist's companion.

Becker, G. S. (1964). *Human Capital*. Columbia University Press, New York, 2nd edition.

Besley, T., Coelho, M., and Van Reenen, J. (2013). Investing for Prosperity: Skills, Infrastructure and Innovation. *National Institute Economic Review*, 224(1):1–13.

Bound, J. and Turner, S. (2011). Dropouts and Diplomas. The Divergence in Collegiate Outcomes. In *Handbook of the Economics of Education*, volume 4, chapter 8, pages 573–613.

Browne, J. (2010). Securing a Sustainable Future for Higher Education. Technical report, Department for Business, Innovation and Skills (BIS).

Card, D. (1999). The causal effect of education on earnings. In *Handbook of Labor Economics*, volume 3, chapter 30, pages 1801–1863.

De Philippis, M. (2015). STEM Graduates and High School Curriculum: Does Early Exposure to Science Matter? *Mimeo*.

Gibbons, S. and Vignoles, A. (2012). Geography, choice and participation in higher education in England. *Regional Science and Urban Economics*, 42(1-2):98–113.

Goldin, C. D. and Katz, L. F. (2009). *The Race Between Education and Technology*. Harvard University Press, Cambridge, MA.

Lange, F. and Topel, R. (2006). The social value of education and human capital. In *Handbook of the Economics of Education*, volume 1, chapter 6, pages 1–68.

Meghir, C. and Rivkin, S. (2011). Econometric Methods for Research in Education. In *Handbook of the Economics of Education*, volume 3, pages 1–87.

Mincer, J. (1958). Investment in Human Capital and Personal Income Distribution. *Journal of Political Economy*, 66(4):281–302.

OECD (2013). Education at a Glance 2013. Technical report.

Sá, F. (2014). The Effect of Tuition Fees on University Applications ad Attendance: Evidence from the UK. *IZA DP 8364*.

UCAS (2013). 2013 Application Cycle: End of Cycle Report. Technical report.

Wyness, G. (2015). Paying for Higher Education. *CEP Election Analysys EA026*.

A Graphs and Tables

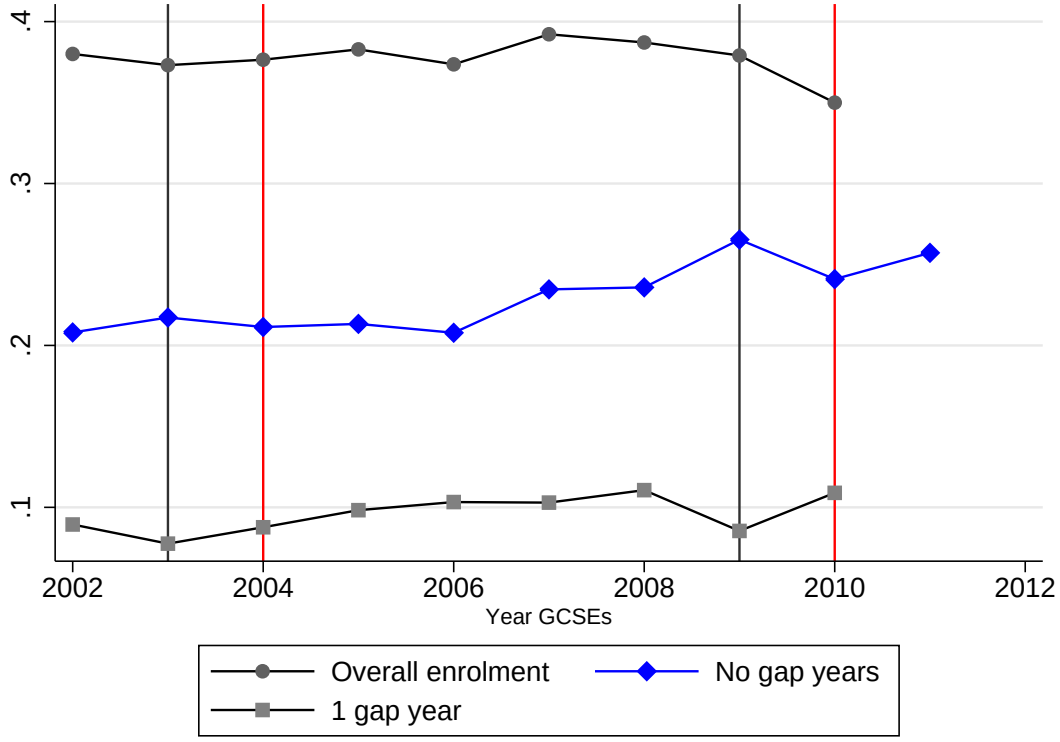
Table 1: Summary of the compulsory education system in England.

School level	Age	Years	Test
Key Stage 1	5-7	1-2	Standardised tests (1998-2003) and teacher assessment.
Key Stage 2	7-11	3-6	Standardised tests and teacher assessment.
Key Stage 3	11-14	7-9	Standardised tests (until 2008) and teacher assessment.
Key Stage 4	14-16	10-11	General Certificate of Secondary Education (GCSE).

Table 2: University fees in England.

Year	Yearly fee cap	Characteristics
Until 1998	Free of charge	
1998-2005	£1,000	Payable upfront and means-tested.
2006-2011	£3,000	Deferrable and not means-tested. Inflation adjusted.
2012 onwards	£9,000	Deferrable and not means-tested

Figure 1: University enrolment. Proportions of students enrolled at university by year they finished compulsory education.



Notes: Vertical axis represents the proportion of students finishing compulsory education in a given year that belong to each of the following groups: 'Overall enrolment' refers to the proportion, among the cohort finishing compulsory education in each given year of pupils enrolling at a bachelor degree. 'No gap year' refers to the proportion of pupils enrolling straight after high-school. while '1 Gap year' refers to the proportion of pupils enrolling the year after the end of the high-school, and '>1 gap year' repers to the proportion enroling more than one year after. Being the 2011 cohort the last recorded in the dataset, there is no information on pupils choosing to wait one year before the enrolment. Years in the horizontal axis refer to the years in which the cohort ends compulsory education. Red vertical lines represent the cohorts that were fully affected by the increases in fee caps, while black lines represent the cohorts that could anticipate the reforms not taking a 1 year gap. Cohort 2011 is the last cohort for which university data is available, therefore only students entering at the 'right time' can be observed.

Table 3: Overview of the cohorts included in the analysis.

		of which (%)	
Year GCSEs	**Number of pupils**	HE with no gap	HE with 1 year gap
2003	562,001	21.73	7.76
2004	574,330	21.14	8.77
2005	569,474	21.33	9.83
2006	578,423	20.78	10.33
2007	582,501	23.46	10.29
2008	582,103	23.58	11.06
2009	564,581	26.54	8.54
2010	565,399	24.10	10.90
2011	554,696	25.72	N.A.

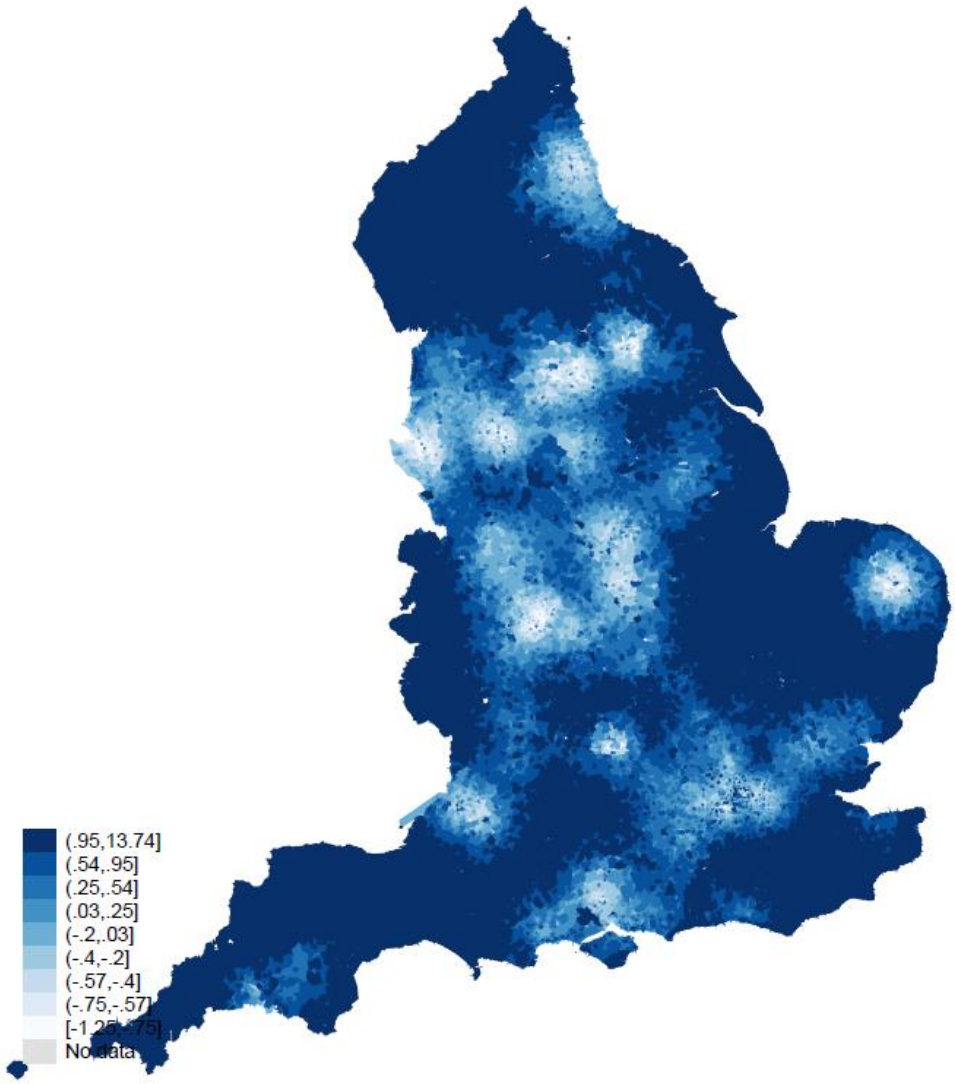
'HE with no gap' represents the proportion of pupils in the cohort enrolling at university straight after the end of high school.
'HE with 1 year gap' represents the proportion of pupils enrolling at university with 1 gap year after high school.

Table 4: Descriptive statistics.

Variables	HE no gap	HE 1 year gap	No HE
Female	0.56	0.52	0.46
FSM	0.06	0.10	0.16
Ethnicity			
White (Not British)	0.02	0.02	0.01
Asian	0.11	0.13	0.05
Chinese	0.01	0.01	0.001
Black/Carribean	0.05	0.07	0.04
Other	0.04	0.06	0.04
KS2 English level (std)	0.61	0.39	-0.30
KS2 Maths level (std)	0.59	0.37	-0.29
IMD	18.06	20.26	25.08
Median Income	31109	29345	26188

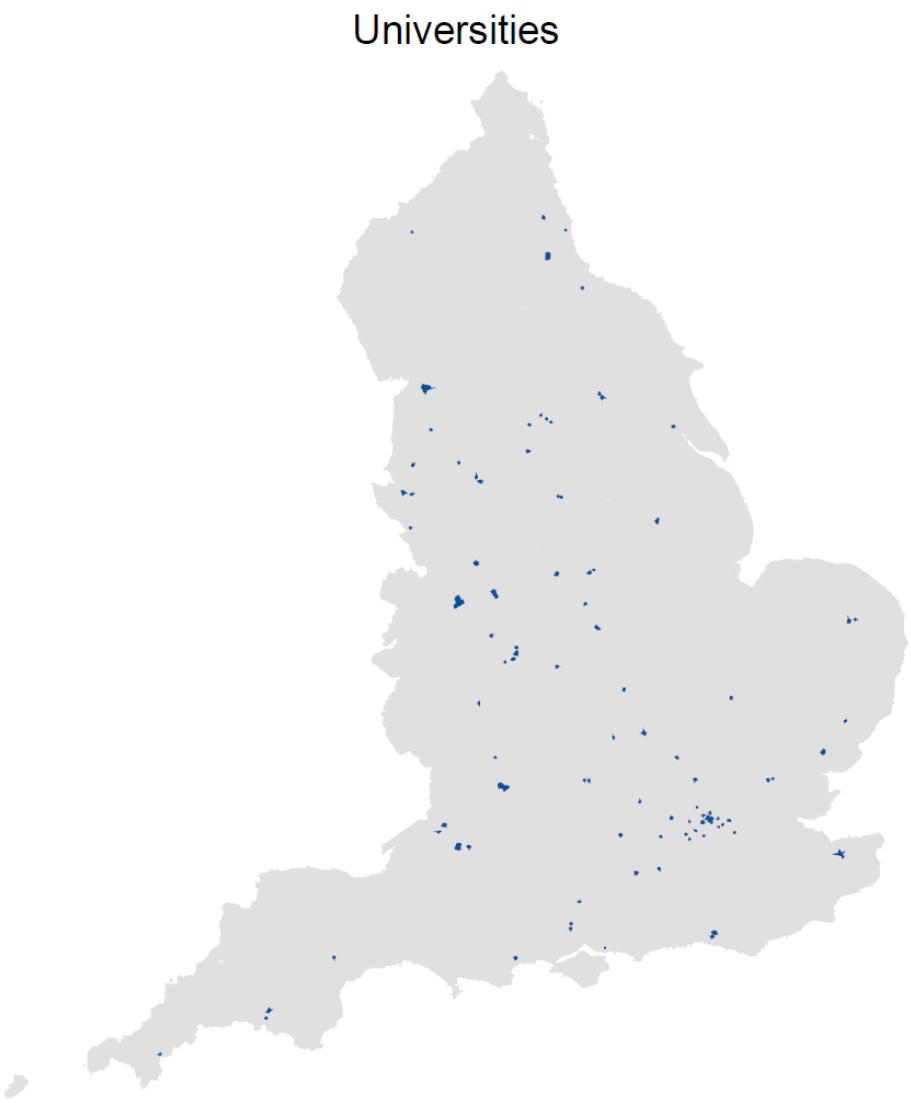
'HE no gap' represents pupils in the cohort enrolling at university straight after the end of high school. 'HE 1 year gap' represents pupils enrolling at university with 1 gap year after high school. 'No HE' represents pupils not enrolling at university. Female represents the share of females in the sample. FSM represents the share of Free School Meal eligible students. The *Ethnicity* section shows the proportion of students for each ethnic category. KS2 English level and KS2 Maths level represent the results at the national level standard tests at the end of Key Stage 2 in English and Maths, respectively, standardised to have mean zero and standard deviation of 1. IMD is the Index of Multiple Deprivation in the Lower Super Output Area where pupils lived at the age of 16, while Median Income is the median annual income in the same area.

Figure 2: Distribution of the cost related to the 3 closest universities.



Notes: For this figure the cost is calculated as the sum of annual tuition fees, annual average rent price for one room, and distance. Intervals in the legend represents the deciles of the distribution of the cost. For each pupil the cost is calculated based on the three closest universities from where

Figure 3: Distribution of the universities in England.



Notes: Every blue dot represents a Lowe Super Output Area with at least one university.

Table 5: Probability of enrolling at university (straight after high school) on the cost related to the three closest universities.

	(1)	(2)	(3)
Cost	-0.0110***	-0.0093***	-0.0066***
	(0.001)	(0.001)	(0.001)
Female	0.0471***	0.0471***	0.0451***
	(0.001)	(0.001)	(0.001)
KS2 - Maths level	0.0789***	0.0790***	0.0717***
	(0.001)	(0.001)	(0.000)
KS2 - English level	0.0772***	0.0772***	0.0724***
	(0.001)	(0.001)	(0.000)
FSM eligible	-0.0369***	-0.0367***	-0.0339***
	(0.001)	(0.001)	(0.001)
IMD	-0.0140***	-0.0139***	-0.0172***
	(0.001)	(0.001)	(0.001)
Median Income	0.0414***	0.0415***	0.0298***
	(0.001)	(0.001)	(0.001)
Cohort FE	No	Yes	Yes
Linear time trend	Yes	No	No
City FE	Yes	Yes	Yes
Ethnicity FE	Yes	Yes	Yes
KS4 School FE	No	No	Yes
Observations	4,797,068	4,797,068	4,797,068
R^2	0.166	0.167	0.192

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the KS4 school level within parentheses. The cost measure is calculated as the sum of annual tuition fees and rental price for one room in the university area of the 3 universities closest to where pupils lived at the end of compulsory education, standardised to have mean 0 and standard deviation 1. All regressions include information on 8 cohorts of pupils, finishing compulsory education in 2003 to 2010. KS2 levels. Female is a gender dummy (1 for females). FSM represents Free School Meal eligible students. KS2 English level and KS2 Maths level represent the results at the national level standard tests at the end of Key Stage 2 in English and Maths, respectively, standardised to have mean zero and standard deviation of 1. IMD is the Index of Multiple Deprivation in the Lower Super Output Area where pupils lived at the age of 16, while Median Income is the median annual income in the same area, they are both standardised to have mean zero and standard deviation of 1. City FE includes dummies for the following cities where pupils lived at the end of compulsory education: London, Birmingham, Manchester, Liverpool and Leeds. Ethnicity FE include dummies for the following categories: Non British Whites, Asian (non Chinese), Chinese, Black/Carribean and Other ethnic groups (White British is the excluded dummy). KS4 school FE are fixed effects for the school where pupils attended the end of compulsory school tests.

Table 6: Probability of enrolling at university (straight after high school) on alternative cost measures considering the 5 and 10 closest universities, all universities within 50 miles (both referring to the place where living at the end of high school), all universities ('Average') and the top 5 percent universities in terms of performance.

	(1) 5 closest	(2) 10 closest	(3) In 50 Miles	(4) Average	(5) Top 5 percent
Cost	-0.0077***	-0.0081***	-0.0059***	-0.0037**	-0.0006
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Constant	0.1987***	0.1982***	0.1985***	0.1983***	0.2016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Individual and area controls	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes
Ethnicity FE	Yes	Yes	Yes	Yes	Yes
KS4 School FE	Yes	Yes	Yes	Yes	Yes
Observations	4,802,102	4,802,102	4,802,102	4,802,102	4,802,102
R^2	0.192	0.192	0.192	0.192	0.192

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the KS4 school level within parentheses. The cost measurse are all calculated as the sum of annual tuition fees and rental price for one room in the university area of the universities considered in each definition, standardised to have mean 0 and standard deviation 1. All regressions include information on 8 cohorts of pupils, finishing compulsory education in 2003 to 2010. All regressions control for KS2 results in Maths and English, the median income and the Index of multiple deprivation in the area where living at the end of KS2. Gender, Free School Meal Eligibility, ethnicity dummy variables, major city dummy variables, cohort and KS4 school fixed effects are taken into account. KS2 levels, Index of Multiple Deprivation and median income in the LSOA where living at the end of KS4, standardised to have mean 0 and standard deviation of 1. Corresponding estimated coefficients are available upon request.

Table 7: Probability of going at university on time on the cost related to the three closest universities, controls for academic path.

	(1)	(2)
Cost	-0.0107***	-0.0046***
	(0.001)	(0.001)
Constant	0.1272***	0.1305***
	(0.001)	(0.001)
Cohort FE	Yes	Yes
City FE	Yes	Yes
Ethnicity FE	Yes	Yes
KS4 School FE	No	Yes
Observations	4,797,068	4,797,068
R^2	0.277	0.296

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the KS4 school level within parentheses. The cost measure is calculated as the sum of annual tuition fees and rental price for one room in the university area of the 3 universities closest to where pupils lived at the end of compulsory education, standardised to have mean 0 and standard deviation 1. All regressions include information on 8 cohorts of pupils, finishing compulsory education in 2003 to 2010. All regressions control for a dummy taking value 1 for pupils choosing a full academic path during high school, KS2 results in Maths and English, the median income and the Index of multiple deprivation in the area where living at the end of KS2. Gender, Free School Meal Eligibility, ethnicity dummy variables, major city dummy variables, cohort and KS4 school fixed effects are taken into account. KS2 levels, Index of Multiple Deprivation and median income in the LSOA where living at the end of KS4, standardised to have mean 0 and standard deviation of 1. Corresponding estimated coefficients are available upon request.

Table 8: Probability of to one of the universities included in the cost definition, conditional on enrolling at university.

	(1)	(2)	(3)	(4)	(5)
	3 closest	5 closest	10 closest	In 50 miles	Top 5 percent
Cost	-0.0086***	-0.0032**	0.0039**	0.0165***	0.0016
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
FSM	0.0180***	0.0212***	0.0210***	0.0308***	-0.0008
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
Constant	0.2903***	0.3563***	0.4542***	0.5486***	0.0370***
	(0.003)	(0.003)	(0.004)	(0.004)	(0.001)
Controls	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes
Ethnicity FE	Yes	Yes	Yes	Yes	Yes
KS4 School FE	Yes	Yes	Yes	Yes	Yes
Observations	1,758,489	1,758,489	1,758,489	1,758,489	1,758,489
R^2	0.068	0.083	0.099	0.085	0.006

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the KS4 school level within parentheses. The cost measures are all calculated as the sum of annual tuition fees and rental price for one room in the university area of the universities considered in each definition, standardised to have mean 0 and standard deviation 1. All regressions include information on 8 cohorts of pupils, finishing compulsory education in 2003 to 2010. All regressions control for KS2 results in Maths and English, the median income and the Index of multiple deprivation in the area where living at the end of KS2. Gender, Free School Meal Eligibility, ethnicity dummy variables, major city dummy variables, cohort and KS4 school fixed effects are taken into account. KS2 levels, Index of Multiple Deprivation and median income in the LSOA where living at the end of KS4, standardised to have mean 0 and standard deviation of 1. Corresponding estimated coefficients are available upon request.

Table 9: Probability of enrolling at university (straight after high school) by Free School Meal eligibility status.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	3 closest		5 closest		10 closest		Average	
	FSM[33]	No FSM[34]	FSM	No FSM	FSM	No FSM	FSM	No FSM
Cost	-0.010 ***	-0.006 ***	-0.011 ***	-0.007 ***	-0.013 ***	-0.007 ***	-0.017 ***	-0.002
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)	(0.002)
Constant	0.0953 ***	0.200 ***	0.094 ***	0.200 ***	0.093 *_***	0.200 ***	0.089 ***	0.201 ***
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.003)	(0.002)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ethnicity FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KS4 School FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.150	0.189	0.150	0.189	0.150	0.189	0.150	0.189

*** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the KS4 school level within parentheses. The cost measures are all calculated as the sum of annual tuition fees and rental price for one room in the university area of the universities considered in each definition, standardised to have mean 0 and standard deviation 1. All regressions include information on 8 cohorts of pupils, finishing compulsory education in 2003 to 2010. All regressions control for KS2 results in Maths and English, the median income and the Index of multiple deprivation in the area where living at the end of KS2. Gender, Free School Meal Eligibility, ethnicity dummy variables, major city dummy variables, cohort and KS4 school fixed effects are taken into account. KS2 levels, Index of Multiple Deprivation and median income in the LSOA where living at the end of KS4, standardised to have mean 0 and standard deviation of 1. Corresponding estimated coefficients are available upon request.