Essays on the Economics of Higher Education

Xiaoxuan Jia

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Royal Holloway, University of London

Declaration

I, Xiaoxuan Jia, hereby declare that this thesis and the work presented in it is my own. Chapter 2 and 4 are based on research conducted in collaboration with Dr. Arnaud Chevalier.

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Date: _____

Abstract

A series of UK higher education reforms over the past 30 years have created an increasingly competitive market where students have a large number of institutions/degree courses to choose from and institutions compete to attract students. This thesis investigates the factors that could potentially influence students' decision to invest in higher education and their choice of universities.

The second chapter investigates how university league tables affect prospective students' application decisions. The results suggest a one standard deviation change in the subject-level ranking score of an institution is associated with a 4.3% increase in application numbers per faculty. This effect is particularly pronounced among institutions with the best scores, and it has grown stronger over time.

The third chapter analyses whether the sharp increase in tuition fees in 2012 for home (UK) and EU students have changed their expected earnings after graduation. Thus it indirectly assesses whether the increased fees have increased their demand for information on the returns to higher education and made them more aware of the labour market for university graduates. The results suggest while the increased tuition fees have no impact on students' expected starting salary, home and EU students that entered university in or after 2012 have lowered their expected return to higher education.

The fourth chapter studies the price sensitivity of non-EU students to changes in overseas tuition fees. After controlling for institutional quality and endogeneity of fees, we find that overall, overseas students do not react negatively to changes in fees, and better ranked institutions and institutions with more home/UK students attracts more students from outside the Europe.

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1. Introduction

A series of reforms over the past 30 years have led to a number of changes in the UK higher education sector. The higher education participation rate and the number of overseas students studying at UK universities have both increased substantially during this period. During the same period, the government has been gradually shifting the burden of funding for higher education from the public to the private sector. As such, institutions are under more pressure than before to compete with each other to attract students. With this in mind, this thesis investigates the factors that could potentially influence students' decision to invest in higher education and their choice of universities.

Using application data across UK universities over a period of 8 years, the second chapter investigates how league tables affect prospective students' application decisions. We use subject specific ranking rather than the commonly used institution level ranking. We find that a one standard deviation change in the subject-level ranking score of an institution is associated with on average a 4.3% increase in application numbers per faculty. This effect is particularly pronounced among faculties with the best scores, and overseas applicants. Limits to the number of choices per applicant have increased the preponderance of league tables. This chapter contributes to the literature in three distinct ways. First, we conduct our analysis at the subject level (as opposed to institution-level classifications), as we believe students' application decisions are primarily bound by institutions' provision of the subject they intend to study, and heterogeneity in the quality across subjects within an institution could underestimate the true impact of league tables on applications. Second, we investigate whether the demand for information on quality changes, when the institution framework changes (tuition fees, and the number of choices allowed per applicant). Third, we test for heterogeneity in the impact of league tables by focusing on different types of applicants. The findings of this chapter could be particularly relevant considering that recently the cap on the number of UK and EU student at English universities have been fully lifted and income effect of rankings could go up. The findings here call for institution participation in monitoring and improving the data and methodology used by league table compilers.

Using surveys handed out to first-year undergraduate Economics students at a British University, the third chapter analyses whether the sharp increase in tuition fees

in 2012 for home (UK) and EU students have changed their expected earnings after graduation. Thus this chapter contributes to previous literature by indirectly assessing whether the increased fees have increased their demand for information on the returns to higher education and made them more aware of the labour market for university graduates. The results suggest that while the increased tuition fees have no impact on students' expected starting salary, home and EU students that entered university in or after 2012 have lowered their expected return to higher education on average by about 30 percentage points, bringing it closer to the realised returns shown in previous literature. The reduction in students' expected wage growth/premium shown in this chapter contradicts earlier findings of the progressive nature of the 2012 reforms, and could imply that some students made their decisions of not investing in higher education from inaccurate or incomplete information. Therefore, this chapter calls for government intervention to provide prospective students with clear and accessible information on the real cost of higher education, and the fact of substantial life time earning premium for university graduates.

Using UK data on first-year undergraduate students and university tuition fees, the fourth chapter builds a panel of all incoming undergraduate students by country of origin to study the price sensitivity of non-EU students to changes in overseas tuition fees. Unlike previous literature, this chapter focuses on application decisions of overseas students after they have already decided to pursue higher education in the UK. After controlling for institutional quality and the endogeneity of fees, we find that overall, overseas students do not react negatively to changes in fees, but better ranked institutions and institutions with more home/UK students attract more students from outside the Europe. Previous analysis have shown that overseas students bring substantial benefits to the British economy, and given their relatively inelastic demand for British higher education, the findings here call for more relaxed immigration policies towards overseas students.

2. Subject Specific League Tables and Students' Application Decisions

2.1 Introduction

Higher education is an experience good for which it may a-priori be difficult to evaluate its quality, especially when it varies both between but also within provider; i.e. quality might be subject specific. Since higher education quality has been linked to future higher earnings for graduates in the UK (Chevalier, 2014), there should be a strong demand from applicants for private third party evaluation of the said quality. Indeed a number of British media publish university league tables[1] every summer to help prospective students; each of these differ slightly in terms of methodology but all attempt to approximate the quality of degree courses based on a set of objective criteria.

The onus of a league table is to provide information on 'quality' that prospective students find useful when making their decisions about where to apply. While some in the sector view league tables as a limited and somewhat noisy signal of quality (HEFCE, 2008), previous research found that an improvement in the rankings is associated with an increase in the number of applications received (Sauder and Lancaster, 2006; Bowman and Bastedo, 2009; Soo and Elliott, 2010; Broecke, 2012), highlighting their importance to prospective students. However, the literature relies either on institutional-level rankings or a limited group of subjects. These may thus be biased if there is heterogeneity in the quality of different subjects within an institution.

This chapter contributes to the literature in three distinct ways. First, we estimate the elasticity of demand for higher education at the subject level and not at the institution level[2] and compare estimates of the ranking effect on applications when `quality' is measured at the institution level and the subject level.

Second, we investigate whether the relevance of information on degree programme quality changes when the institutional framework changes. In particular we examine two important changes: i) the 2004 Higher Education Act amended the financing of higher education in England and lifted the maximum tuition fees for home and EU

[1] The Times university rankings were first published in 1992, the Sunday Times introduced theirs in 1998, the Guardian followed in 1999 and the Complete University Guide (the Independent) in 2007.

[2] A recent manuscript by Gibbons et al (2014) also uses subject level information but relies on the National Student Survey, a national survey of undergraduate finalists, to approximate quality. This measure obviously correlates with league table scores since it is used as one of the input in producing them.

students from 2006 onwards, ii) starting from 2008, the maximum number of choices (university/degree programme) per applicant was reduced from 6 to 5. Both events should increase the demand for information on quality and thus the demand elasticity with respect to league table.

Third, we test for heterogeneity in the impact of league tables by focusing on different types of applicants. In particular, since the UK is one of the main destinations for international students we test whether overseas applicants have a greater demand for information as they have more limited knowledge of the UK higher education sector.

Since applicants' decisions are primarily bound by their preferences for the subject they intend to study (Roberts and Thompson, 2007; HEFCE, 2008), we collected data on application numbers at the subject (group) level ((Joint Academic Coding System, JACS) for each British higher education institution for the period 2004 to 2011, from the Universities and Colleges Admissions Service (UCAS). UCAS centralises all applications to undergraduate courses, as such we observe the universe of applications, apart from prospective students applying through clearing. In some of our models, we disaggregate this data by geographic origin (home, EU, non-EU) and/or gender of applicants. We match this data on number of applications to subject specific league tables. We rely on the most popular league table, provided free of charge by the Guardian newspaper[3]. We then use fixed effect models, where the identification comes from variations in the subject (group) ranking score over the years, and estimate that when an institution's subject (group) ranking score improves by one standard deviation, degree application numbers increase on average by 4.3%. There is also heterogeneity by institutional regime (reducing the maximum number of choices per candidate increased this elasticity), by origin (non-UK domiciled applicants are more responsive to changes in the ranking score), by subject groups (Arts applicants are less responsive) and by initial position (larger for institutions with higher ranking scores). We also report that estimates of the elasticity of demand with regards to quality are biased when quality is

[3] Circulation figures of The Guardian online edition show it surpasses both The Times and The Sunday Times, and according to figures released by the newspaper, its annual university guides attract 370,000 users (online) a month.
See http://image.guardian.co.uk/sys-files/Guardian/documents/2010/09/13/UniversityGuide.pdf, and February 2010 circulation figures for Guardian newspaper online edition.
http://news.bbc.co.uk/1/hi/8588432.stm.

measured at the institutional level. The results are robust to various specifications of time and quality measures.

The rest of the chapter is organised as follows. Section 2.2 reviews the literature on the influence of university league tables on higher education demand. Section 2.3 details the institutional set-up of higher education in the UK and describes the data. Section 2.4 presents the model and research method, and section 2.5 details our findings. Section 2.6 provides the conclusion.

2.2 Literature review

The literature on university rankings mostly originates from the U.S. and the U.K.. Monks and Ehrenberg (1999), Sauder and Lancaster (2006), Griffith and Rask (2007), Bowman and Bastedo (2009), Luca and Smith (2013) studied the effect of the U.S. News and World Report Rankings (USNWR) on students' application decisions and institutions' admission behaviours. The USNWR divides American universities and liberal arts colleges into four tiers; institutions in the top tier are ranked, the remaining institutions are listed alphabetically per tiers. This literature has generally concluded that improvements in the ranking are associated with increased number of applications, increased selectivity and increased conversion of accepted applications (Monks and Ehrenberg, [1999], Sauder and Lancaster [2006]). Bowman and Bastedo (2009) showed that institutions moving into the top tier of the USNWR see a 3.9% increase in the number of applications received, and an increase of 1.2 point in incoming students' average SAT scores. Using individual-level applicant data, Griffith and Rask (2007) analysed the effect of USNWR on students' enrolment decisions and report that an institution ranked in the top 20 will see a 0.45% change in accepted students' probability of enrolment for each one unit change in rank. Using application data to the top 50 universities, Luca and Smith (2013) estimated the impact of USNWR rankings from changes in the ranking methodology, i.e., institutions' rank changed without any change in underlying quality. They find that a one unit improvement in rank leads to one percentage point increase in the number of applications. To summarise the US findings, the USNWR rankings affects top-tier institutions the most, with the most responsive students being the most able.

For the UK, Broecke (2012) used individual-level data for home applicants and a set of different ranking providers, and found that on average an institution experiences a fall of 100 applications for each 10 places it drops in a league table. His findings also suggest heterogeneity in the impact of rankings across applicants; with male, young, Asian, high-achievers, higher socio-economic classes, and privately educated applicants being more responsive. Using student satisfaction scores published in the National Student Survey (NSS) and the Times university rankings as measures of quality, Gibbons et al. (2013) find that a 10 percentage points increase in NSS score leads to a 2.3% increase in applications, whereas a 10-percentile improvement in the Times (subject-level) ranking score increases the number of applications by 1.5 to 2%. However, they find that NSS score affects applications via its impact on universities' league table positions. In addition, they also find that changes in Times (subject-level) rankings matters more to better ranked institutions.

While most previous studies have relied on static panel and fixed effect models, Soo (2013), used dynamic panel data analysis, and found that changes in the Sunday Times overall rankings as well as changes in entry requirements have no significant impact on application numbers but found strong inertia in application numbers. Soo and Elliott (2010), like us, investigates subject specific rankings but only for overseas students in two subject areas: Business and Engineering. From this limited unrepresentative population, they found that overseas Business application numbers vary between 0.5% to 0.9% for a one unit change in subject rank. We expand this work by looking at all subject and applicant groups.

2.3 Institutional set-up and Data

2.3.1 Institutional set-up

Higher education reforms since the mid-eighties, particularly after the 1987 White Paper and the 1992 Further and Higher education Act, have created an increasingly competitive market for higher education in the UK. Applicants have a large number of institutions/degree courses to choose from, and institutions compete to attract them. As participation to higher education increased throughout the nineties, the model of public financing of higher education became un-sustainable; income per undergraduate student dropped from £8,000 in 1980s to £4,850 in 1997 (Dearden et al., 2011). To limit the burden of higher education on public finances and improve funding, maintenance

grants were abolished and an up-front fee of £1000 was applied to new undergraduate students from 1998 onwards. In 2004, a new round of funding reforms were announced replacing up-front tuition fees with a tuition fee of up to £3000 payable from an income-contingent loan (Higher Education Act, 2004)[4]. The tuition fee reforms differ somewhat in Wales and Scotland. Tuition fees went up to £3000 in Wales in 2007 but Welsh students studying at Welsh institutions benefited from a grant of around £2000 towards their tuition fees till 2010[5]. Scottish students studying in Scotland benefited from free education but had to pay an end of study endowment of £2,000 up to 2007[6]. Institutions in Northern Ireland followed the same institutional framework as English institutions during the period of interest. These differences in fee regimes will be mostly captured by institution specific time trends and our results are robust to restricting the sample to English institutions only[7].

For the period of interest, universities received payments from the central government via the Higher Education Funding Councils, based on their number of home and EU students. This funding was fixed by the government, implicitly fixing the number of home and EU students by institutions. The maximum tuition fees that institutions can charge were also fixed. As such, to increase funding, institutions have over time expanded their programmes to overseas students for which numbers and tuition fees are not capped. As a result, the number of overseas students studying at UK universities almost tripled between 1994/95 and 2009/10 (Universities UK, 2011). Having less prior information on degree programmes at UK universities and paying higher fees, it is possible that they are more reliant on league tables as an indicator of quality. We note that during the period of interest, British universities are under student number controls over how many UK and European students they can recruit such that they will be penalised for over- or under-shooting the target. Hence expanding the intake of

[4] Further funding reforms were implemented in 2012 which increased the tuition fees cap to £9,000, but this does not directly affect the cohorts investigated here.
[5] For Wales, http://www.studentfinancewales.co.uk/continuing-students/201415-what-financial-support-is-available/tuition-fee-support.aspx#.VMz7Y2Byb4g, and http://www.bbc.co.uk/news/education-11515828,
[6] Scottish Parliament Information Centre Briefing on Graduate Endowment, http://www.scottish.parliament.uk/ResearchBriefingsAndFactsheets/S3/SB_07-54.pdf
[7] The data does not allow us to distinguish applicants from the 4 constituent countries of the UK, but there is little mobility across the Scottish border apart from students from Northern Ireland.

overseas students do not imply that an equal number of UK/European students will be stripped of their places at university.

For full time undergraduate degrees, the U.K. university application process is centralised. Prospective students apply via the Universities and Colleges Admissions Service (UCAS), which passes their applications to universities for them to decide whether an offer is made. Until 2007, each applicant, regardless of domicile was allowed a maximum of six programme choices (institution-subject). This was reduced to five in 2008[8]. As such we can define three regimes: top-up fees and 6 applications until 2005, tuition fees and 6 applications in 2006 and 2007, and tuition fees and 5 applications since 2008.

2.3.2 Data

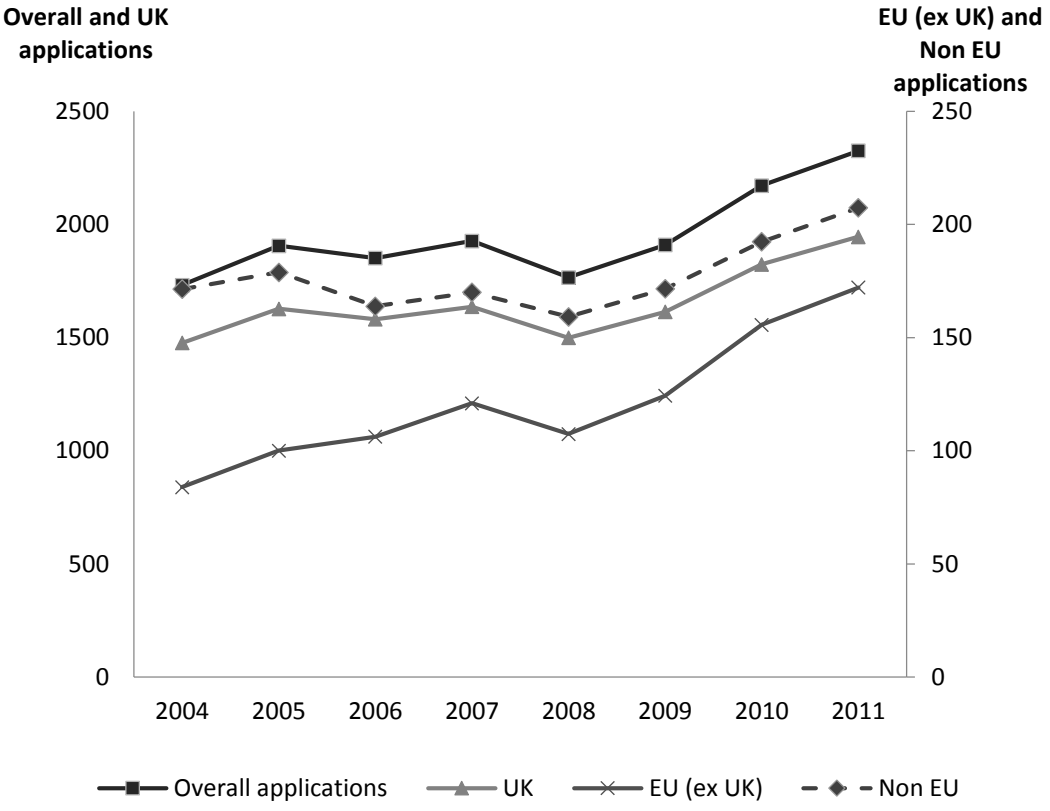
The data originate from two main sources: the UCAS annual report which provides aggregate level data on application numbers[9] by institutions, JACS (Joint Academic Coding Systems) subject groups and student origin and gender, and the Guardian subject-level rankings across more than 40 different academic disciplines[10]. We only keep applications to full time undergraduate degrees for the years 2004 to 2011. Figure 2.1 presents the trends in the number of applications submitted every year from 2004 to 2011, by applicants' geographic origins. Overall, applications have increased throughout the period of interest to reach 2.4 million, with the rise being the steepest for students originating from the EU. The two dips in the overall number of applications coincide with the increase in tuition fees from £1000 to £3000 in 2006 and the change in UCAS application system in 2008 which saw the number of choices per applicant reduced from 6 to 5. The trends by origin of applicants are fairly similar, even if the levels are very different.

[8] Applicants to Oxford or Cambridge universities can only apply to one of the two institutions, not both, and are further restricted to four choices only. Applicants to medical schools and veterinary schools are also limited to four choices. These applications must be completed by the autumn preceding entrance to higher education.

[9] The data excludes clearing applications since those are not centralised via UCAS.

[10] These were obtained from the education section of the Guardian website with the exception of the 2009 ranking which we took from the printed edition of the Guardian University Guide. We have not been able to track down the Guardian data before 2003. (2004 rankings were published in 2003).

Figure 2.1: Number of degree applications by geographic origin: years 2004-2011 (in thousands)



Source: UCAS application data, 2004-2011
Note: graph based on the total number of degree applications submitted every year, which is the sum of all the choices applicants made on their application forms in that year.

Although recent surveys suggest an increasing number of prospective students refer to league tables before making their decisions (Roberts and Thompson, 2007; HEFCE, 2008), such league tables have attracted much criticism about their accuracy and reliability. The main gripe with league tables is that the methodology employed changes over time and hence they do not capture changes to the true quality of programmes (HEFCE, 2008). For this chapter, we do not take side in this debate regarding the merit of methodologies used to construct league tables but only use them as a source of information available to prospective students. Gunn and Hill (2008) find high and significant level of correlation between league tables across different publishers (the Telegraph, the Financial Times, the Guardian, the Sunday Times and the Times). Our choice of the Guardian league tables to conduct this research is no endorsement that it provides a more accurate measure of educational quality, but only reflects that it is easily accessible and currently the most popular ranking (see footnote 3).

Over the period 2004 to 2011, the list of subjects covered by the Guardian league tables changed somehow. When subjects were merged, we take the average score across the two subjects in the years that they were treated independently to create a consistent series. These subject tables were then collapsed further to form new league tables based on the list of JACS subject groups used by UCAS, details of which is provided in Appendix table A3.

The methodology behind the Guardian league tables has also changed over time (see table A1 in Appendix). The most recent set of criteria used to construct them includes *expenditure per student*, *student staff ratio*, *job prospects*, *value added*, *entry tariff*, *course satisfaction* (from the annual National Student Survey (NSS)), *teaching quality* (from NSS), and *feedback* (from NSS). Compare to most of the literature we use ranking scores rather than ranks since each subject (group) has different numbers of institutions offering them, making rank comparisons between subjects meaningless. The National Student Survey became an input in the ranking score in 2008 and brought substantial changes to the set of criteria used, which then led to noticeable changes in the mean subject (group)-level ranking scores[11]. With this in mind, we standardised the subject (group)-level Guardian ranking score by year and subject groups in all of the regressions, to make the mean value consistent throughout the period.

The Guardian does not rank all UK higher education providers but has a focus on institutions catering for full time undergraduate education. It also omits institutions which decline to provide the full set of information and courses with less than 35 full-time equivalent students. Finally, there were some consolidations of the higher education sector over the period; in such cases, we treat the institutions as separate before the merger and as a new institution afterwards[12]. We then merge the UCAS application numbers and Guardian league table information taking care that information on league tables published in year t (and named Guardian ranking year t+1) is linked to applications in year t+1. The final data is an unbalanced panel with gaps; there are 162 institutions across 8 years, and 17 subject groups in total, which give us a sample of 10,753 observations. The number of institutions per subject group in each

[11] We attempted to use change in methodology as an exogenous shock to ranking, independently of true quality. To do so, we replicated the 2008 rankings using the 2007 methods. Unfortunately, the information publicly provided does not allow to replicate grading scores or ranking.
[12] Institutions that changed name are recoded as the same institution throughout.

year is available in Appendix table A2. Table 2.1 contains the summary statistics of the main time-varying variables (raw data, not standardised) at various level of dis-aggregation, and shows that faculties receive on average 1,400 applications, 17% of which are from foreign applicants (EU and Non EU).

Table 2.1 Descriptive Statistics

Variable		Mean	Std. Dev.	Observations
Number of applications (institutional level)		16744.72	2343.73	10753
Number of applications (faculty/subject-group level)		1389.52	354.00	10753
By applicants' domiciles	UK	1178.42	309.09	10726
	EU (excl. UK)	95.41	48.61	9706
	Non EU	142.71	61.10	9641
By gender	Male	705.22	157.73	9532
	Female	812.63	246.53	9840
Guardian (subject group-level) ranking score		62.84	8.19	10753

Note: Source: Guardian university guides and UCAS application data, 2004 – 2011. Cells report the average application numbers for institutions with available institution/subject-level ranking information (more specifically, there are 127 institutions with available institution-level ranking information, and 162 institutions with available subject group-level ranking information).

2.4 Model

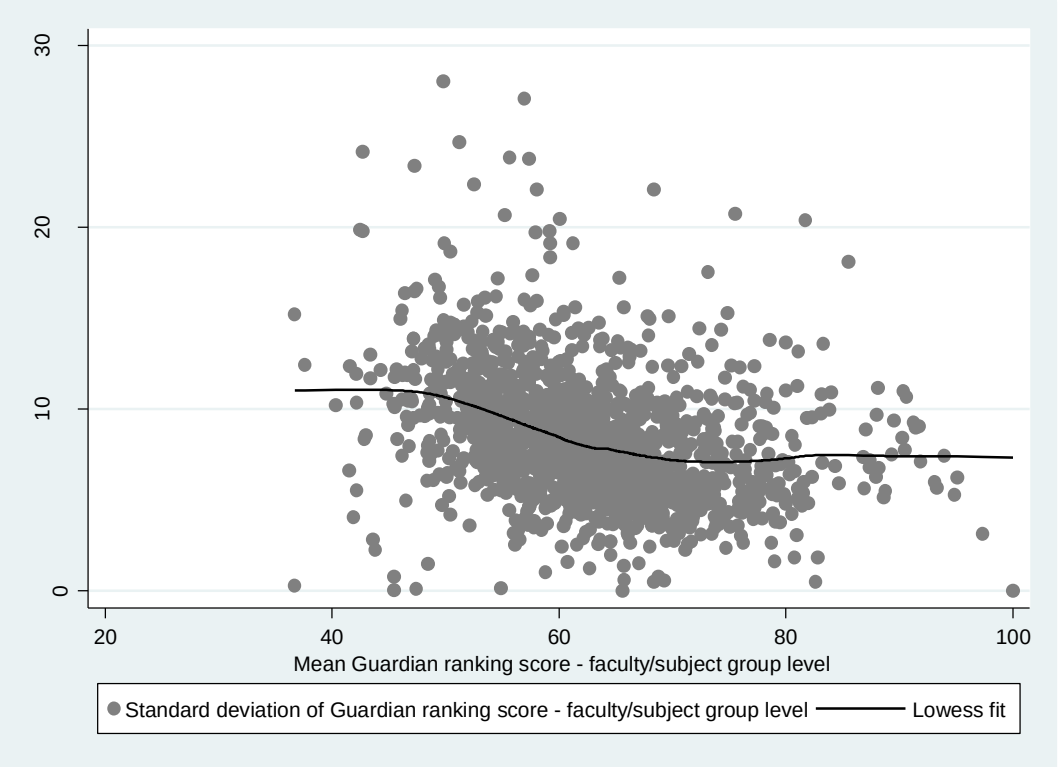
We estimate whether the number of applications to a given subject-group *(i)* at a given institution *(u)* in period *(t)*, y_{iut} is a function of the subject group-level Guardian ranking score/ranks (x_{iut}). The main equation depicting the relationship is

$$\log(y_{iut}) = \beta_1 X_{iut} + \alpha_i + \delta_{iu} + f(T_t) + \varepsilon_{iut} \qquad (1)$$

where: α_i is the subject fixed effect, δ_{iu} is the faculty fixed effect, where faculty refers to subject group i at institution u, $f(T_t)$ is a function of time that includes either year dummies, a linear trend or institution specific trends. Dummies reflecting institutional environment (fees regime and maximum number of choices regime) were also added in some specifications, and ε_{iut} is the random error term. The main coefficient of interest to be estimated, β_1, represents the percentage change in the number of applications associated with a one standard deviation change in the ranking score X_{iut} (about 8 points in the ranking score).

Any correlation between the ranking score and unobserved variables (such as reputation of the faculty, location of the university, etc.) is assumed constant over time and accounted for by the faculty-level fixed effect[13]. Standard errors are clustered at the institutional level to control for within-institution correlations[14]. The model is identified by changes in the ranking score for a given faculty over time, as such it is crucial to assess that there is enough within faculty variation. This is explored in Figure 2.2 which plots for each institution/subject pair the mean and standard deviation in Guardian ranking score. The average variation is around 8 points with a few outliers, as such subject (group) specific scores appear to vary substantially over time.

Figure 2.2: Variation in Guardian ranking score over time (per faculty/institution-subject group)



Source: The Guardian University Guides 2004 – 2011
Note: Lowess fit is a non-parametric fit of the data using locally weighted linear regressions.

[13] We use the Hausman test to verify the appropriateness of the specification and the result shows the null hypothesis of no systematic difference between fixed and random effects estimates is rejected, which confirms fixed effects is preferred as the consistent estimator to be used here.
[14] Clustering at the faculty/institution level produces similar standard errors.

2.5 Results

2.5.1 Main results.

In Table 2.2 we present results using different treatment of the time effect. The first column uses year dummies to account for year-on-year changes in the number of applications. We estimate that when the subject group-level Guardian ranking score improves by one standard deviation, the number of applications received increases by 4.2%. In the second column, we reduce the flexibility of the model by imposing a linear time trend and dummy variables for years under different tuition fees regime and maximum number of choices allowed. The fee increase and the cap on number of choices reduced the total number of applications by 14% and 21% respectively, but the coefficient estimate for the score variable remains the same. In column 3, we estimate the fully flexible model specified above and include institution specific linear trends. An F-test of equality of the time trends between institutions is rejected, confirming that models using only faculties and year fixed effects are biased, as such this is our preferred specification. Note that the adjusted R-square also doubles when this specification is used. The estimates are extremely stable to the treatment of the time effect and range from 4.2% to 4.3% change in application numbers for a one standard deviation change in Guardian ranking score[15].

Table 2.2: Fixed effects model - Guardian (subject group level) ranking score and log applications numbers

	ln (applications by faculty)		
VARIABLES	(1)	(2)	(3)
ranking score (standardised)	0.042***	0.042***	0.043***
	(0.008)	(0.008)	(0.008)
year dummies	x		
linear trend		x	x
post top-up fees		x	x
5 choices per applicant max		x	x
institution specific trends			x
Constant	6.639***	6.546***	6.546***
	(0.015)	(0.016)	(0.005)
Observations	10,753	10,753	10,753
Number of groups	1,554	1,554	1,554
Adjusted R-squared	0.124	0.120	0.207

[15] The estimated results are robust to the inclusion of a quadratic term of ranking score. The estimated result marginally increases to 4.5% change in applications, for a one standard deviation change in the ranking score, while the coefficient on the quadratic term (ranking score) is never statistically significant.

F test for institution specific trends (p-value)	-	-	1923.60 (0.0000)

Note: Source: Guardian university guides and UCAS application data, 2004 – 2011. "Number of groups" refers to observations by institution and subject groups. Degrees of freedom for the F test are (3, 161). Robust standard errors in parentheses, clustered at the institution level. *** p<0.01, ** p<0.05, * p<0.1

We then test whether the effect of ranking score on applications has changed over time, especially following the aforementioned institutional reforms, tuition fee increase and restriction on application choices, which should have increased the demand for information about course quality. We thus interact the ranking score with a dummy for the higher fee regimes (post-2006) and with a restricted choice dummy (post-2008). Results are presented in Table 2.3 column 1. Only the interaction of score with the reduction in the number of choices per candidate is significant and positive, increasing the elasticity of application with respect to quality by 2 percentage points[16]. In the second column, we report estimates for an even more flexible model, using year dummies and their interactions with the ranking score, with 2004 used as the baseline year. These interactions overall are statistically significant as shown by the F-test, and confirm that the demand for quality information sharply increased in the two years following the reduction in the number of choices allowed before going back to trend. Overall the evidence appears consistent with our assumption that in the short-run the demand for information grew when the returns to information increased.

[16] Additionally, we tested incorporating each interaction separately to the model, the effects are then larger, and the change in fees interactions becomes marginally significant. A three-way interaction of *fee increase*, *ranking score* and *limit on choices* again reveals positive but not statistically significant results and the three ways interactions terms are not substantially different from those presented.

Table 2.3: Heterogeneity in the effect of Guardian (subject group level) ranking score by institutional regime and applicants' type.

	ln (applications by faculty)		ln (applications by faculty and applicant group)	
VARIABLES	(1)	(2)	(3)	(4)
ranking score (standardised)	0.032**	0.023	0.018*	0.050***
	(0.014)	(0.017)	(0.009)	(0.008)
ranking score x post top-up fees	0.0024			
	(0.013)			
post top-up fees	-0.135***		-0.174***	-0.174***
	(0.017)		(0.015)	(0.015)
ranking score x 5 choices	0.024**			
	(0.010)			
5 choices per applicant	-0.215***		-0.262***	-0.262***
	(0.013)		(0.014)	(0.014)
2005 x ranking score		0.020		
		(0.017)		
2006 x ranking score		0.002		
		(0.016)		
2007 x ranking score		0.023		
		(0.018)		
2008 x ranking score		0.047***		
		(0.018)		
2009 x ranking score		0.043**		
		(0.020)		
2010 x ranking score		0.025		
		(0.022)		
2011 x ranking score		0.022		
		(0.025)		
EU (ex UK) x ranking score			0.040***	
			(0.014)	
Non EU x ranking score			0.056***	
			(0.013)	
female x ranking score				-0.003
				(0.006)
Institution specific trends	x	x	x	x
Constant	6.546***	6.593***	3.709***	3.710***
	(0.004)	(0.010)	(0.004)	(0.004)
Observations	10,753	10,753	61,500	61,500
Number of groups	1,554	1,554	9,126	9,126
Adjusted R2	0.208	0.212	0.128	0.127
F test for: year x ranking score	-	2.66	-	-
(p-value)		(0.012)		
Chow test for: domicile x ranking score	-	-	11.93	-
(p-value)			(0.0000)	

Note: Source: Guardian university guides and UCAS application data, 2004 – 2011. "Number of groups" refers to observations by institution and subject groups (and domicile and gender in column (3) and column (4)). 2004 is the baseline year in column (2). Controls for applicants' domiciles (UK, EU(ex UK), Non EU) and gender are included in column (3) and column (4). The degrees of freedom for the F-test are (7, 161). Robust standard errors in parentheses, clustered at institution level. *** p<0.01, ** p<0.05, * p<0.1

We then turn to assessing heterogeneity in the impact of ranking score for applicants of different geographic origins (domiciles) and gender. Non-UK students typically have less a-priori knowledge about the quality of various institutions, so one may expect them to be more reliant on external information, as published in various university guides, and consequently be more sensitive to changes in the ranking scores. In addition, while EU students pay the same fees as home students, those from outside the EU are not publicly subsidised and face uncapped tuition fees (typically around £10,000 for this period), which should also make them more sensitive to changes in 'quality'. We split the applicant cells by the geographical origin of applicants, and interact the standardised ranking score with applicants' domiciles (Column 3)[17]. The results confirm that changes in the ranking score have a disproportional effect on non-UK students. While a one standard deviation change in the ranking score marginally increases the number of British applications by 1.8%, for EU and non-EU applications this stands at 5.8% and 7.4% respectively. Overseas applicants are 4 times more sensitive to change in quality information which could reflect the higher costs of education or their lack of initial information. These differences in the effect of ranking score on applications by applicants origin are large and significantly different from each other (Chow test F=11.93).

Finally, we test whether there is any heterogeneity in the response to quality information changes by gender. To do so, we split the applicant cells by gender and include an interaction term of ranking score and gender. The last column in Table 2.3 reports results from this model which reveals no significant difference in application behaviour by gender.

In Table 2.4, we assess whether the impact of ranking score differs for applicants to different subject groups. For doing so, we interact each subject group with the standardised ranking score. We find little difference in the responsiveness of prospective students to quality score across subject groups. The only exception being Creative Arts & Design, which has a slightly different application process, whereby applicants provide a portfolio demonstrating their artistic competence. As such, they probably gather information about the quality of the institutions at this stage. Alternatively, they might have strong preferences for being taught in a given university

[17] Conclusions are similar if the analysis is run for each group separately.

where the faculty better match their artistic interest, which could make them less sensitive to changes in ranking scores.

Table 2.4: Heterogeneity in the effect of Guardian (subject group level) ranking score by subject and number of institutions

VARIABLES	ln (applications per faculty)	
ranking score (standardised)	0.044*	0.093**
	(0.024)	(0.038)
Group A Medicine & Dentistry x ranking score	-0.023	
	(0.031)	
Group B Subjects allied to Medicine x ranking score	-0.047	
	(0.032)	
Group C Biological Sciences x ranking score	-0.018	
	(0.025)	
Group D Vet Sci, Ag & related x ranking score	-0.086	
	(0.065)	
Group F Physical Sciences x ranking score	-0.006	
	(0.036)	
Group G Mathematical & Comp Sci x ranking score	0.013	
	(0.030)	
Group H Engineering x ranking score	-0.000	
	(0.033)	
Group J Technologies x ranking score	-0.012	
	(0.080)	
Group K Architecture, Build & Plan x ranking score	0.067	
	(0.055)	
Group M Law x ranking score	0.035	
	(0.031)	
Group N Business & Admin studies x ranking score	0.029	
	(0.031)	
Group P Mass Comms x ranking score	0.021	
	(0.040)	
Group Q Languages and Linguistics x ranking score	-0.021	
	(0.029)	
Group V Hist & Philosophical studies x ranking score	0.014	
	(0.031)	
Group W Creative Arts & Design x ranking score	-0.068*	
	(0.036)	
Group X Education x ranking score	0.074	
	(0.073)	
number of institutions (per subject group) /100		0.005
		(0.157)
ranking score x number of institutions / 100		-0.054
		(0.037)
post top-up fees	x	x
5 choices per application max	x	x
institution specific trends	x	x
Constant	6.546***	6.542***
	(0.005)	(0.145)
Observations	10,753	10,753
Number of groups	1,554	1,554
Adjusted R-squared	0. 210	0.207

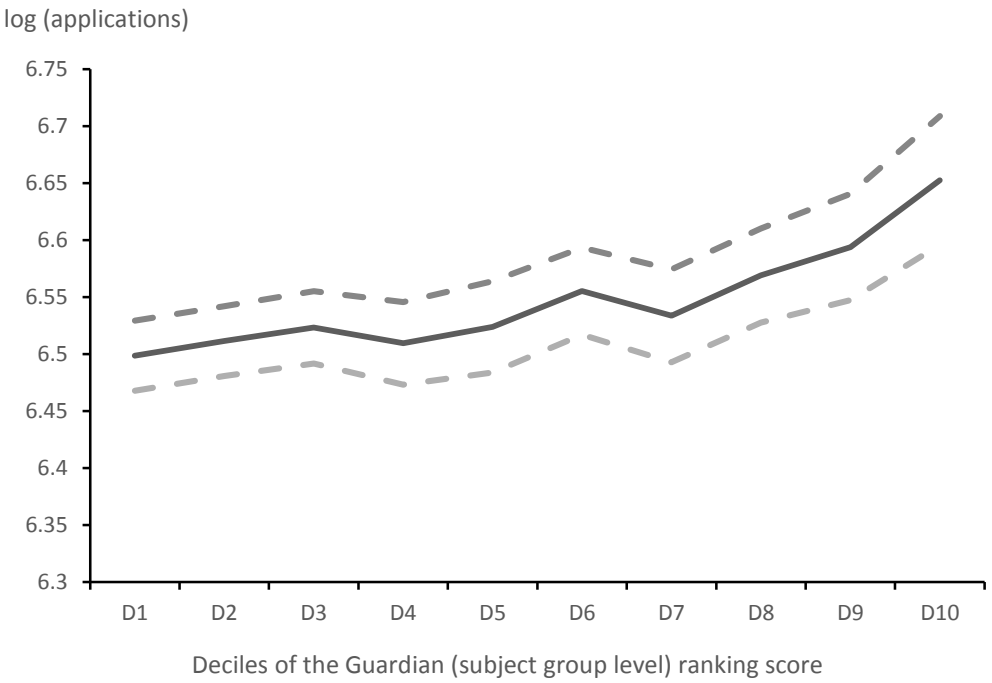
F test of Subject Groups x ranking score (p-value)	1.79 (0.0363)	-

Note: Source: Guardian university league guides and UCAS application data, 2004 – 2011. "Group L Social Sciences" is the baseline group in column (1). "Number of groups" refers to observations by institution and subject groups. Degrees of freedom for the F test in column 1 are (16,161). Robust standard errors in parentheses, clustered at university level. *** p<0.01, ** p<0.05, * p<0.1

Finally, we test whether information on educational quality is more valuable when there are more HE providers to choose from in a subject area. For doing so, the standardised ranking score is interacted with the number of institutions offering the subject (group). The second column of Table 2.4 reports these estimates. We can reject this hypothesis since the number of institutions reported in a subject (group)-specific league table does not affect the impact of the ranking score. Perhaps this is not entirely surprising, since the subject groups used in this analysis are quite broad and the model includes subject fixed effects, as such the effect on number of institutions is identified from changes in the number of providers per subject group, which does not vary substantially from year to year.

Finally, we assess possible non-linearity in the relationship between ranking score and application numbers. More talented applicants who typically apply to better ranked institutions may be more sensitive to information that suggests change in `quality' of those institutions. Figure 2.3 shows estimates of the quality effect at each decile of the ranking score distribution. There is some evidence of non-linearity. The effect of a score improvement is greater for faculties in the top three deciles, and especially for the top one. Like previous U.S. and British studies have shown for institution quality, the impact of information on course quality is non-linear and increases at the top, this is also true when quality is measured at the subject level.

Figure 2.3: Effect of a change in the (standardised) Guardian ranking score at different points (deciles) of the score distribution



Data Source: The Guardian University Guides and UCAS application data 2004-2011

Note: Graph based on the regression of log (applications) on (dummies of) each decile of the Guardian ranking score.

Overall, it appears that the reaction to a change in quality information is broadly similar between applicants of different subject groups (with the exceptions of Creative Arts & Design) and gender, and that the only heterogeneity originates from applicants' geographical origin, whereby applicants with the least a-priori knowledge of British institutions and paying higher fees are more sensitive to quality information. The effects are also much stronger for faculties moving to the top deciles of the quality distribution.

2.5.2 Robustness checks

In this section, we conduct various robustness checks of our specification (Table 2.5). First, we assess whether the results are sensitive to the use of rank rather than ranking score. The reason for focusing on ranking score is that rank is difficult to interpret when the number of Higher Education providers differs between subject groups. To compare with the rest of the literature we re-run our favoured specification using subject (group) rank as the independent variable, and estimate that a one unit changes in rank is associated with a 0.1% change in application numbers (Column 1). The estimated results are rather small compared to Soo and Elliott (2010) which may be driven by their focus

on overseas applicants only, a group that has a greater elasticity to quality information. To attenuate our concerns that rank is sensitive to the number of competitors, we change the dependent variable to market share in a specific subject group, i.e. we implicitly control for the number of competitors (Column 2). This has little effect on the size of the estimated coefficient.

To interpret the size of the coefficients on rank in terms of the number of applications, we find that a 10-place change in rank, for an institution with on average 11 subject groups, will lead to a fall of 183 applications on average. This is significantly higher than Boecke (2012), where a 10 place change in rank is associated with a drop of 100 applications, and is consistent with the hypothesis that institutional level analysis on the impact of rankings could be biased due to the fact that they do not account for heterogeneity in the quality of different subjects an institution offers. To further test whether applicants put more weight to the subject or institution-level ranking score, we include both in the model. The results confirm that applicants are more focused on the subject specific quality information (Column3, Column 4). A one unit increase in rank (moving down a league table) has a 25% larger effect on number of applications when quality is measured at the faculty rather than the institution level. This jumps to 50% when ranking score rather than rank is used as a measure of quality. This is consistent with the findings of Roberts and Thompson (2007) that applicants are mostly focused on subjects rather than institutions. As such, previous research has largely underestimated the effect of quality information on the decision of applicants.

Finally, as detailed in the institutional set-up, Welsh and Scottish institutions adopted different tuition fees regimes compare to their English counterparts during the period of interest. We re-run our favoured specification using English institutions only (Column 5). The estimated coefficient remains very stable and marginally increases to 4.5%, for a one standard deviation change in ranking score.

Table 2.5 Fixed effect model: subject group/institution rankings and application numbers

VARIABLES	(1) ln (applications by faculty)	(2) ln (market share – by faculty)	(3) ln (applications by faculty)	(4) ln (applications by faculty)	(5) ln (applications by faculty) England only
subject group rank	-0.0012***	-0.0012***	-0.0010***		
	(0.0003)	(0.0002)	(0.0003)		
subject group ranking score				0.0380***	0.0450***
				(0.0090)	(0.0099)
institution rank			-0.0008*		
			(0.0004)		
institution ranking score				0.0253*	
				(0.0144)	
trend	x	x	x	x	x
post top-up fees	x	x	x	x	x
5 choices per applicant	x	x	x	x	x
institution specific trends	x	x	x	x	x
Constant	6.602***	-4.891***	6.646***	6.553***	6.593***
	(0.0129)	(0.0124)	(0.0262)	(0.0044)	(0.0053)
Observations	10,753	10,753	10,434	10,434	8,580
Number of groups	1,554	1,554	1,491	1,491	1,222
Adjusted R-squared	0.204	0.108	0.199	0.201	0.211

Note: Source: Guardian university league guides and UCAS application data, 2004 – 2011. "Market share" is the share of applications received by each institution per year, among all the institutions that appear in the same subject group. "Number of groups" refers to observations by institution and subject groups. Robust standard errors in parentheses, clustered at institution level. *** p<0.01, ** p<0.05, * p<0.1

2.6 Conclusion

Do prospective students care about league Tables? Using data from the UK which allow us to observe all applications and detailed information on ranking scores at the subject level, we find that a one standard deviation improvement in the subject-level ranking score increases the number of applications by 4.3% in our favoured specification. The underlying information of the ranking score became more important, as the maximum number of choices allowed per applicant was curtailed, and for better ranked faculties. This is consistent with previous findings that change in quality matters especially at the top. We find weak evidence of heterogeneity by subject groups but noticeable differences by prospective students' geographic origin. Non-British applicants, especially those paying the highest tuition fees, are four times more sensitive to information on the quality of the higher education. Finally, previous research, by focusing on institution level ranking, has underestimated the effect of league tables on applications; applicants are 50% more sensitive to information at the faculty level than at the university level.

Should institution care about their ranking? We now conduct some back of the envelope calculations to assess the size of the reported effects for an average institution. For the period covered in the data, numbers of home and EU students at each university were controlled and the only free market was for overseas students (assuming no visa restriction). An improvement in the Guardian ranking score of one standard deviation would lead to a 7.4% change in overseas applications, or 10.5 additional applications from overseas students per faculty, at the mean. With a conversion rate of 17% (computed from UCAS report), this loosely translates to an additional two students enrolled and £20,000 additional revenue per subject group, which does not appear very substantial. Taking our overall estimates, the average 4.3% change in applications for a one standard deviation improvement in Guardian ranking score represents an additional 60 applications received per faculty. Given the current level of tuition fees and a conversion rate of applications to students of 20%, this loosely translates into a change in income of £108,000 for each subject group per year or £1,188,000 per institution, on average, or roughly a 0.7% increase in income[18]. The direct immediate impact on an institution's budget from variation in Guardian ranking score thus appears quite limited.

[18] The average institutional income is £168 million in the 2010/11 academic year (HESA).

However, recent reforms have fully lifted the caps on number of home and EU students English universities can recruit[19], and the income effect of league tables could increase when institutions are no longer penalised for going over the student number control target.

[19] http://www.hepi.ac.uk/wp-content/uploads/2014/09/Clean-copy-of-SNC-paper1.pdf

3. Tuition fees and students' expected future incomes: Evidence from a natural experiment

3.1 Introduction

Expected earnings lie at the heart of the decision to invest in education (Becker, 1964; Betts, 1996; Webbink and Hartog, 2004; Jenson, 2010). Human capital theory explains that individuals will invest in education if their expected returns, measured in terms of present value of perceived future incomes, exceed present costs (including forgone earnings). Annual university tuition fees in England rose threefold to £9000 for undergraduate home and EU students entering universities from 2012 onwards. Using survey data collected since 2007 amongst first year undergraduate students at a British institution, we analyse whether the change in tuition fees in 2012 led to changes in students' expected future incomes after graduation. As such, we indirectly assess whether post fee increase, the newly enrolled undergraduate students are better informed about their future job market prospects. This chapter contributes to the literature by indirectly testing Becker's assumption that investment in education is driven by students' perception of future returns.

In 2010, the Independent Review of Higher Education Funding and Student Finance in England recommended a removal of the cap on maximum tuition fees English universities can charge to home and EU students. This subsequently led to the government lifting the tuition fee cap from £3,375 to £9,000, for home and EU students entering universities from 2012 onwards. Students from outside the EU were not affected by this reform, as their tuition fees are unregulated. Students are eligible to an interest free loan, for which repayments are conditional on an earning threshold. The reform additionally lifted the earning threshold above which students start to pay back their loans, from £15,795 to £21,000. Moreover, the government introduced more generous support to students from the poorest backgrounds, whilst introduced an income related real interest rate of up to 3 percent on student loans for the highest earners. Chowdry et. al. (2012) simulated UK graduates' life time earnings post 2012 reform and concludes the more progressive nature of the new funding system, such that the wealthiest graduate will face higher loan repayments due to the increased interest rates, whilst the poorest will receive more generous financial support.

The increased earning threshold for loan repayments and the variable interest rates applicable to graduates of different income levels should provide incentives for home and EU prospective students to gain information on their expected future income flows. To test this assumption, we assess whether students wage expectations were affected by the reform. We rely on a difference in difference methods with non-EU students being considered a control group, since they were not affected by the fee reform.

Previous literature on expected earnings is relatively sparse. Manski (1991) summarised that economists tend to assume that students form their income expectations based on either their knowledge of realised earnings of those with similar characteristics (Freeman, 1971), or based on their personal characteristics and that they are aware of how supply and demand for skills determines wage rates (Willis and Rosen, 1983). Dominitz and Manski (1996) carried out computer-assisted surveys over a group of high school and college students and find that while students are willing to provide meaningful answers to questions on their income expectations, they significantly overestimated the returns to college education. Empirical analysis finds heterogeneity in expected earnings across students by gender, age, subject of study, year of course at university and family backgrounds (Smith and Powell, 1990; Betts, 1996; Varga, 2001; Webbink and Hartog, 2004; Brenello et al., 2004; Delaney et al., 2011; Jerrim, 2011).

Findings of Betts (1996), Brunello et al. (2004), Botelho and Pinto (2004) and Jerrim (2011) suggest university students go through a process of "learning" about labour markets and wage rates as they progress through university and on average revise down their expected future incomes as they get nearer to joining the labour market. These findings show that compared to first-year undergraduate students, students in senior years tend to have lower, more "realistic"[20] expectations of future incomes as a result of learning about graduate labour market performances (Botelho and Pinto, 2004; Brunello et. al., 2004). This also suggests that as they revise their expected wages down, some students will decide to stop attending college and drop out.

A couple of papers have assessed how information about returns affects decisions to invest in education. Jensen (2010) finds that after eighth grade boys at randomly

[20] As being closer to realised earnings in the labour markets

selected Dominican schools were given information on the realised returns to secondary education, they revised (up) their expected returns and subsequently completed more years of schooling. Following the government's announcement of £9,000 tuition fees in late 2010 (to be implemented in 2012), McGuigan et al. (2012) find that debt-centred media reporting of the increased tuition fees at the time significantly increased the number of students who perceive going to university as 'too expensive', but providing students with simple information on the costs and returns to a university degree can substantially reduce this negative effect. However, as far as we are aware, few has analysed how students' expected earnings might have changed following an exogenous shock to the cost of higher education. In other context, Lewis and Marvel (2011) propose that a relative increase in prices increases consumer's willingness to search and indeed they find that consumers tend to search more when prices rise in the retail gasoline market.

We hypothesise that students' formulate their expected returns of higher education (or their expected earnings after graduation) as a function of their knowledge of realised labour market wage rates for university graduates, adjusted by their own academic ability, their perceived cost of university degrees, and a random error term. The random error term consists of two components, u_1 is normally distributed with a mean of 0, and u_2, which is positive and reflect the over-estimation of future earnings by freshmen students (see Betts, 1996; Brunello et al., 2004; Botelho and Pinto, 2004; and Jerrim, 2011). The increase in fees, by making it salient that reimbursement of loans is conditional on earnings should increase the demand for information about graduate salaries (see figure 3:A1 in the appendix)[21] and readjust u_2. To verify this, we study whether a rise in tuition fees does trigger this "learning" behaviour among first-year undergraduate students, by analysing changes in their expected future incomes.

Since we cannot observe the characteristics of those who didn't apply for universities, we investigate whether the increased tuition fees has made first year students more aware of labour market outcomes for university graduates. If the first year students have put more effort into learning relevant (graduate) wage information

[21] In addition, we find that a Chow test of equality based on monthly data from 2006 to 2013, rejects the null that the number of Google searches on "Graduate salary" are the same before and after the tuition fees announcement in November 2010 (Chow test F=10.06), with more searches after 2010."

as a consequence of higher fees, this should be reflected through changes in their expected earnings and expected returns after graduation. We use surveys handed out to first year undergraduate Economics students to elicit their expected future incomes, in the first week of term, at a large college of the University of London from 2007 to 2013.

Using surveys of first-year students and corresponding administrative data over the 7-year period, we find that increased tuition fees have no impact on students' expected starting salary. However, we find some evidence that first year students in our sample do appear to be more aware of the labour market outcomes for university graduates, since expected wage growth and expected returns to higher education for home and EU students are around 30 percentage points lower post fee increase compared to overseas (Non-EU) students, bringing it closer to realised returns (32% for men and 42% for women) found by Walker and Zhu (2011) for Law, Economics and Management graduates.

The rest of the chapter is organised as follows. Section 3.2 reviews the previous literature on students' expected earnings. Section 3.3 describes the institutional set up and the policy change. Section 3.4 describes the data. Section 3.5 introduces the model and section 3.6 reports the findings. Section 3.7 presents robustness check. Section 3.8 concludes.

3.2 Literature

According to Becker (1964), expected return is the most important factor that influences the decision to invest in education. This should warrant wide research interest, but economists have long been sceptical about the validity of empirical analysis based on subjective data collected from surveys. However, Dominitz and Manski (1996) find that income expectations of youth can be meaningfully elicited using surveys. Wolter (2000) replicated the computer-assisted survey in Dominitz and Manski (1996) over a small sample of Swiss high school and university students, and the results suggest students have rational expectations of future incomes. Botelho and Pinto (2004) carried out experiments as well as surveys to elicit expected return to higher education over a small sample of Portuguese college students. They finds no significant difference between income expectations elicited using hypothetical surveys or real financial incentives. The latter further strengthens the validity of research on income expectation

using survey data. Moreover, Botelho and Pinto (2004) also report that first year students expect higher or less "realistic" returns to college education than senior students, regardless of gender.

Smith and Powell (1990) use surveys of senior college students at two midwestern universities in the U.S. and find that in general students have a good understanding of earnings of both college and high school graduates, but men tend to have a higher expected earnings ten years after (college) graduation, compare to their estimate for college peers. Betts (1996) use surveys of undergraduate students at a U.S. university and find that students' average estimates of current young workers' salaries are very close to reality, but this is more of the case for students in the senior years rather than freshman classes, which suggest that the former are more aware of graduate labour market outcomes as they prepare join the labour market themselves.

In Europe, Brunello et al. (2004) analysed wage expectations of undergraduate business and economics students at universities across 10 European countries, and also find that senior students have lower, more realistic, expected earnings compared to students in the lower years. Jerrim (2011) compares UK undergraduate students' expected starting salaries in 2005 with the average realised earnings of the same cohort, and concludes that on average, full time students overestimate their starting salary by about 15 per cent, and for freshman classes this figure stands at 20 per cent. Delaney et al. (2011) use surveys of undergraduate students at Irish universities and find that gender, risk preference, high school performance, college and subject choice, and years of parental education can influence both the short run and long run wage expectation.

In general, these findings show a tendency for first-year students to over-estimate their future incomes, but their expectations become more realistic as they progress closer to the point of joining the labour market.

To give a more detailed picture of how income expectations vary across students with different characteristics, previous studies show that male students (Smith and Powell, 1990; Betts, 1996; Webbink and Hartog, 2004; Brunello et al., 2004; Botelho and Pinto, 2004; Martins, 2006), and students from higher income families tend to have higher expected earnings (Smith and Powell, 1990; Betts, 1996; Varga, 2001; Webbink and Hartog, 2004). Webbink and Hartog (2004), Martins (2006), Delaney et al. (2011),

Jerrim (2011) find that students' income expectations are also dependent on the subject area they study, with most of them show students of law, economics, and business and management subjects having higher expected earnings, which is consistent with differences in realised income between subjects. Martins (2006) and Delaney et al. (2011) find that parents' education attainment is positively linked to students' income expectations, while Brunello et al. (2004) show that students tend to have higher expected starting salaries (by 4%) if their mothers are educated to university level, but Smith and Powell (1990) or Bett (1996) find a negative relationship between fathers' years of education and expected future incomes.

In terms of controlling for individual ability, previous findings are rather mixed. Smith and Powell (1990), and Bett (1996) find that controlling for high school grades and SAT scores barely changed their estimates of expected income and subsequently those were dropped in Smith and Powell (1990). Rather than students' realised score, Brunello et al. (2004) use expected grades and show that students who believe they have higher academic ability than their class peers also have higher expected incomes. Webbink and Hartog (2004) find that students with higher (secondary education) score in science expect higher earnings, but the same cannot be said for students with higher scores in other subjects.

A limit of these papers is that more informed students may be the ones who have decided to go to university. To avoid this selection bias, Varga (2001) surveyed students in their senior years at Hungarian high schools and find that consistent with human capital theory, students' expected returns from tertiary education have a positive and significant influence over their decision to apply for further studies, after controlling for their ability, family and high school characteristics. Jensen (2010) suggest that students are not necessarily well informed when they make their education decisions and he find that despite high measured returns, eighth grade boys (primary school) from Dominican Republic have very low expected returns to secondary education and only a small proportion would go on to study at secondary schools. However, from experiments carried out over students at randomly selected Dominican schools, he finds that this negative effect can be mitigated, particularly for the least poor students, if they were given information on the realised returns to secondary schooling. Similarly, McGuigan et al. (2012) show that running an 'information campaign' on the financial costs and

benefits of going to university among students (aged 14/15) at randomly selected secondary schools in London, can improve their understanding of the progressive nature of the 2012 UK higher education reforms, and hence counter the negative impact generated by the media reporting of the trebling of university tuition fees.

3.3 Institutional Set-up

The rapid expansion of the UK higher education sector, both in terms of the number of higher education providers, and the number of students (participation rate trebled from 1989 to 2010 - Wyness, 2010; BIS, 2013) challenged the public financing of higher education. The UK higher education funding system has undergone a series of reforms over the past thirty years: the 1989 White Paper introduced a means-tested student loan system, the 1998 Teaching and Higher Education Act imposed for the first time, an up-front tuition fee of £1000 for home and EU students entering universities from 1998 onwards[22], and the 2004 Higher Education Act replaced the up-front tuition fees with a deferred fee of up to £3,000[23] while increased financial support to students from the poorest backgrounds (Wyness, 2010). As for students from outside the EU, they are not publicly funded throughout this period and UK universities have been charging them the full cost of their education since 1980 (Harris, 1995). As such the number of overseas students each university can recruit are not limited and universities must compete for overseas students in order to generate additional revenue.

The government still finances a substantial part of the cost of higher education, but through the introduction of student loans and lifting the cap on tuition fees, it gradually increased the amount that students need to contribute towards their education. Also rather than funding institutions directly, the reforms subsidise students, allowing competition a la Tiebout between institutions. Public funding accounted for roughly 40% of institutional income in England during the first decade of the 21st century. This figure fell to 30% in 2011/12, and it is estimated that it would fall to 23% in 2012/13 (Universities UK, 2013). With the aim to further reduce the burden of higher education on public finance, the 2010 Independent Review of Higher Education and Student Finance (Browne Review) recommended a removal of the cap on university tuition fees for home and EU students, which had stood at a level of £3,000 - £3,375 from 2006 to

[22] Students from poor family backgrounds were exempt

[23] To be implemented in 2006; "deferred" in the sense that students can apply for student loans to pay for their tuition fees.

2011. The government responded by lifting the maximum tuition fees English universities can charge to £9,000 instead, for home and EU students entering universities from 2012 onwards, with most institutions deciding to set their fees at the new upper limit[24]. Overseas students are not affected by the policy change since they do not receive public funding and their fees are not capped[25].

The means-tested student loan system was implemented in the UK in 1990, which meant that once home and EU students graduate university and become employed, they pay back (part of) the cost of their university education[26]. Initially the interest rates on loans were indexed to the rate of inflation, and repayments wouldn't start until graduates earn more than 85% of average earnings. This repayment threshold was changed to £10,000 (in cash terms) after the introduction of tuition fees in 1998, and the 2004 Higher Education Act further increased the repayment threshold to £15,000 (Wyness, 2010). As part of the 2012 funding reform, the government lifted the repayment threshold again, from £15,795[27] in 2012 to £21,000 in 2016. The government also introduced a variable real interest of up to 3% on student loans for graduates of different income levels, with those earning £41,000 or more facing the maximum 3% real interest rate. Chowdry et al (2012) summarised that the new system will also allow students from the poorest backgrounds to receive more generous financial support in terms of increased maintenance grants and maintenance loans. Using simulated data, Chowdry et al. (2012) also analysed the distributional impact of the 2012 reform and find that on average, graduates will be roughly £8,850 worse off over their life time, but the poorest will be better off given the increased financial support and generous loan

[24] Royal Holloway, University of London, the institution where our data originates from, was one of the English universities that announced a tuition fee of £9,000 for home and EU students entering in 2012/13 on full time undergraduate degrees. https://www.royalholloway.ac.uk/aboutus/newsandevents/news/newsarticles/royalholloway,universityoflondon,announcesfeesof9000from2012.aspx. Scottish students faced effectively zero tuition fees. Scottish graduate endowment was abolished for those graduated after 2007. Scottish students studying at Scottish institutions will have their tuition fees paid by the Scottish government, page 11, http://www.saas.gov.uk/_forms/sas4.pdf. Welsh students studying anywhere in the UK can apply for a grant of up to £5,315 to cover part of the £9,000 fees. http://www.studentfinancewales.co.uk/continuing-students/201415-what-financial-support-is-available/tuition-fee-support.aspx#.U99nqmB0z4g. There are less than 10 Welsh observations in our sample, and all of which occurred prior to 2012.

[25] Average tuition fees for overseas students for a classroom based degree is around £12,000, subject to inflation changes (Reddin, 2011)

[26] Prior to 2006/07, loans were mainly used to cover maintenance cost while at university. Repayments are income contingent, and would be written off after 25 years (pre-2012)

[27] http://www.hmrc.gov.uk/softwaredevelopers/paye/update2.htm

repayment terms, whilst the richest graduates (those earning more than £41,000) will pay back more due to the increased interest rates on their student loans. Given the changes in repayment threshold and the introduction of variable real interest rates on student loans, home and EU students entering universities from 2012 onwards should be more aware of their future income flows after graduation.

In addition to the funding reforms, there was another policy change that would affect student recruitment in 2012. Higher Education Funding Councils in the UK are responsible for allocating public funds from the government to universities to support a range of teaching and research activities. For teaching, the size of payments are based on the number of home and EU students at each institution. The student numbers were fixed by the funding councils, implicitly fixing the teaching grant to institutions. Alongside the increase in tuition fees, the Higher Education Funding Council in England (HEFCE) relaxed the student number controls imposed over the recruitment of some home and EU students at English institutions. From 2012 onwards, universities in England are free to recruit as many home and EU students as they like, provided that the student has achieved the equivalent of UK A-level grades of AAB and above. The student number controls were further relaxed in 2013 with the grade threshold lowered to ABB. In the next section, we show that the post-2012 students have lower credentials, but do not differ in other dimensions.

3.4 Data

The data originates from two sources. We use surveys of first-year undergraduate Economics students at a British University from 2007 to 2013, and the corresponding administrative data which includes information on students' country of domicile and pre-university qualifications. We keep first year undergraduate entrants only in the sample, and as such any students repeating their first year of courses will be dropped.

The survey took place in the autumn term of each academic year, typically during the first lecture of the first-year economics core course *Principles of Economics*, where we tend to observe the highest attendance rates from students. Over 95% of students in our sample are taking a single or a joint degree programme in Economics and are registered with the Economics department at the time of survey.

The survey asks for mainly two sets of information from students. Firstly, it asks for students' personal information and their family backgrounds, which include gender, age, ethnicity, parents' education and family income[28]. Secondly, the survey aims to measure students' expected earnings in four different dimensions[29], namely *expected wage upon graduation* (*expected starting salary*), *expected wage growth*, *overconfidence* in expected wages and *expected return to higher education*. We define the *expected wage growth* as the log difference between students' expected wage at 30 and their expected starting salary (with a university degree). We define *overconfidence* as the log difference between students' expected wage at 30 (with degree) and their estimation for their class peers. Finally, we define *expected return to higher education* as the log difference between the expected wage at 30 with and without a university degree. In addition, we also ask students whether they think that they will become self-employed in their careers. We give no indication to students on whether they should include inflation when answering the expected income questions, and as such we assume that all responses are given in cash terms and we deflate all income variables used in the analysis to 2013 prices. The design of earnings questions closely follows that of Smith and Powell (1990) and Brunello et al. (2004), in the sense that we are concerned with two particular time points in a university graduate's career, namely the expected earnings upon (university) graduation and the expected earnings at the age of 30, with and without a degree.

The survey also contains a lottery question that is designed to elicit students' risk preferences, but controlling for risk preferences barely changed our estimated coefficients of interests, and this is subsequently omitted from regression specifications.

The non-response rates for some questions are high and certain information is not missing at random. Information on expected earnings is least missing for the expected

[28] Outliers of family incomes, i.e., those with reported family income less than £5,000 are replaced with missing, and those with family income higher than £1.5 million are replaced with £1.5 million. A dummy variable is added to indicate which observation has missing family income information. The missing family incomes for home and overseas students are then replaced with the mean value (yearly) for each respective group to preserve the sample size. Outliers count for less than 3% of the 589 observations with reported family incomes

[29] Students are asked: i). In your first job after graduation what do you expect to earn (gross per year)? ii). By the age of 30, how much do you expect to be earning gross per year (not self-employed)? iii). By the age of 30, if you had not done a degree how much do you expect to be earning gross per year? iv). What is your best estimate of the average expected (gross annual) earnings, at age 30, of someone on your course?

starting salary question. As the questions become more complex, more students fail to report their expected future incomes[30]. The response rate falls from 89% for expected starting salary, to 66% for expected return to higher education. From table 3: A1 in the Appendix, we find that male students are less likely to fail to report their expected starting salary, estimated peer's wage and their family income, but they are more like to fail to report their expected wage at 30 with or without degree. Home students are less likely to be missing expected wage at 30 with or without degree, but the same can't be said for those with higher family income. Those with higher family income are also likely to fail to report their estimated wage for class peers. Those who fail to report their family income are likely to fail to report their income expectations overall. Students of later cohorts are less likely to fail to report their family incomes, but the 2010 cohort are overall less likely to miss any of the income related questions.

The corresponding administrative data includes students' age on entry, fee bands (home/EU, overseas), pre-university qualifications (UCAS tariffs), and first-year end-of-year exam results. Students' pre-university qualifications, such as the UK A-levels and International Baccalaureate qualifications, are translated into UK UCAS tariff points based on their respective grades[31]. Information on students' UCAS tariffs is not available for those who achieved their pre-university qualifications prior to the year of entry, and those whose qualifications cannot be translated into UCAS tariffs[32]. Out of the 298 observations with missing tariff information, over 90% are EU and overseas students (based on their fee status and country of domiciles). The types of pre-university qualifications these students have may include French Baccalaureate, Italian High School Diplomas, German Abitur, Advanced Placement programmes in the US, and various university foundation programmes run by British universities. UCAS does not provide official translation of these qualifications into UCAS tariffs, but all are accepted by the majority of UK universities, which determines equivalence and sets entry requirements for each type of qualification independently. Similar to family incomes, those missing

[30] i.e. At a time point beyond graduation (expected wage at 30) or in cases that are less applicable to themselves (estimate of average salary for class peers, or at age 30 without a university degree)

[31] The highest tariff points are given to the best grades. For the exact grade conversion, see http://www.ucas.com/how-it-all-works/explore-your-options/entry-requirements/tariff-tables

[32] Information on pre-university qualifications are only available for students whose prior qualification are accepted by British universities and also can be directly translated into UCAS tariffs

tariff information are also replaced with the mean value in that year, and flagged with a dummy. [33]

We merge the two datasets through students' ID number, and overall we have 1046 observations over a seven-year period from 2007 to 2013.

Table 3.1 shows the descriptive statistics for the key variables. Overseas students on average are older than home and EU students by a very small margin. The difference between overseas students and home and EU students in terms of UCAS tariff and family income are fairly consistent both before and after the increase in tuition fees. There has been a decline in students' average UCAS tariff during the period of concern, particularly after the fee increase in 2012[34]. This is consistent with the 2012 higher education admission reform which led to increased competition between English universities to attract students, and a decrease in the quality of the recruited students at the institution used for this analysis.

[33] Despite the richness of our data, we cannot impute the missing tariff information or family incomes. For students, we only have information on gender, age, ethnicity, and nationality/domiciles; for family, we only have information on parents' education and whether they own house.

[34] A Probit regression reveals no noticeable changes in the composition of the student population, apart from that on average students entered in or after 2012 have a lower UCAS tariff. See Table 3: A2 in the Appendix section.

Table 3.1 Descriptive statistic for key variables

	UK & EU students		Overseas students		t-statistic
Variables	**pre 2012**	**post 2012**	**pre 2012**	**post 2012**	**(*Diff-in-diff*)**
age on entry	18.63	18.70	19.29	19.05	1.72
	(1.10)	(1.36)	(1.48)	(1.27)	
	[484]	[210]	[248]	[104]	
Male	0.61	0.61	0.46	0.54	-1.12
	(0.49)	(0.49)	(0.50)	(0.50)	
	[484]	[210]	[248]	[104]	
UCAS tariff	375.59	355.52	367.82	333.92	1.19
	(83.20)	(78.55)	(72.78)	(93.40)	
	[484]	[210]	[248]	[104]	
Family income (£000s)	91.69	99.34	157.99	166.46	-0.04
	(81.32)	(105.10)	(238.51)	(231.55)	
	[484]	[210]	[248]	[104]	
GDP per capita (2013 US dollars)	38141.58	37452.66	13999.34	20025.21	-3.60
	(11167.03)	(11388.24)	(14676.93)	(18590.84)	
	[484]	[210]	[248]	[104]	
Expected starting salary (£000s)	26.65	28.70	27.43	31.95	-0.92
	(10.70)	(18.33)	(19.81)	(29.60)	
	[440]	[193]	[214]	[80]	
Expected wage growth	0.73	0.69	0.78	1.03	-2.62
	(0.45)	(0.43)	(0.68)	(0.82)	
	[388]	[173]	[132]	[39]	
Over-confidence in expected earnings	0.16	0.13	0.02	-0.03	0.15
	(0.49)	(0.54)	(0.69)	(0.88)	
	[376]	[168]	[123]	[40]	
Expected return to HE	0.71	0.74	0.92	1.24	-2.42
	(0.51)	(0.47)	(0.74)	(0.89)	
	[361]	[166]	[123]	[40]	

Note: The statistics for each variable in each category is arranged by *mean* , (*std. dev.*), and [*number of observations*]. UCAS tariff information is not available (298 observations) for those who didn't take the qualification at the year of entry to university, those who didn't take qualifications that can be translated into UCAS tariff and those who dropped out before the end of their first year. Family income is missing for 457 observations. After eliminating outliers, these missing family income and UCAS tariffs are replaced by the mean value in that year. Income variables are measure in thousand British pounds. Outliers for all income variables are eliminated

Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013.

There is a small increase in age on entry for home fee paying students. Despite the proportionally sharp increase in GDP per capita for overseas students after 2012, we show that controlling for business cycles in students' declared country of domiciles does not change our baseline results by much. Compare to previous UK studies, students in our sample have relatively high expected earnings. The average expected starting salary is around £27,000 for home and EU students in our sample, which is noticeably higher than £18,300 found in Jerrim (2011)[35]. Walker and Zhu (2011) find that average college premium for Law, Economics and Management graduates is around 33% for males, and 42% for females. The average expected return for students in our sample is around 78%[36].

[35] The data used in Jerrim (2011) is based on surveys of over 3,000 undergraduate students across 70 UK universities in 2005, and the average realised salary for 2005 (UK) graduates is found to be £15,900.

[36] Similar to our definition of expected return to HE, Walker and Zhu (2011) defined college premium as the log difference in wages between those with a university degree and those with high school qualifications.

3.5 Model

As the increase in tuition fees only apply to home and EU students, we devise a difference-in-difference estimation for expected future income *y* for student *i* in year *t*, we therefore use overseas students as the control group:

$$\ln(y_{it}) = \textit{fee increase} + \textit{home fee status} + \textit{fee increase} \times \textit{home} + \sum \beta_i x_i + \sum u_t + \varepsilon_{it}$$

where x_i is a set of personal and family characteristics, which includes age, gender, UCAS tariffs, exam grades, parental education, and family income, u_t is a set of year dummies that captures any unobserved year specific effect[37], and ε_t is the robust random error term. Standard errors are clustered at year level. Since the student population consists of a large number of nationalities, we also control for business cycles in students' declared country of domicile by merging the dataset with the GDP per capita information collected from the International Monetary Fund[38].

The interaction term *fee increase* x *home* captures the changes in home and EU students' expectations following the tuition fee increase, as compared to overseas students whom are unaffected by the change in fees.

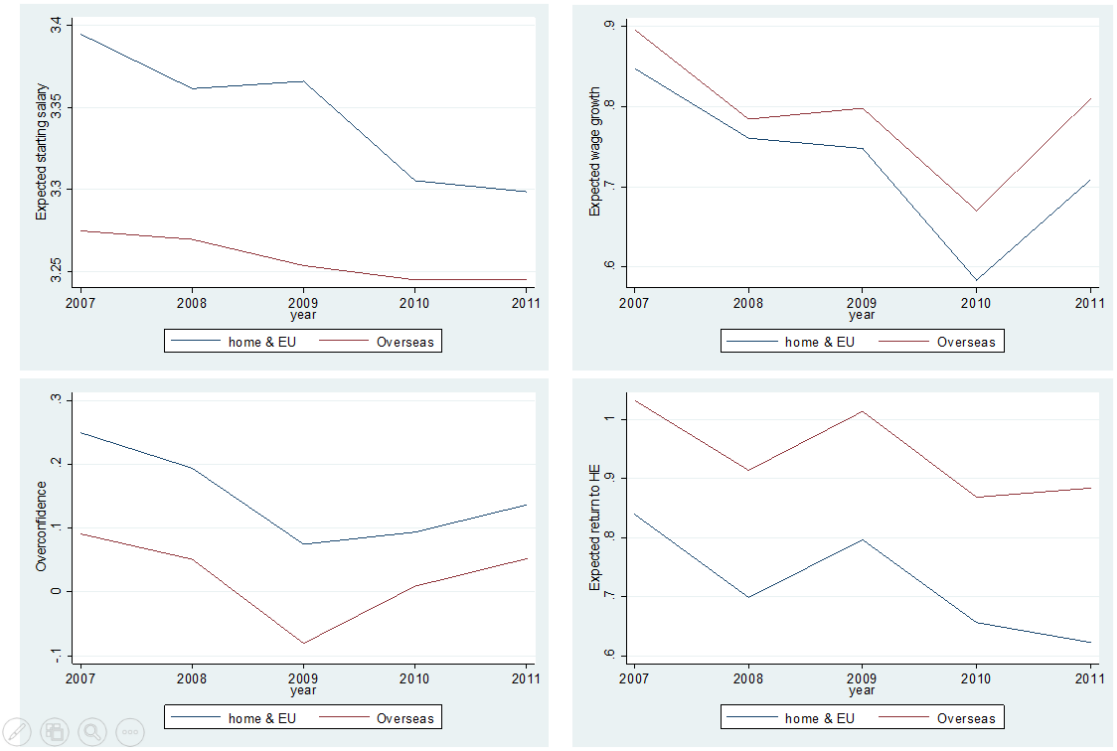
For our main estimates we use 2012, the year when the tuition fee increase comes into effect as the cut-off point (time of treatment). To check the robustness of our results, we later define the treated population as students entering from 2011 onwards, due to the announcement effect of the reform.

Figure 3.1 presents the (estimated) expected earnings by student fee groups (home & EU, overseas), prior to the tuition fee reform in 2012. In each of the four graphs, expected earnings of home (& EU) students and overseas students tracked each other fairly consistently from 2007 to 2011. Hence, overseas students is a reasonable control group to be used in our analysis.

[37] An F-test shows the year dummies are jointly significant. Imposing a linear trend barely changes the size of our estimates, but it produces larger standard errors.

[38] More specifically the World Economic Outlook Database, provided by the IMF. This particular data contains IMF staff's estimate of GDP per capita across countries in 2013, which is not yet available from the World Bank database

Figure 3.1: (Estimated) Expected earnings by student fee groups (home and EU, overseas): pre-2012 tuition fee reform



Note: Clockwise from top left corner: expected starting salary, expected wage growth, expect return to HE and Overconfidence. Graphs based on (difference-in-difference) regression estimates of students' expected earnings from 2007 to 2013, using survey data collected from first year undergraduate economics students at a British University.

3.6 Results

Table 3.2 shows the results for expected wage upon graduation. The coefficients on the interaction term are insignificant in all of the specifications, which suggest that the increase in tuition fees had no impact on students' expected starting salaries. We test the effect of fee increase on expected starting salary in column 1, and we control for individual characteristics (age and gender) in column 2 and individual ability in column 3 and 4. Like previous studies (Smith and Powell, 1990; Betts, 1996; Varga, 2001; Webbink and Hartog, 2004), we control for family incomes in column 5 to account for the possibility that higher family income may allow students to have better labour market information. Since we have a diverse international student population, we also take into account any effect economic fluctuations in home countries may have on expected earnings (column 6).

Table 3.2: Expected wage upon graduation (2007 – 2013)

VARIABLES	ln (Expected starting salary - 2013 prices (£))					
fee incr x home	-0.0491	-0.0502	-0.0585	-0.0768	-0.0544	-0.0513
	(0.103)	(0.0913)	(0.0884)	(0.0863)	(0.127)	(0.124)
fee increase	-0.0818	-0.0711	-0.0521	-0.0675	-0.0622	-0.0646
	(0.0701)	(0.0613)	(0.0599)	(0.0609)	(0.087)	(0.0848)
home fee status	0.0856	0.0737	0.0895	0.115**	0.127*	0.131*
	(0.0537)	(0.0442)	(0.0470)	(0.0391)	(0.055)	(0.0586)
male		0.174***	0.172***	0.159***	0.183***	0.184***
		(0.0148)	(0.0137)	(0.0287)	(0.0187)	(0.0174)
age on entry		0.0146	0.00748	0.0208*	0.0043	0.0046
		(0.00869)	(0.0105)	(0.0106)	(0.0066)	(0.0065)
ln (UCAS tariff)			-0.0113		0.004	0.004
			(0.0278)		(0.0297)	(0.0278)
missing UCAS tariff			0.0778*		0.065	0.0650
			(0.0351)		(0.040)	(0.0423)
mother university					0.0349	0.0343
					(0.0353)	(0.0351)
father university					0.0186	0.0180
					(0.0259)	(0.0270)
ln (family income)					0.0456	0.0461
					(0.029)	(0.0288)
missing family income					0.0252	0.0240
					(0.0525)	(0.0527)
ln (exam grade)				-0.00171		
				(0.0407)		
ln (GDP per capita)						-0.003
						(0.022)
year dummies	x	x	x	x	x	x
Constant	3.309***	2.931***	3.093***	2.816***	2.782***	2.803***
	(0.0365)	(0.160)	(0.303)	(0.242)	(0.278)	(0.423)
Observations	927	927	927	872	888	887
Adjusted R-squared	0.005	0.040	0.043	0.044	0.055	0.054

Note: Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013. All income variables are deflated to 2013 prices. GDP per capita is in 2013 US dollars. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Male students appear to have higher expected wage upon graduation, by about 17%. The coefficient on male students is consistent with previous findings, and could reflect the persistent wage differentials between male and female workers in the labour market (Smith and Powell, 1990). Compare this result to previous findings on realised gender wage gap, Chevalier (2007) use UK data on a cohort of students who graduated in 1996 and find a gender wage gap of 12%. Purcell et al. (2013) tracked the 2006 (UK) university applicant cohort and find that the gender wage gap for those graduated in

2009/2010 from the same subject can vary from 4.3% in education to 28% in law. So the wage gap in expected earnings appear to reflect the market situation.

Being classified as home fee paying student is also positively related to a higher expected wage upon graduation, but this is only significant at the 10% level, in column 5 and column 6[39]. Using UCAS tariff or average exam grades to control for ability produced statistically insignificant estimates[40] and it barely changes the main estimate of interest. The level of GDP per capita in students' declared country of domicile does not appear to influence their expected starting salary. We have also used GDP and GDP growth, none of which changed our estimate of interest by much.

Table 3.3 shows the results for expected wage growth, which is defined as the log difference between expected wage upon graduation and expected wage at the age of 30 with degree). The mean expected wage growth for students in our sample is around 74%. The coefficients on the interaction term are all statistically significant, and adding different sets of controls increases the precision but barely changes the magnitude. This finding suggests that the increase in tuition fees in 2012 for home and EU students is associated with a reduction in their expected wage growth by about 26 percentage points, relative to overseas students. This brings the expected wage growth closer to the realised wage growth during the first 10 years of career, which is measured around 50-60% (Manning and Swaffield, 2008). Among the first year students in our sample, one year increase in their age on entry to university lowers their expected wage growth on average by about 3.4 percentage points. Parental income can influence students' access to labour market information (Betts, 1996), which would in turn affect their income expectations. Similar to Smith and Powell (1990) and Webbink and Hartog (2004), we find that students from higher income families expect higher wage growth; a 10% increase in family income is associated with a 1.2 percentage point increase in expected wage growth. However, it works in the opposite direction for those who failed to report their family incomes, and for them the expected wage growth is around 12 percentage points lower. This statistically significant result again confirms that family

[39] We find no interaction effect between home fee status and gender in any of our regression estimates. In all of our analysis, controlling for ethnicity barely changes our estimates of interest

[40] We also tested the robustness of our specifications by using UCAS tariff and UCAS tariff squared, neither of which changed our estimates by much. We stick to UCAS tariff in all latter specifications since we believe first-year exam results could be influenced by their experience of first year at university, and therefore cannot accurately reflect students' true abilities

income is not missing at random. The positive link between expected wage growth and (reported) family income could also suggest that students look for realised incomes of people close-by when they form their own expectations.

Table 3.3: Expected wage growth (2007 – 2013)

VARIABLES	Expected wage growth			
fee incr x home	-0.269*	-0.246*	-0.284**	-0.290**
	(0.113)	(0.110)	(0.111)	(0.116)
fee increase	0.103	0.0740	0.122	0.127
	(0.0902)	(0.0886)	(0.0856)	(0.0896)
home fee status	-0.0636	-0.0956	-0.00453	-0.0182
	(0.0781)	(0.0700)	(0.0674)	(0.0841)
male		0.0658*	0.0411	0.0391
		(0.0303)	(0.0257)	(0.0258)
age on entry		-0.0409**	-0.0328*	-0.0335
		(0.0137)	(0.0168)	(0.0183)
ln (UCAS tariff)		0.0465	0.0186	0.0185
		(0.0566)	(0.0606)	(0.0608)
missing UCAS tariff		0.0172	-0.0128	-0.0110
		(0.0459)	(0.0496)	(0.0504)
mother university			0.0581	0.0595
			(0.0376)	(0.0365)
father university			-0.0167	-0.0156
			(0.0393)	(0.0417)
ln (family income)			0.116***	0.114**
			(0.0315)	(0.0335)
missing family income			-0.0985***	-0.0964***
			(0.0163)	(0.0153)
ln (GDP per capita)				0.0106
				(0.0369)
year dummies	x	x	x	x
Constant	0.929***	1.412**	0.872	0.792
	(0.0597)	(0.463)	(0.578)	(0.496)
Observations	732	732	703	702
Adjusted R-squared	0.033	0.042	0.059	0.058

Note: Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013. Expected wage growth is measured as the log difference between the expected wage at 30 (with degree) and expected wage upon (university) graduation. All income variables are deflated to 2013 prices. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Overconfidence is defined as the log difference between students' expected wage at 30 (with degree) and their estimate for their class peers. Results from table 3.4 suggest that the increase in university tuition fees does not appear to affect the tendency for students to be "over-confident", or "self-enhance" in their expected

earnings (at the age of 30 with university degree). This implies that since home and EU students lowered their expected wage growth after graduation (table 3.3), they also revised down their estimates for class peers to the same extent. Consistent with Smith and Powell (1990) and Botelho and Pinto (2004), we find that male students appear to be "over-confident" in their expected earnings at 30, in the sense that their expected earnings at 30 are on average 18.7 percentage points higher than their estimate for class peers. We find that those who are eligible to pay home fees also tend to "self-enhance" in their expected earnings at 30, but the effect is much smaller, measured at 10 percentage points on average[41].

Table 3.4: Overconfidence in expected wage at age 30 against peers (2007 – 2013)

VARIABLES	Overconfidence in expected earnings			
fee incr x home	0.0373	0.0358	0.0246	0.0344
	(0.180)	(0.179)	(0.174)	(0.167)
fee increase	-0.172	-0.153	-0.140	-0.149
	(0.149)	(0.143)	(0.140)	(0.135)
home fee status	0.126**	0.137***	0.133**	0.134**
	(0.0513)	(0.0360)	(0.0423)	(0.0446)
male		0.193***	0.182***	0.183***
		(0.0207)	(0.0126)	(0.0109)
age on entry		0.0044	0.0110	0.0114
		(0.0068)	(0.0081)	(0.0080)
ln (UCAS tariff)		0.0678	0.0953	0.0949
		(0.0702)	(0.0780)	(0.0778)
missing UCAS tariff		-0.0391	-0.0468	-0.0460
		(0.0567)	(0.0618)	(0.0631)
mother university			0.0357	0.0349
			(0.0451)	(0.0451)
father university			-0.0600	-0.0602
			(0.0616)	(0.0612)
ln (family income)		0.0734	0.0765	0.0768
		(0.0458)	(0.0453)	(0.0449)
missing family income		0.0131	0.0010	-0.0014
		(0.0433)	(0.0544)	(0.0555)
ln (GDP per capita)				0.0011
				(0.0377)
year dummies	x	x	x	x
Constant	0.133**	-0.797	-1.075	-1.071
	(0.0391)	(0.624)	(0.721)	(0.819)
Observations	707	707	681	680
Adjusted R-squared	0.013	0.043	0.037	0.037

[41] We also tested whether overconfidence can be driven by male home fee paying students, but including an interaction term of home fee status and male yielded negative and statistically insignificant results.

Note: Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013. Overconfidence is measured as the log difference between students' expected earnings at 30 (with degree) and their estimate for their class peers. All income variables are deflated to 2013 prices. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.5 shows the results for expected returns to university education. We define expected returns as the log difference between students' expected wage at 30 with and without a university degree. The mean expected returns for home and EU students before 2012 is around 71%. The coefficients on the interaction terms are all statistically significant and indicate that the increase in tuition fees is associated with a reduction in the expected returns to higher education by about 30 percentage points for home and EU students in our preferred specification (column 4). This is somewhat surprising, compared to Walker and Zhu (2011) where they simulated realised returns to LEM degrees under different tuition fees schemes (pre- and post-2012), and find that a sharp increase in fees (to £9,000) would only lower the returns by about 3%.

Table 3.5: Expected return to university education at age 30 (2007 – 2013)

VARIABLES	Expected return to university education			
fee incr x home	-0.294*	-0.316**	-0.319*	-0.320*
	(0.138)	(0.125)	(0.136)	(0.135)
fee increase	0.189	0.212*	0.205	0.212*
	(0.113)	(0.102)	(0.107)	(0.108)
home fee status	-0.214**	-0.177	-0.136	-0.204
	(0.0860)	(0.0963)	(0.119)	(0.139)
male		0.0265	0.0122	0.0054
		(0.0387)	(0.0327)	(0.0294)
age on entry		-0.0268*	-0.0193	-0.0226
		(0.0121)	(0.0154)	(0.0176)
ln (UCAS tariff)		0.0365	0.0444	0.0400
		(0.0897)	(0.0879)	(0.0894)
missing UCAS tariff		0.194**	0.134**	0.146**
		(0.0628)	(0.0425)	(0.0424)
mother university			0.0679*	0.0731*
			(0.0332)	(0.0333)
father university			-0.0010	0.0049
			(0.0329)	(0.0337)
ln (family income)			0.0838	0.0767
			(0.0643)	(0.0636)
missing family income			-0.0342	-0.0284
			(0.0538)	(0.0527)
ln (GDP per capita)				0.0541
				(0.0475)
year dummies	x	x	x	x
Constant	1.094***	1.277*	0.664	0.269
	(0.0675)	(0.576)	(0.699)	(0.553)
Observations	690	690	666	665
Adjusted R-squared	0.063	0.075	0.084	0.086

Note: Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013. Expected return is measured as the log difference between expected wage at 30 with and without a university degree. All income variables are deflated to 2013 prices. GDP per capita is in 2013 US dollars. Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

As described in section 3.4 Data, UCAS tariff information is not missing at random. The coefficients on the *missing tariff* variable show that for those students, their expected return to a UK university degree is nearly 15 percentage points higher than the rest of the first-year student population in the preferred specification. Similar to Brunello et al. (2004), we find that the students whose mothers went to university, have a higher expected return to university education, by about 7.2 percentage points. The

effect of fathers' education on students' income expectations are statistically insignificant in all of the regressions.

Comparing our results in table 3.5 to previous findings, a reduction in home and EU students' expected returns to higher education brings it closer to the realised wage premium for graduates who studied Law, Economics, and Management subjects, which are 33% for men and 42% for women (Walker and Zhu, 2011). This does appear to suggest that the increased tuition fees have made home and EU students more aware of graduate labour market performances and hence become relatively more realistic in their expectations of future incomes.

3.7 Robustness checks

From table 3.1 (Descriptive statistics), it is evident that there are some noticeable differences in characteristics between the treatment (home and EU students) and control (overseas students) groups, before and after the change in tuition fees. Overseas students are on average older than home (and EU) students. There are more female students in the overseas student sample. Home and EU students have higher UCAS tariffs on average, but lower family incomes. Furthermore, GDP per capita are higher for home and EU students. Hence, to check the robustness of our results against potential selection bias, we match overseas students to home students using propensity score, and assess the average treatment effect.

Similar to earlier regression results, the average treatment effect of change in tuition fees on home students' expected starting salary and over-confidence in expected earnings reveal no significant difference. However, the reduction in expected wage growth disappears, while the reduction in expected returns to university remains. Table 3.7 details the quality of matching for the key control variables, and the results suggest that after matching, there is no statistically significant difference in the key control variables age, (log) UCAS tariffs, (log) family income, and (log) GDP per capita between the treatment and control groups.

Table 3.6: Expected future earnings (propensity score matching, 2007 – 2013)

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
ln (Expected starting salary)	Unmatched	3.31	3.24	0.07	0.03	2.09
	ATT	3.31	3.31	0.00	0.21	-0.01
Expected wage growth	Unmatched	0.71	0.83	-0.12	0.05	-2.57
	ATT	0.71	0.70	0.01	0.23	0.04
Overconfidence in expected earnings	Unmatched	0.14	0.00	0.15	0.05	2.93
	ATT	0.14	-0.15	0.29	0.24	1.21
Expected return to university	Unmatched	0.70	1.01	-0.30	0.05	-5.96
	ATT	0.70	1.30	-0.59	0.28	-2.12

Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013.

Table 3.7: Quality of the propensity score matching – list of controls

	Mean			t-test		
Variable	Treated	Control	%bias	t	p>|t|	V(T)/V(C)
male	0.6099	0.49505	23.3	3.69	0	0.95
age on entry	18.614	18.58	2.5	0.49	0.627	1.16
ln (UCAS tariff)	5.8786	5.8794	-0.3	-0.05	0.964	1.63*
missing UCAS tariff	0.1604	0.20198	-9.5	-1.72	0.086	0.84*
mother university	0.40594	0.68713	-58.2	-9.35	0	1.12
father university	0.45545	0.71287	-55.3	-8.59	0	1.21*
ln (family income - £000s, 2013 prices)	4.1304	4.0871	5.3	0.97	0.33	1.03
missing family income	0.34455	0.11485	47.7	9.01	0	2.22*
ln (GDP per capita)	10.503	10.521	-2.3	-0.69	0.491	0.85

Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013.

The government responded to recommendation made by the Browne Review by announcing the new £9,000 tuition fee cap in late 2010 (for it to be implemented in 2012)[42], and the British University used in our analysis decided that it will charge the full £9,000 to the 2012 cohort in April 2011. Hence, even though the 2011 cohort of first year students in our sample wouldn't be paying the increased fees, we can't rule out the possibility that they also collected more information of their future labour market. In this section we test the robustness of our results by controlling for any possible announcement effect.

Table 3.8 includes interaction terms of year dummies with the increase in tuition fees in 2012 and the home-fee paying status, and the results show how home students' expected earnings have changed each year during the period of 2007 – 2013. For the expected return to university, the effect of increase in fees (sizable downward

[42] http://www.bbc.co.uk/news/education-11677862

adjustment) is only evident after 2012, but the announcement of higher fees in late 2010 is associated with a downward adjustment in students' expected starting salary, as well as over-confidence in expected earnings.

Table 3.8: Change in students' expected earnings by year (2007 – 2013).

VARIABLES	(1) ln (Expected starting salary)	(2) Expected wage growth	(3) Over-confidence in expected earnings	(4) Expected return to university
feeincr x home	-0.0100	-0.142***	-0.232***	0.0218
	(0.0205)	(0.0181)	(0.0411)	(0.0151)
2012 x fee incr x home		0.236***	0.428***	
		(0.0201)	(0.0280)	
2013 x fee incr x home	-0.296***			-0.212***
	(0.0278)			(0.0236)
home fee status	0.241***	-0.295***	0.180**	-0.435***
	(0.0423)	(0.0510)	(0.0648)	(0.0741)
2008 x home	0.0311*	0.472***	0.0114	0.322***
	(0.0140)	(0.0221)	(0.0273)	(0.0409)
2009 x home	-0.0414**	0.198***	0.105**	-0.0762***
	(0.0134)	(0.0177)	(0.0352)	(0.0140)
2010 x home	-0.221***	0.300***	-0.0854**	0.346***
	(0.0201)	(0.0149)	(0.0329)	(0.0278)
2011 x home	-0.164***	0.414***	-0.177**	0.479***
	(0.0274)	(0.0365)	(0.0692)	(0.0528)
ln (family income)	0.0505	0.122**	0.0779	0.0893
	(0.0273)	(0.0376)	(0.0465)	(0.0628)
male	0.175***	0.0429	0.178***	0.0118
	(0.0188)	(0.0262)	(0.0130)	(0.0290)
fee increase	-0.102***	-0.168***	-0.289***	0.114**
	(0.0148)	(0.0139)	(0.0152)	(0.0321)
age on entry	0.00542	-0.0325	0.00770	-0.0202
	(0.00745)	(0.0190)	(0.00833)	(0.0179)
ln (UCAS tariff)	-0.00682	0.0104	0.0698	0.0368
	(0.0223)	(0.0614)	(0.0728)	(0.0909)
missing UCAS tariff	0.0698	-0.00706	-0.0489	0.154***
	(0.0395)	(0.0512)	(0.0663)	(0.0381)
mother university	0.0303	0.0616	0.0241	0.0800**
	(0.0374)	(0.0370)	(0.0459)	(0.0297)
father university	0.0181	-0.0137	-0.0460	0.00373
	(0.0291)	(0.0445)	(0.0635)	(0.0342)
missing family income	0.0165	-0.0917***	-0.00687	-0.0282
	(0.0509)	(0.0167)	(0.0554)	(0.0496)
ln (GDP per capita)	-0.0138	0.0148	-0.00591	0.0562
	(0.0212)	(0.0346)	(0.0394)	(0.0470)
2008	-0.0289**	-0.445***	-0.0574***	-0.362***
	(0.00996)	(0.00780)	(0.00929)	(0.0195)
2009	0.0473***	-0.252***	-0.218***	-0.000133
	(0.00709)	(0.0198)	(0.0272)	(0.0200)
2010	0.103***	-0.494***	-0.0627**	-0.439***
	(0.0106)	(0.0160)	(0.0216)	(0.0198)
2011	0.0563**	-0.469***	0.0304	-0.567***

	(0.0207)	(0.0321)	(0.0508)	(0.0338)
2012				-0.137***
				(0.0210)
2013	0.233***	0.198***	0.367***	
	(0.0219)	(0.0148)	(0.0149)	
Constant	2.874***	0.947	-0.838	0.337
	(0.366)	(0.532)	(0.815)	(0.471)
Observations	887	702	680	665
Adjusted R-squared	0.063	0.066	0.039	0.098

Note: Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013. All income variables are deflated to 2013 prices. See notes in tables 3.2 - 3.5 for calculations of each dependent variable. GDP per capita is in 2013 US dollars. Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To assess the heterogeneity in the effect of fees changes between gender, we interact the increase in fees in 2012 with home-fee paying status, and the gender of students. The results from table 3.9 suggest that, overall home and EU students have revised down their expected wage growth and expected returns to university, but male home and EU students also revised down their expected starting salary and their penchant for being over-confident in expected earnings.

Table 3.9: Heterogeneity in students' expected earnings (gender). (2007 - 2013)

	(1)	(2)	(3)	(4)
VARIABLES	ln (Expected starting salary)	Expected wage growth	Over-confidence in expected earnings	Expected return to university
fee incr x home	0.0425	-0.281**	0.124	-0.378**
	(0.121)	(0.0945)	(0.135)	(0.132)
male	0.215***	0.0424	0.213***	-0.0155
	(0.0375)	(0.0352)	(0.0202)	(0.0357)
fee incr x home x male	-0.148***	-0.0141	-0.134**	0.0906
	(0.0349)	(0.0429)	(0.0533)	(0.0708)
fee increase	-0.0633	0.127	-0.153	0.212
	(0.0831)	(0.0890)	(0.132)	(0.109)
home fee status	0.127*	-0.0188	0.129**	-0.201
	(0.0583)	(0.0840)	(0.0424)	(0.141)
age on entry	0.00391	-0.0336	0.0103	-0.0218
	(0.00648)	(0.0183)	(0.00770)	(0.0179)
ln (UCAS tariff)	0.00268	0.0184	0.0929	0.0411
	(0.0294)	(0.0617)	(0.0772)	(0.0878)
missing UCAS tariff	0.0665	-0.0109	-0.0454	0.145**
	(0.0420)	(0.0505)	(0.0628)	(0.0422)
mother university	0.0319	0.0593	0.0348	0.0734*
	(0.0357)	(0.0367)	(0.0457)	(0.0336)
father university	0.0176	-0.0157	-0.0617	0.00494
	(0.0270)	(0.0418)	(0.0617)	(0.0338)
ln (family income)	0.0458	0.114**	0.0771	0.0763

	(0.0289)	(0.0336)	(0.0452)	(0.0631)
missing family income	0.0209	-0.0969***	-0.00588	-0.0258
	(0.0508)	(0.0161)	(0.0558)	(0.0555)
ln (GDP per capita)	-0.00330	0.0105	-0.00134	0.0545
	(0.0212)	(0.0369)	(0.0382)	(0.0483)
year dummies	x	x	x	x
Constant	2.814***	0.794	-1.047	0.255
	(0.424)	(0.505)	(0.795)	(0.551)
Observations	887	702	680	665
Adjusted R-squared	0.058	0.056	0.038	0.086

Note: Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013. All income variables are deflated to 2013 prices. See notes in tables 3.2 - 3.5 for calculations of each dependent variable. GDP per capita is in 2013 US dollars. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Students' socio-economic status is not recorded in the survey or the administrative data. Hence, we use their family income as a proxy to test for heterogeneity in the effect of fee changes between students of different family backgrounds. In table 3.10, the increase in tuition fees in 2012 and the home fee paying status are interacted with quintiles of family income. This barely changes earlier estimates, while the coefficients on the interaction terms suggest that changes in home students' expected earnings do not seem to vary by family income.

Table 3.10: Heterogeneity in students' expected earnings (family income levels). (2007 - 2013)

	(1)	(2)	(3)	(4)
VARIABLES	ln (Expected starting salary)	Expected wage growth	Over-confidence in expected earnings	Expected return to university
fee incr x home	-0.0184	-0.261*	0.0501	-0.378***
	(0.143)	(0.117)	(0.121)	(0.0995)
fam income quintiles	0.0293*	0.0487*	0.0364	0.0248
	(0.0128)	(0.0220)	(0.0248)	(0.0141)
fee incr x home x family income quintiles	-0.0113	-0.00653	-0.00461	0.0222
	(0.0129)	(0.0205)	(0.0432)	(0.0176)
male	0.183***	0.0361	0.181***	0.00355
	(0.0174)	(0.0260)	(0.0113)	(0.0298)
home fee status	0.0936	-0.111	0.0734	-0.266*
	(0.0531)	(0.0804)	(0.0535)	(0.110)
age on entry	0.00356	-0.0372*	0.00901	-0.0257
	(0.00631)	(0.0174)	(0.00719)	(0.0167)
ln (UCAS tariff)	0.00277	0.0217	0.0945	0.0408
	(0.0282)	(0.0611)	(0.0817)	(0.0884)
missing UCAS tariff	0.0636	-0.0115	-0.0460	0.147**
	(0.0422)	(0.0487)	(0.0601)	(0.0448)
mother university	0.0326	0.0584	0.0332	0.0730*
	(0.0340)	(0.0371)	(0.0457)	(0.0316)
father university	0.0178	-0.00841	-0.0559	0.00670

	(0.0277)	(0.0409)	(0.0580)	(0.0320)
missing family incomes	0.0260	-0.0727**	0.0109	-0.00921
	(0.0504)	(0.0232)	(0.0569)	(0.0594)
ln (GDP per capita)	-0.00301	0.0175	0.00216	0.0599
	(0.0226)	(0.0359)	(0.0379)	(0.0477)
year dummies	x	x	x	x
Constant	2.978***	1.191**	-0.783	0.565
	(0.416)	(0.447)	(0.765)	(0.470)
Observations	887	702	680	665
Adjusted R-squared	0.053	0.047	0.032	0.081

Note: Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013. All income variables are deflated to 2013 prices. See notes in tables 3.2 - 3.5 for calculations of each dependent variable. GDP per capita is in 2013 US dollars. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.11 shows regressions results of students' expected earnings after the 2008 financial crises, in the period of 2010 – 2013. We choose the period as 2010 is the first year UK GDP picked up following the crisis (based on current US dollars)[43]. The reduction in expected wage growth and expected return to university found in earlier regressions still persist, but magnitude of estimates increased and the results now suggest that the increase in tuition fees in 2012 reduced expected wage growth and expected return to university by 36 and 52 percentage points respectively.

Table 3.11: Students' expected earnings post 2009. (Post financial crisis)

	(1)	(2)	(3)	(4)
VARIABLES	ln (Expected starting salary)	Expected wage growth	Over-confidence in expected earnings	Expected return to university
fee incr x home	0.0550	-0.364*	0.110	-0.521**
	(0.117)	(0.114)	(0.175)	(0.112)
fee increase	-0.0568	0.339**	-0.0757	0.604***
	(0.0807)	(0.0828)	(0.133)	(0.0892)
home fee status	0.00999	0.0217	0.145**	-0.0337
	(0.0550)	(0.104)	(0.0391)	(0.112)
male	0.190***	0.0301	0.180***	0.0147
	(0.0204)	(0.0292)	(0.0236)	(0.0383)
age on entry	0.00641	-0.0495**	0.0158*	-0.0253
	(0.00574)	(0.0133)	(0.00564)	(0.0224)
ln (UCAS tariff)	0.0120	-0.00713	0.0811	-0.0580
	(0.0381)	(0.0845)	(0.104)	(0.109)
missing UCAS tariff	0.0894	0.0170	-0.0508	0.171*
	(0.0431)	(0.0734)	(0.109)	(0.0613)
mother university	0.0218	0.0768*	0.0444	0.0526**
	(0.0475)	(0.0298)	(0.0406)	(0.0164)
father university	0.00554	-0.0446	-0.0663	-0.0317
	(0.0452)	(0.0415)	(0.0550)	(0.0370)

[43] http://data.worldbank.org/indicator/NY.GDP.MKTP.CD

ln (family income)	0.0384	0.138**	0.0957*	0.148***
	(0.0314)	(0.0417)	(0.0302)	(0.0247)
missing family income	0.0878	-0.0969**	-0.0129	0.0104
	(0.0676)	(0.0254)	(0.0614)	(0.0849)
ln (GDP per capita)	0.0103	0.0460	-0.0649**	0.0896
	(0.0391)	(0.0267)	(0.0151)	(0.0577)
year dummies	x	x	x	x
Constant	2.631**	0.600	-0.605	-0.0981
	(0.653)	(0.604)	(0.700)	(0.876)
Observations	561	448	436	429
Adjusted R-squared	0.052	0.095	0.026	0.146

Note: Source: Survey and administrative data of first year Economics students at a British University, 2007 – 2013. All income variables are deflated to 2013 prices. See notes in tables 3.2 - 3.5 for calculations for each dependent variable. GDP per capita is in 2013 US dollars. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

3.8 Conclusion

Using surveys of first-year economics students at a British University, we contribute to the existing literature by showing how income expectations change following an increase in the cost of higher education. We find that while the sharp increase in tuition fees in 2012 had no impact on students' expected starting salary, it lowers student's expected wage growth and expected return to higher education by about 30 percentage points. Despite that the increase in tuition fees is associated with a fall in students' expected returns to higher education, our results show that they still expect positive and significant financial returns from investing in a university degree. This is consistent with the human capital theory. We should note that even if the estimates take into account all expected changes in the cost of higher education, the results still reflect a sizable change in students' expected earnings.

Great caution is required when applying our results to the rest of the UK undergraduate student population. After all, average (reported) family income for first-year economics students (Home and EU) in our sample is around £80,000, which falls within the top decile of UK household incomes[44], and suggest that credit constraints may be less of a problem to this particular sample and also they should have easier access to (graduate) labour market information (Betts, 2006). In addition, all students in our sample are full time students, and over 96% are under the age of 21. Over 40% of

[44] For a family of two adults and two teenage children (and falls under UK council tax band D: £1,500), http://www.ifs.org.uk/wheredoyoufitin/

students stated their ethnicity as "white", and over another 40% of students stated their ethnicity as "Chinese", "Indian" or "other". Overseas students (non-home fee paying) take up a third of our overall sample, and such proportion of international students are one of the highest among UK universities[45]. Hence although (home and EU) students in our sample may appear to be more "realistic" in their income expectations following the sharp increase in tuition fees, we make no implications that this will be the case for the rest of first-year home and EU students at this particular university, or indeed the rest of first-year home and EU students at other English universities.

Although we cannot observe those who chose not to apply to university in 2012, McGuigan et al. (2012) find that media reporting of the increased tuition fees has significantly increased the number of secondary school students who considers going to university as 'too expensive'. Hence, it is possible that like the first year home and EU students in our sample, these prospective students revised down their expected returns to university, but to the extent that investing in higher education no longer seems worthwhile. However, this is inconsistent with Walker and Zhu (2011) which find that the sharp increase in fees should only lower the returns by a very small amount, and Chowdry et al. (2012) which find that the 2012 fee reform is more progressive in nature. Hence, the reduction in expected returns for those who didn't apply to university could be based on inaccurate or incomplete information. If this is the case, we believe that the fall in applications in 2012[46] calls for government intervention[47] in terms of providing prospective students with easier access to information on the true cost of higher education and graduate labour market outcomes, given that Jensen (2010) and McGuigan et. al. (2012) find that a simple information campaign can significantly improves people's perception of returns to schooling.

[45] http://www.thecompleteuniversityguide.co.uk/international/international-students-the-facts/by-university/

[46] The drop in applications roughly translates to a drop of 50,000 applicants compared to previous years, http://www.bbc.co.uk/news/education-18768857

[47] Since investment in higher education is shown to have positive social returns as well (Greenaway and Haynes, 2003).

4. Price sensitivity of non-EU students to British Higher Education

4.1 Introduction

Despite institutions charging the full cost of their higher education[48], the number of international students (non-EU) at British universities has more than tripled over the past twenty years (Universities UK, 2011). With the sharp increase in student numbers, comes significant financial contribution to the British economy. Such export of UK higher education is valued at around £10 billion in 2011/12 (HEFCE, 2014). Given the shrinking public funding that UK universities receive (Universities UK, 2013), and the potential economic growth that well trained university graduates (home or overseas domiciled) can generate (Chellaraj et al., 2008; Barro, 2011; Bergerhoff et al., 2013), it is important both for the higher education institutions and the UK economy to sustain a high demand for university education from overseas students. With a tuition fee of £9,000 for home and EU students, and an average tuition fee of £12,000 for overseas students, the UK has one of the highest level of tuition fees in Europe[49]. We analyse how overseas students' enrolment decisions can be affected by the level of tuition fees UK institutions charge.

There are a number of studies on international migration and the subsequent "brain gain/drain" effect (Bartel, 1989; Gould et al., 2009; Agrawal et. al., 2011; Gibson and McKenzie, 2012; Kerr and Kerr, 2013), but few analyse factors that influences students' choice of university/degree programme after they have decided to pursue higher education in a different country. This is particularly the case for the UK, despite the significant expansion of the overseas student population in the country, and the substantial contribution they make to the UK economy. Rosenzweig (2006) find that foreign students coming to study in the US are driven by prospects of higher returns to skills in the US, rather than a lack of education resources/facilities in the home country. Beine et. al. (2012) use data from 13 OECD countries and find that network, housing prices and reported quality of university can influence overseas students' choice of destination countries, but they do not find any effect of university registration fees. Students' decision to study in the UK could be driven by many factors, including the quality of UK higher education[50], the close proximity to other European countries, the

[48] Average of £11,000 for a classroom based degree.
[49] http://www.studyineurope.eu/tuition-fees
[50] http://www.theguardian.com/higher-education-network/blog/2012/may/11/universitas-21-rankings

returns from learning English as a second language, and being able to enjoy the wage premium that the UK labour market offers relative to their home countries. Unlike previous studies on the determinants of student migration, we contribute to the existing literature by analysing how price (tuition fees) sensitive non-EU students are once they have decided to study in the UK. We recognise that the UK is not the sole player in the international higher education market, and the US, Canada, Australia are other major destinations for students who wish to purse higher education abroad. Hence, prospective students could be comparing universities and the level of tuition fees between countries when they make their decision on where to study. For the purpose of this analysis, we should note that we take overseas students' decision to study in the UK implicitly as given.

Tuition fees in the United Kingdom are not uniform across its four constituent countries, England, Wales, Scotland and Northern Ireland. However, under European rules, European-domiciled students studying anywhere in the UK are treated by British universities the same way as locally domiciled students and therefore paying subsidised fees. Hence for the purpose of our study, we define non-EU/overseas/international students as those from outside the Europe and are subject to the higher tuition fees.

Prior to 1998, the UK government used to fully subsidize the costs of higher education for home and European domiciled students. A series of higher education reforms introduced by the government in late 80s and the early 90s tripled the higher education participation rate but also brought considerable strains to public financing for higher education, and the funding per full time students nearly halved during this period (Dearden et al., 2011). Hence, for home and EU students registered at institutions in England (and Northern Ireland prior to 2012), means-tested up-front tuition fees of £1,000 was introduced to students entering universities from 1998 onwards. The up-front fee was abolished in 2006, and replaced with a deferred fee of maximum £3,000 in 2006, and this cap was lifted to £9,000 in 2012. A student loans system was introduced in 1990 to help home and EU students pay for their maintenance costs and tuition fees. Prior to 2012, students could borrow at zero real interest rates, and repayments don't start until they earn above a certain threshold[51].

[51] From 2006 to 2012, £10,000 from 1998 to 2005, more than 85% of average earnings from 1990 to 1997(Wyness, 2010).

The other part of the costs of providing higher education is paid by the Higher Education funding councils which provide teaching grants to institutions based on the number of home and EU students taught. To contain costs, institutions were limited until 2012 to a set number of home and EU students.

On the other hand, overseas students do not receive financial support from the government and institutions are free to set their tuition fees. Hence the recruitment of overseas students are not restricted, and with the immense funding pressure faced by the whole higher education sector, overtime UK institutions increased their effort to attract overseas students in order to sustain their income streams.

We use data on UK first-year undergraduate student population to assess the price sensitivity of prospective students when they make their enrolment decisions, after controlling for institutional quality. We build a panel of first-year undergraduate students by institution, and country of domiciles (England, Wales, Scotland, Northern Ireland, European (EEA) countries, and non-EU countries). Overall, we find that overseas students do not appear to react negatively to higher tuition fees, and better ranked institutions and institutions with more home/UK students tend to attract more students from outside the Europe.

The rest of the chapter is organised as follows. Section 4.2 reviews previous literature. Section 4.3 describes the background of our analysis. Section 4.4 describes the data. Section 4.5 introduces the model. Section 4.6 describes the results. Section 4.7 tests the robustness of our findings, and section 4.8 concludes.

4.2 Literature Review

It has often been argued that migration of skilled labour can greatly benefit the economy of receiving countries, but at the same time, the flow of knowledge and resources to the home countries of the emigrants can also benefit sending countries' domestic economic growth (Agrawal et. al., 2011). Similar findings can be found in Batista et al. (2012), Beine et al. (2010), Beine et al. (2008), Chad and Clemens (2008). Barro (2011) used data for around 100 countries and find that higher years of schooling for adult males is positively associated with stronger economic growth[52]. Chellaraj et al. (2008) find that foreign students contribute greatly to research and development in the

[52] Measured by real GDP per capita.

US, as a 10% increase in the number of foreign graduate students is associated with a 4.5% increase in patent applications, and it is also associated with increased patent grants. An even bigger effect is found by Hunt and Gauthier-Loiselle (2008), which shows that a one percentage point increase in foreign graduate students increases patents per capita by about 15%. Based on a two-country model, Bergerhoff et al. (2013) find that international migration of students is associated with higher (steady-state) economic growth in the receiving countries.

Rosenzweig (2006) proposes two factors that drives the international migration of students, a lack of educational resources/facilities and a low return to skills in the sending country. He finds that the US wage premium (over other countries) encourages foreign students to migrate. Clemens (2013) finds that location alone can explain a significant part of return to skills. De Vreyer et al. (2010) find that experience abroad results in a substantial wage premium for migrants returning from an OECD country, not from other countries.

Students migrating to the UK to study could also be driven by the returns to learning English as second language. A number of studies find that (foreign/second) language skills is positively linked to earnings. Angrist and Lavy (1997) analysed the effect of change in language of instruction at Moroccan schools and find that the change from French to Arabic to deliver school curriculum has lowered the returns to schooling for those who are affected. Using Israeli and US data, Berman et al. (2003) and Bleakley and Chin (2004) find that language proficiency complements earnings of immigrant workers. As for the return to language skills to workers in developing countries, Azam et al. (2010) use Indian data and find that being fluent in English (compared to not speaking any English at all) increases hourly wages of men by 34%.

Based on data of 18 European countries, Van Bouwel and Veugelers (2009) find that the quality of higher education is positively linked to the number of students migrating from one country to the other. Similar findings can also be found in Gordon and Jallade (1996). Quality of education can also influence students' decision to migrate within a country. Baryla and Dotterweich (2011) analyse student migration in the US and find that colleges that provide a recognised quality degree programme attracts more non local students. Using panel data on the flow of international students to North America and a number of developed European countries, Kahanec and Kralikova (2011)

find that indeed, the quality of higher education in the receiving country is an important factor in determining the inflow of foreign students, but no significant correlation is found between tuition fees and size of overseas student population. They contribute the latter finding to reverse causality in the sense that popular universities can afford to charge a higher price. Similarly, Beine et. al. (2012) use data of 13 OECD countries to analyse factors that influence international students' choice of destination countries, and find significant network effect in the migration of students, other factors include housing prices and reported quality of university, but not registration fees. Their initial findings even suggested a positive relationship between tuition fees and the size of the flow of international students. They propose two explanations for this apparent positive results. First, tuition fees may act as a signal of quality. Secondly, popular destinations, and universities with high reputation can charge higher fees without losing their applicant pool. In the UK, Soo and Elliot (2010) used overseas subject-level application data to UK universities from the period of 2002 to 2007, and find that fees may impact overseas students' application decisions, and this effect is non-linear.

Previous analysis on the impact of fees on domestic enrolment, Kane (1995) used US data for the period of 1977 to 1993 to evaluate price sensitivity of students to tuition fees at US public higher education institutions. He find that states with higher level of tuition fees experience lower enrolment rates, with the effect vary between 3.5 percentage point for public 2-year institutioins, to 1.4 percentage points for 4-year institutions, for each $1,000 increase in fees. Using US data of American public universities (4-year institutions) from the period of 1991 to 2007, Hemelt and Marcotte (2008) find that a $1000 increase in fees is associated with a reduction in college enrolment by about 2.5 percent. For the effect of tuition fees on higher education participation in the UK over the same period, Dearden et al. (2011) constructed pseudo-panels by aggregating individual level data (over UK-domiciled students) and find that, higher tuition fees are negatively linked to university participation rate, with the effect measured at 3.9 percentage points decrease in university participation for every £1,000 increase in tuition fees. Seven German states briefly introduced university tuition fees in 2012, and Dwenger et al. (2012) find that the probability of students applying to university fall by 2 percentage points if they live in a state with tuition fees. Similar findings using German data can also be found in Hubner (2012).

4.3 Institutional set-up

The UK higher education system for home and EU students was entirely state funded prior to 1998. The government introduced a series of reforms in late 80s and the early 90s to boost the higher education participation rate in the UK, namely the 1989 White Paper which introduced a student loans system for it to be implemented in 1990, and the 1992 Further Education and Higher Education Act which changed the status of former polytechnics to universities and introduced funding councils for universities in England. The participation rate subsequently went up from 15% in 1989 to 42% in 2005 (Wyness, 2010). This brought considerable strains to public financing for higher education, and the funding per full time students declined from £9,000 in 1989 to £4,850 (Dearden et al., 2011). Hence, a student loans system was implemented in 1990, initially its purpose was to cover part of the cost of student maintenance, and from 2006 onwards, it is extended tuition fees as well. Furthermore, the 1998 Higher Education Act introduced means-tested up-front tuition fees of £1,000 to students entering universities from 1998 onwards.

Six years later the 2004 Higher Education Act abolished up-front tuition fees and introduced a deferred fee of £3,000[53] to be implemented in 2006 for students domiciled in England and Northern Ireland. Responding to recommendations made by the Browne Review of higher education funding in 2010, the Government announced that the maximum tuition fees UK universities can charge will be raised to £9,000 for English domiciled students and EU students who wish to enter universities in England from 2012 onwards. The interest rates on student loans was indexed to the rate of inflation prior to 2012, and students did not have to make repayments until they earned above £15,000[54]. This was changed in the 2012 tuition fee reforms, and a variable real interest rate of up to 3% was introduced to student loans, but the repayment threshold was lifted to £21,000.

Like institutions in the rest of the UK, Scottish universities initially adopted the £1,000 tuition fees in 1998, but this up-front tuition fees was abolished by the Scottish

[53] "Deferred" in the sense that students can borrow at effectively zero interest rates to pay for their tuition fees, and repay their loans after they have graduated and earn above a set threshold.
[54] From 2006 to 2012, £10,000 from 1998 to 2005, more than 85% of average earnings from 1990 to 1997(Wyness, 2010).

Government in 2001, and replaced with the graduate endowment scheme[55]. This was abolished in 2007[56], and for subsequent cohorts of Scottish students studying at Scottish institutions, they would have their tuition fees paid by the Scottish government[57]. Since our data started from 2002/03, this effectively means that the 2002 cohort of Scottish domiciled students and European students studying at Scottish universities, are the only ones that actually paid the Graduate endowment scheme in our period of analysis[58]. In addition, several types of students were exempt from paying the Graduate Endowment, including mature students, part-time students, those studying Midwifery or nursing courses[59].

The 2004 Higher Education Act raised tuition fees from 2006 onwards from £1,200 to £3,000 for students in England and Northern Ireland, but the fee increase was delayed among Welsh universities to 2007 and a grant was introduced for Welsh students (and European students studying in Wales) to cover the amount of the fee increase (Wyness, 2010). For the 2012 tuition fee reform, the Welsh government increased the grant to Welsh students to £5,425, whilst the rest of the £9,000 can be covered by tuition fee loans, and this applies not just to Welsh students who studies in Wales, but Welsh students studying anywhere in the UK. Tuition fees in Northern Ireland changed very much in line with tuition fees in England, except in 2012 when it decided to freeze the tuition fees for students who are domiciled and enrolled at higher education institutions within Northern Ireland[60]. Students from continental Europe who are studying at each of the four constituent countries of the United Kingdom are able to enjoy the same benefits as locally domiciled students, but in general UK students who are domiciled in one of the constituent countries and wish to study in another do not enjoy the same financial support towards tuition fees as a locally domiciled students.

[55] A payment of £2,000 (cash term, fixed) payable in April following graduation. http://www.scottish.parliament.uk/S1_Bills/Education%20(Graduate%20Endowment%20and%20Student%20Support)%20(Scotland)%20Bill/b22s1pm.pdf

[56] For all that graduate after April 2007.

[57] The tuition fees for Scottish students studying at Scottish universities currently stands at £1,820. http://www.saas.gov.uk/full_time/ug/young/funding_available.htm.

[58] We find that including Graduate Endowment in the fees barely changes our estimate and hence this is subsequently omitted in our analysis.

[59] For a full list of student groups that are exempt from paying Graduate endowment, see http://www.scotland.gov.uk/Publications/2002/04/14605/3634

[60] http://www.bbc.co.uk/news/uk-northern-ireland-14843377

Higher Education funding councils provide teaching grants to institutions based on the number of home and EU students there are in each institution. Hence, prior to 2012, institutions were limited to the number of home and EU students they could recruit, or they would be penalised in terms of the teaching grant they received in the following year. The Higher Education Funding Council in England have relaxed the student number control from 2012 onwards, so that institutions are free to recruit as many home/EU student as they like, provided that the student has achieved the UK A-level equivalent of AAB and above[61].

On the other hand, the UK government stopped funding for overseas students and subject them to the full tuition fees since 1980 (Harris, 1995). Hence the recruitment of overseas students are not restricted, and with the immense funding pressure faced by the whole higher education sector, overtime more effort were put in by UK institutions to strengthen their presence in the international higher education market and attract more overseas students in order to boost their income.

A number of regulations concerning student visas have also changed during this period, and overall the UK immigration rules governing overseas students have been toughened rather than relaxed over time. Prior to 2003, overseas students could renew their student visa free of charge in the UK. However, a visa extension charge of £155[62] was introduced in 2003 (for a postal application), and this figure stood at £357 in 2009 and it costs £422 in 2014. The student visa application fee is around £100 in 2007[63], and it increased to £145 in 2009 and it costs £310 in 2014 (UKCISA, 2014)[64]. The UK government introduced a Points-Based Immigration System in 2008[65], and at the same time, overseas students who graduate from UK institutions with a degree or higher, were allowed to stay in the UK for up to 2 years to look for work/work experience without having to apply for a work permit[66]. This post study work scheme was abolished

[61] This was lowered to ABB for the 2013/14 prospective student cohort. This policy change inevitably means more competition between institutions to attract students.
[62] http://www.theguardian.com/education/2004/nov/29/internationalstudents.students
[63] http://news.bbc.co.uk/1/hi/education/6428399.stm
[64] Throughout this period, the UK government has also gradually increased language requirement for a student visa, as well as the amount of (maintenance) funds the applicant need to have in their bank accounts
[65] http://news.bbc.co.uk/1/hi/uk_politics/4244707.stm;
http://www.birmingham.ac.uk/Documents/staff/pbcoverview.pdf
[66]http://webarchive.nationalarchives.gov.uk/20081230092243/http:/www.ukba.homeoffice.gov.uk/sitecontent/applicationforms/pbs/tier1poststudyworkguidance.pdf

in April 2012[67], and replaced with a Graduate Entrepreneur visa, for overseas graduates who have plans to set up businesses in the UK. However, for overseas students to apply for the Graduate Entrepreneur visa, they need to be endorsed by their university, and universities are limited to how many graduates they can endorse per year[68].

4.4 Data

The data originates from three sources over the 11-year period of 2002/03 to 2012/13. First, we have the aggregate first-year undergraduate student population data by institution, fee status (eligible vs not eligible to pay home fees) and 208 countries of domiciles (over the world), from the UK Higher Education Statistical Agency (HESA). This dataset covers all UK higher education institutions. Next, we have the tuition fees data[69] by institutions and students' domiciles[70]. Finally, to control for institutional quality, we have the Times Good (institutional-level) University Rankings. The Times is a popular newspaper in the UK and publishes the longest running national university rankings in the country (since 1992). We use the university ranking score published in its annual university guide to reflect the quality of higher education provided by UK universities[71].

There are normally three levels of undergraduate tuition fees in the UK, namely home and EU student fees, overseas fees for classroom based courses and overseas fees for laboratory based courses. Of course in practice there can be more than three level of fees, particularly for overseas students[72]. In cases like this, the fees information are recorded as a range rather than a single figure, under one of the three aforementioned broad categories. We transform them by taking the average to make them comparable across institutions. In a few cases the fee information is missing for some institutions in

[67] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/261421/tier1poststudyworkguidance1.pdf

[68] https://www.york.ac.uk/students/support/international/after/working/

[69] Mike Reddin tuition fees data for the period of 2002-2011, and fee information for the 2012/13 academic year is obtained from the Complete University Guide.

[70] UK/EU and overseas, the latter includes two fee bands, namely classroom based and laboratory based courses.

[71] The university rankings are published in the summer of each year to help prospective students decide which university they should apply for entry in the following year.

[72] For instance, certain business, law and medical degrees. http://www.qmul.ac.uk/docs/tuitionfees/2014/119002.pdf, https://www.sheffield.ac.uk/international/enquiry/money/tuitionfees.

certain years[73], and we replace them by interpolating linearly. We use the classroom based course fees for overseas students[74], and all fees are deflated to 2013 prices.

We model students' enrolment decisions by using the HESA first-year student population data, which are recorded in December of each academic year[75]. Since the level of tuition fees vary across the four constituent countries of the UK, we assign tuition fees according to the region of the institution, the student's country of domiciles, and their fee eligibility. We note that European (EU) students are treated the same as locally domiciled students in each of the four countries in the UK.

As described above, the UK tuition fees vary by 6 domiciles overall, namely England, Wales, Scotland, Northern Ireland, students from European (EEA) countries, and those from outside the Europe. Hence, we sum the yearly number of students in each institution and collapse the data by the 6 domiciles and fee eligibility. Any observations that are listed under "England, Wales, Scotland, Northern Ireland and European countries" but are "not eligible to pay home fees" are changed to "Non EU", and any observations that are listed under "Non EU" but are "eligible to pay home fees" are changed to the region of UK where their institution is located[76].

Over the period of 2007 to 2012, some universities have changed their names or merged with other institutions to form new universities (for example, Victoria University of Manchester merged with UMIST (University of Manchester Institute of Science and Technology) in 2004 to form the University of Manchester). For the former cases, we have cleaned up the names of institutions so that they are consistent both across years and across the fees, rankings and student population datasets. For the latter, we treat institutions as separate before the merger and as a new institution afterwards.

Overall, merging the student population data, the tuition fees information and university rankings gives us 119 institutions over the 11-year period. However, we note

[73] 17 observations with missing fee information, two of which are missing undergraduate home/EU fees. Reason for missing not explicitly given.
[74] For consistency reasons, since not all university offer lab-based courses to students.
[75] We define academic year as the September of each year to the September in the following year. We cannot rule out the possibility that some students may have dropped out between September (when the academic year starts) and December (when the HESA data is recorded).
[76] For example, "Non EU" domiciled students who are "eligible to pay home fees" are changed to "Scotland" if their institution is based in Scotland, i.e. these non EU students will be paying zero tuition fees as Scottish domiciled students.

that since the 2012/13 tuition fees data is collected from the Complete University Guide[77], there are only 91 institutions in that year[78]. With the aforementioned merging of universities to form new institutions, the created panel is thus unbalanced.

4.5 Model

Our main objective is to estimate whether the number of first-year non-EU students enrolled at institution *i* in year *j*, y_{ij}, is a function of the level of tuition fees (x_{ij}). The number of students is log transformed to give a better fit of the model. The main equation depicting the relationship is

$$log\ (y_{ij}) = \beta_i + f(T_t) + \delta_i * x_{ij} + \varepsilon_{ij}$$

where β_i is the institution specific fixed effect (to control for location, reputation, and living costs at the location of the institution); $f(T_t)$ is a function of time, which include year dummies, linear trend, and institution specific trends; and ε_{ijkl} is the random error term. The main coefficient of interest to be estimated, δ_i, represents the percentage change in the number first-year non-EU students with every one thousand pound increase in tuition fees. The standard errors are robust and clustered at the institutional level to control for within-institution correlations and heteroskedasticity.

It is important to note that we implicitly assume that foreign students have decided to study in the UK, and we only assess their price sensitivity to tuition fees conditional on studying in the UK. We assess the effect of tuition fees under two settings, the aggregate number of non-EU (1 domicile) students at each institution, and the country-level (208 countries of domiciles) number of non-EU students at each institution.

From table 4.1, we can see that among all UK and European students, the English domiciled students pay the highest level of tuition fees during the period of 2002/03 to 2012/13, and the average level of tuition fees for overseas students is around £10,550 (2013 prices). Figure 4.1 shows the number of first-year undergraduate students by country of domiciles from 2002/03 to 2012/13. The number of English students,

[77] The person who collected the tuition fees information for previous years, Mike Reddin, passed away in 2011, and the Complete University Guide took over the responsibility from 2012 onwards.
[78] See Appendix 4:A1. Although the fee information for a number of universities is missing in 2012 due to that they have merged with other institutions prior, for other institutions, there is no clear reasons (based on their characteristics) as to why their fee information is not available in that year.

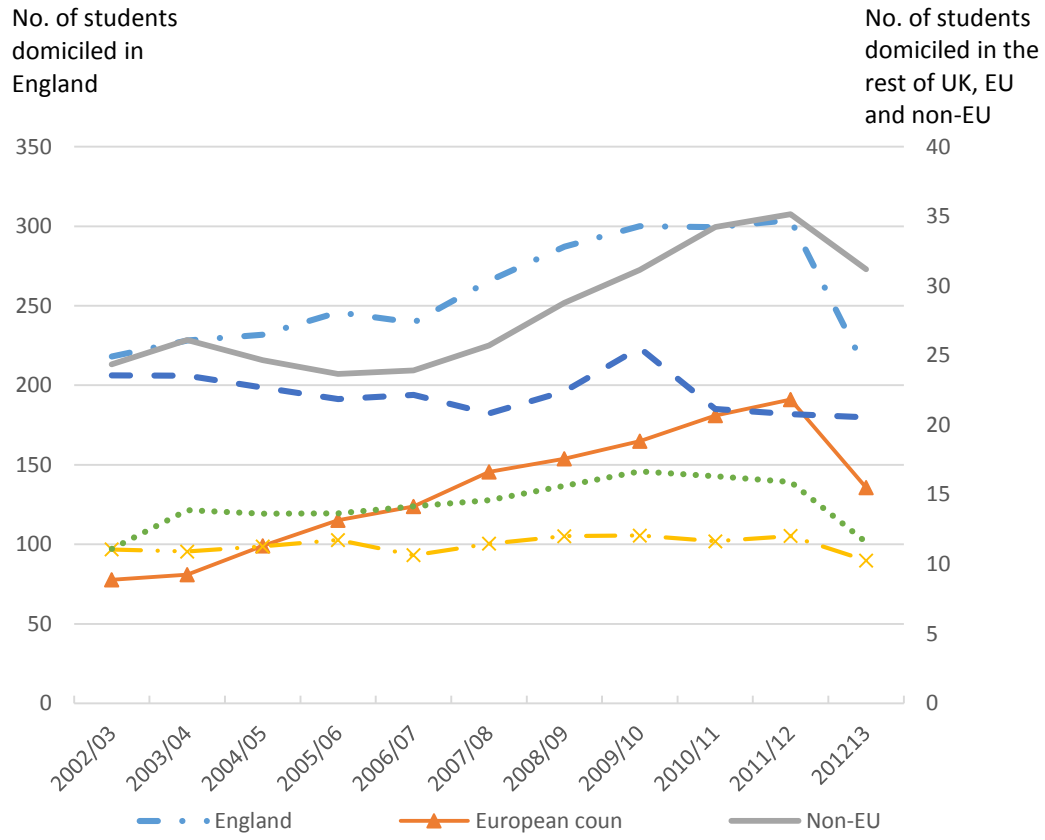
European students and non-EU students have been gradually increasing until 2012/13, whilst the number of Northern Irish students, Scottish students, and Welsh students remained relatively unchanged during this period. Figure 4.2 shows the average UK tuition fees for students domiciled in different regions. Tuition fees for overseas students have been steadily increasing during the period of concern, from £10,000 to £12,000. English students have seen the highest level of tuition fees, whist Welsh and Scottish students have experienced lower fees, since they are able to benefit from tuition fee grants and zero tuition fees if they choose to study locally. Average fees for European student and Northern Irish students changed very much in line with English students.

Table 4.1 Descriptive Statistics

Variable		Mean	Std. Dev.	Observations
number of first year students (by institution, academic year, and country of domicile)		**570.47**	**162.28**	**6720**
By students' domiciles:	England	2509.67	367.71	1128
	Wales	141.08	52.74	1110
	Scotland	219.78	52.37	1111
	Northern Ireland	111.88	39.81	1118
	European countries	148.77	64.51	1128
	Non EU countries	274.62	103.24	1125
tuition fees (2013 prices, in thousands, £)		**4.19**	**1.51**	**6720**
By students' domiciles:	England	3.11	1.77	1128
	Wales	2.72	0.95	1110
	Scotland	2.85	1.76	1111
	Northern Ireland	3.09	1.75	1118
	European countries	2.80	1.70	1128
	Non EU countries	10.55	0.84	1125
ranking score		**588.37**	**79.24**	**6720**

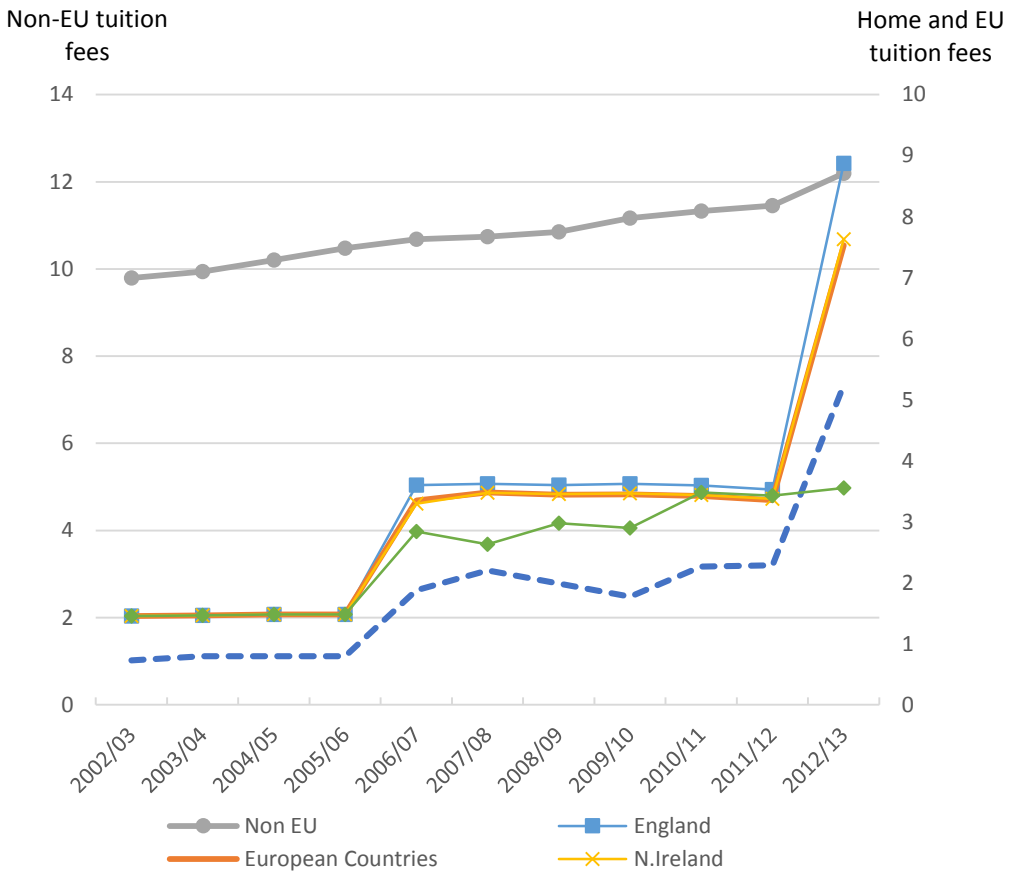
Note: Source: HESA (aggregate-level) student population data, Times institutional-level rankings and Reddin (& The Complete University Guide) tuition fees data, 2002 – 2012. We report the within institutions standard deviations. Although Scottish students pay zero fees in Scotland, they are subject to higher fees if they wish to study in other parts of the UK

Figure 4.1: Number of first-year undergraduate students by country of domiciles (in thousands)



Note: source: HESA first-year undergraduate student population data (2002/03 – 2012/13)

Figure 4.2: UK average tuition fees for students of different country of domiciles.



Note: Source: Mike Reddin (& The Complete University Guide) tuition fees data (2002/03 – 2012/13)

4.6 Results

In Table 4.2, we assess how the effect of tuition fees on the size of (aggregate) non-EU student population[79] vary under different specifications of the time effect. The effect of tuition fees are positive and statistically significant when year dummies (column 1) or linear trend (column 2) or are imposed. For each one thousand pound increase in tuition fees (2013 prices), the first-year undergraduate student population shrinks by about 6%. However, the effect of fees are not significant and work in the opposite direction when the institution specific trends are imposed (the preferred specification). The F-tests of time constraints in column 1 and column 3 show that they are all statistically significant.

[79] i.e. one country of domicile only_"non-EU"

Table 4.2 (Institution) Fixed effects estimates: Price sensitivity of non-EU students

	(1)		
VARIABLES	log (total non-EU students - by institution, academic year)		
Overseas fees (2013 prices, in thousands, £)	0.0664**	0.0593**	-0.0441
	(0.0310)	(0.0277)	(0.0289)
year dummies	x		x
trend		x	
institution specific trends			x
F-test: year dummies	5.71		4.85
(p-value)	(0.0000)		(0.0000)
F-test: institution specific trends			2591.15
(p-value)			(0.0000)
Constant	4.544***	-36.88*	5.552***
	(0.289)	(19.65)	(0.275)
Observations	1,125	1,125	1,125
Number of institutions	119	119	119
Adjusted R-squared	0.112	0.074	0.478

Note: Source: HESA (aggregate-level) student population data, Times institutional-level rankings and Reddin (& The Complete University Guide) tuition fees data, 2002 – 2012. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In table 4.3, we test the robustness of previous results when institutional qualities are controlled for. We use the Times university level ranking score as proxies for institutional quality, and we find that controlling for quality does not change the previous estimates by much. However, an increase of £1,000 in overseas tuition fees lowers overseas student population by about by 5% (column 3), but this effect is statistically significant at the 10% level. The magnitude of this estimate for non-EU students is roughly the same as the ones for domestic students found in Dearden et al. (2011) and Hemelt and Marcotte (2008). An increase of 100 points in Times university ranking score increases the size of overseas student population by about 10% in our favoured specification. The latter is consistent with previous findings (Soo and Elliot, 2010; Broecke, 2012) on the effect of rankings on student applications, such that better ranked institutions attract more overseas students.

Table 4.3 Price sensitivity of non-EU students, controlling for quality

VARIABLES	Fixed effects estimates			System GMM estimates
	log (total non-EU students - by institution, academic year)			log (total non-EU students - by institution, academic year)
Overseas fees (2013 prices, in thousands, £)	0.0492	0.0465*	-0.0490*	0.0597
	(0.0298)	(0.0273)	(0.0280)	(0.0370)
ranking score	0.182***	0.0769***	0.109**	0.176***
	(0.0476)	(0.0278)	(0.0425)	(0.0313)
year dummies	x		x	x
linear trend		x		
institution specific trends			x	
institution dummies				x
F-test: year dummies	6.71		5.29	
(p-value)	(0.0000)		(0.0000)	
F-test: institution specific trends			3319.15	
(p-value)			(0.0000)	
Constant	3.532***	-72.14***	4.892***	3.209***
	(0.439)	(26.11)	(0.362)	(0.463)
Observations	1,125	1,125	1,125	1,006
Number of institutions	119	119	119	-
Adjusted R-squared	0.140	0.085	0.484	0.854

Note: Source: HESA (aggregate-level) student population data, Times institutional-level rankings and Reddin (& The Complete University Guide) tuition fees data, 2002 – 2012. Robust standard errors in parentheses. Fees are instrumented with lagged fees (period 1) for the System GMM estimates. Institution dummies are omitted in the fixed effects analysis. *** p<0.01, ** p<0.05, * p<0.1

Overseas fees are highly correlated with the Times ranking score of universities (corr.=0.51), which could means that any positive effect that we find of fees on changes in first-year overseas student population could reflect that fees are acting as a signal for quality to overseas students, or that the better ranked institution can afford to increase their level of tuition fees and still attract students[80]. To test the robustness of our results against the potential endogeneity of the tuition fees, we run a system generalised method of moment estimation using lagged tuition fees (1-period) as an instrument (column 4, table 4.3). The results suggest that the level of overseas fees have no impact on student population, but the effect of institutional quality remains. This former is

[80] In addition, admission of overseas students is conditional on the full payment of fees.

consistent with findings in Beine et al. (2012), after a GMM estimation is used to eliminate potential reverse causality in fees.

Soo and Elliot (2010) find that overseas subject-level application numbers is positively linked to the number of applications from home students an institution receives, which may reflect some popularity or reputational effect that are not captured by the university rankings. Hence, we test the robustness of our results after controlling for changes in the number home and EU students at an institution (Table 4.4). We find that a 10% increase in the number of home/UK students at an institution increases the number of overseas students by about 3.5%. The number of European students however, does not seem to influence the size of overseas student population. Compared to table 4.2, controlling for the number of home and EU students barely changes the estimate of effect of overseas fees on overseas student population.

Table 4.4 (Institution) Fixed effects estimates: Price sensitivity of non-EU students, controlling for the number of home and EU stundents

	(1)		
VARIABLES	log (total non-EU students - by institution, academic year)		
Overseas fees (2013 prices, in thousands, £)	0.0690**	0.0627**	-0.0426
	(0.0312)	(0.0297)	(0.0298)
log (total home/UK students - by institution, academic year)	0.346*	0.332*	0.389**
	(0.183)	(0.183)	(0.153)
log (total EU students - by institution, academic year)	0.0105	-0.0374	0.0654
	(0.0693)	(0.0670)	(0.0730)
year dummies	x		x
trend		x	
institution specific trends			x
F-test: year dummies	5.20		6.16
(p-value)	(0.0000)		(0.0000)
F-test: institution specific trends			484.06
(p-value)			(0.0000)
Constant	1.821	-33.63	2.288**
	(1.587)	(24.79)	(1.117)
Observations	1,082	1,082	1,082
Number of institutions	117	117	117
Adjusted R-squared	0.123	0.086	0.496

Note: Source: HESA (aggregate-level) student population data, Times institutional-level rankings and Reddin (& The Complete University

Guide) tuition fees data, 2002 – 2012. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

We again test the robustness of results in table 4.4, after controlling for institutional quality (Table 4.5). Under the fixed effects set-up (column 1-3), the effect of overseas tuition fees are statistically significant at the 10%, but with different signs. The effect of fees are positive and measured at around 5% (for each £1,000 increase in fees) under the year dummies, but increase in fees lowers overseas student numbers under institution specific trends, with the effect measured around the same magnitude. Instrumenting the overseas fees with lagged fees under the GMM set-up (column 4) shows that a £1,000 increase in fees increases number of overseas students by about 6%, but the effect is statistically significant at the 10% level. A 100 points increase in university rankings scores increases the number of overseas students by about 10%, and a 10% increase in the number of home students increases overseas student population by about 4%. The effect of ranking score and the effect of home student population are statistically significant under both fixed effects and the GMM set up.

Table 4.5 Price sensitivity of non-EU students, controlling for quality and the number of home and EU students

	Fixed effects estimates			System GMM estimates
VARIABLES	log (total non-EU students - by institution, academic year)			log (total non-EU students - by institution, academic year)
Overseas fees (2013 prices, in thousands, £)	0.0506*	0.0480*	-0.0476*	0.0651*
	(0.0294)	(0.0279)	(0.0286)	(0.0352)
log (total home/UK students- by institution, academic year)	0.395**	0.437**	0.395**	0.572***
	(0.183)	(0.188)	(0.153)	(0.0626)
log (total EU students- by institution, academic year	-0.00100	-0.0315	0.0571	0.00903
	(0.0659)	(0.0668)	(0.0716)	(0.0498)
ranking score	0.198***	0.104***	0.108**	0.193***
	(0.0481)	(0.0289)	(0.0421)	(0.0318)
year dummies	x		x	x
trend		x		
institution specific trends			x	
institution dummies				x
F-test: year dummies	6.45		6.32	
(p-value)	(0.0000)		(0.0000)	
F-test: institution specific trends			400.96	
(p-value)			(0.0000)	

Constant	0.377	-76.25***	1.615	-1.284***
	(1.681)	(28.01)	(1.144)	(0.246)
Observations	1,082	1,082	1,082	971
Number of institutions	117	117	117	
Adjusted R-squared	0.157	0.105	0.502	0.853

Note: Source: HESA (aggregate-level) student population data, Times institutional-level rankings and Reddin (& The Complete University Guide) tuition fees data, 2002 – 2012. Robust standard errors in parentheses. Overseas fees are instrumented with lagged fees (by 1 period) for system GMM estimates. *** p<0.01, ** p<0.05, * p<0.1

We also assess the effect of fees under the full non-EU student population sample, when institutional quality, and country specific economic conditions are controlled for (4:A2 – 4:A4, appendix). Overall, we do not find that overseas students react negatively to changes in tuition fees, but better ranked institutions attract more non-EU students, and higher GDP growth and smaller exchange rate fluctuations in the home country increases the size of the non-EU student population at an institution.

4.7 Conclusion

Estimating the price sensitivity of non-EU students to UK tuition fees over a panel of student population data across all UK institutions over the period of 2002/03 to 20012/13, we find that overall, non-EU students do not react negatively to changes in tuition fees, and better ranked institutions, and institutions with higher number of home students attract more students from outside the Europe.

Assessing the price sensitivity of non-EU students to UK (overseas) tuition fees has important policy implications. Considering that average within-institution variation of overseas students is around 103, and the average overseas tuition fees per year is around £12,000 in 2012/13, this means effectively a change of £1.2 million in institutions' income. However, contrast to immigration policies on international students in other popular destination countries, where policies are introduced to streamline the visa application process, simplify requirements to student visas, and allow students to stay and gain work experience after their study (Australian government, 2011), the UK government on the other hand gradually increased the cost for non-EU students to come and study in the country, includes international students in the immigration target, and

withdrew the Post Study Work scheme for non-EU students in 2012. HEFCE (2014) reports that the drop in the number of non-EU students to English institutions in 2012/13 is the first drop in 29 years. Hence, such policy changes could potentially harm the financial welfare of UK universities and damage UK universities' presence in the international higher education market.

References

Agrawal, A., Kapur, D., McHale, J., and Oettl, A. (2011) Brain drain or brain bank? The impact of skilled emigration on poor country innovation, Journal of Urban Economics, 69(2011), 43-55

Angrist, J. D., Lavy, V. (1997) The effect of a change in language of instruction on the returns to schooling in Morocco, Journal of Labor Economics, 15(1), 48-76

Australian Government (2011) Strategic Review of the Student Visa Program 2011 Report

Barro, R. J. (2001) Human capital and growth, American Economic Review, 91(2)

Bartel, A. P. (1989) Where do the new U.S. immigrants live? Journal of Labor Economics, 7(4), 371-391

Baryla, E. A. JR., and Dotterweich, D (2001) Student migration: do significant factors vary by region? Education Economics, 9(3), 269-280

Bastedo, M. N., and Bowman, N. A. (2009) Getting on the Front Page: Organizational Reputation, Status Signals, and the Impact of U.S. News and World Report on Student Decisions. Research in Higher Education, 50, 415-436

Bathmaker, A.M. (2003) The Expansion of Higher Education: A Consideration of Control, Funding and Quality IN Bartlett, S. and Burton, D. (eds) Education Studies. Essential Issues, London: Sage, pp.169-189

Beine, M., Noel, R., and Ragot, L.(2012) The determinants of international mobility of students, CESifo working papers, No. 3848

Bergerhoff, J., Borghans, L., Seegers, P. K., and Van Veen, T. (2013) International Education and Economic growth, IZA discussion paper series, No. 7354

Betts, J. R. (1996) What do students know about wages? Evidence from a survey of undergraduates. Journal of Human Resources, 31(1), 27-56

Botelho, A., Pinto, L.C. (2004) Students' expectations of the economic returns to college education: results of a controlled experiment. Economics of Education Review, 23(6), 645-653

Broecke, S. (2012). University rankings: do they matter in the UK? Education Economics, 20, 1-25

Brunello, G., Lucifora, C., and Winter-Ebmer, R. (2004) The wage expectations of European business and economics students. Journal of Human Resources, 39(4), 1116-1142

Chellaraj, G., Maskus, K. E., and Mattoo, A. (2008) The contribution of international graduate students to US innovation, Review of International Economics, 16(3), 444-462

Chevalier, A. (2007) Education, occupation and career expectations: Determinants of the gender pay gap for UK graduates. Oxford Bulletin of Economics and Statistics, 69(6), 819– 842

Chowdry, H., Dearden, L., Goodman, A., and Jin, W. (2012) The distributional impact of the 2012-13 Higher Education Funding Reforms in England. Fiscal studies, 33(2), 211-236

Croson, R., and Gneezy, U. (2009). Gender Differences in Preferences. Journal of Economic Literature, 2009, 47(2), 448-474

De Vreyer, P., Guber, F., and Robilliard, A. (2010) Are there returns to migration experience? An empirical analysis using data on return migrants and non-migrants in West Africa, Migration and Development, 307-328

Dwenger, N., Stork, J., and Wrohlich (2012) Does tuition fees affect the mobility of university applicants? Evidence from a natural experiment. Economics of Education Review, 31, 155 – 167

Dearden, L., Fitzsimons, E., and Wyness, G. (2011) The impact of tuition fees and support on university participation in the UK, Centre for the Economics of Education, London School of Economics

Delaney, L., Harmon, C., and Redmond, C. (2011) Parental education, grade attainment and earnings expectations among university students. Economics of Education Review, 30(6), 1136-1152

Dominitz, J., and Manski, C. F. (1996) Eliciting student expectations of the returns to schooling. Journal of Human Resources, 31(1), 1-26

Gibson, J., and McKenzie, D. (2012) The economic consequences of 'brain dran' of the best and brightest: microeconomic evidence from five countries, The Economic Journal, 122(May), 339-375

Gordon, J., and Jallade, J. (1996) 'Spontaneous' Student Mobility in the European Union: Statistical Survey. European Journal of Education, 31(2), 133 – 151

Gould, E. D., Lavy, V., and Paserman, M. D. (2009) Does immigration affect the long-term educational outcomes of natives? Quasi-experimental evidence, The Economic Journal, 119(October), 1243-1269

Greenaway, D., and Haynes, M. (2003) Funding for higher education in the UK: the role of fees and loans. Economic Journal, 113(485), 150-166

Griffth, A., and Rask, K. (2007) The influence of the U.S. News and World Report collegiate rankings on the matriculation decision of high-ability students: 1995-2004 Economics of Education Review, 26, 244-255

Harris, R. (1995) Overseas students in the United Kingdom university system. Higher Education, 29(2), 77-92

HEFCE (2008) Counting what is measured or measuring what counts? League tables and their impact on higher education institutions in England. April 2008/14. Issue Paper.

HEFCE (2010) Guide to funding: How HEFCE allocates its funds. September 2010/24

Hubner, M. (2012) Does tuition fees affect enrolment behaviour? Evidence from a 'natural experiment' in Germany. Economics of Education Review, 31, 949 - 960

Jensen, R. (2010) The (perceived) returns to education and the demand for schooling. The Quarterly Journal of Economics, 125(2), 515-548

HEFCE (2014) Global demand for English higher education: An analysis of international student entry to English higher education courses. April 2014, 2014/08a

Jerrim, J. (2011) Do UK higher education students overestimate their starting salary? Fiscal Studies, 32(4), 483-509

Kahanec, M., and Kralikova, R. (2011) Pulls of International Student Mobility, IZA Discussion paper series, No. 6233

Kerr, S. P., and Kerr, W. R. (2013) Immigration and Employer Transitions for Stem Workers, American Economic Review: Papers & Proceedings, 103(3): 193-197

Lewis, M. S., and Marvel, H. P. (2011) Why do consumers search? The Journal of Industrial Economics, 59(3), 457-483

Manning, A., and Swaffield, J. (2008) The gender gap in early career wage growth. The Economic journal, 530(118), 983-1024

Martins, P. S. (2006) The return to university degrees: the students' perspectives. Queen Mary, University of London

McGuigan, M., McNally, S., and Wyness, G. (2012) Student awareness of costs and benefits of educational decisions: effects of an information campaign. CEE Discussion Papers 0139, London School of Economics

Miller, D. C., Byrnes, J. P., and Schafer, W. D. (1999). Gender Differences in Risk Taking: A Meta-Analysis. Psychological Bulletin, 125(3), 367-383

Monks, J., and Ehrenberg, R. G. (1999) The Impact of U.S. News & World Report College Rankings on Admission Outcomes and Pricing Policies at Selective Private Institutions. Change, 31(6), 42-51

Purcell, K., Elias, P., Atfield, Gaby., Behle, H., Ellison, R., and Luchinskaya, D. (2013) Transitions into employment, further study and other outcomes. The Futuretrack Stage 4 Report, Higher Education Careers Services Unit

Roberts, D. and Thompson, L. (2007) University League Tables and the Impact on Student Recruitment, Reputation Management for Universities, Working Paper Series No. 2

Rosenzweig, M. (2006) Global wage differences and international student flows. Brookings Trade Forum, 57-96

Sauder, M., and Lancaster, R. (2006) Do Rankings Matter? The Effects of U.S. News & World Report Rankings on the Admissions Process of Law Schools. Law & Society Review, 40, 105-134

Soo, K. T. (2011) Does anyone use information from university rankings? Education Economics, 2011, 19, 1-15

Soo, K. T., and Elliot, C. (2010) Does price matter? Overseas students in UK higher education. Economics of Education Review, 29, 553-565

Smith, H. L., and Powell, B. (1990) Great expectations: variations in income expectations among college seniors. Sociology of Education, 63(3), 194-207

UCAS (2012) End of cycle report, http://www.ucas.com/sites/default/files/ucas-end-of-cycle-report-2012.pdf

UKCISA (2014) 5 years of Tier 4: key developments and changes. Special briefing.

Universities UK. (2011) Higher education in facts and figures, http://www.universitiesuk.ac.uk/Publications/Documents/HigherEducationInFactsAndFiguresSummer2011.pdf

Universities UK, (2013) The funding environment for universities. http://www.universitiesuk.ac.uk/highereducation/Documents/2013/FundingEnvironmentForUniversities.pdf

Van Bouwel, L., and Veugelers, R. (2010) Does university quality drive international students flows? Department of managerial economics, strategy and innovations, Catholic University of Leuven

Varga, J (2001) Earnings expectations and higher education enrolment decisions in Hungary. Budapest Working Papers on the Labour Market 2001/10, Institute of Economics, Hungarian Academy of Sciences and Department of Human Resources, Budapest University of Economics, Budapest

Walker, I., and Zhu, Y. (2011) Differences by degree: evidence of the net financial rates of return to undergraduate study of England and Wales. Economics of Education Review, 30(6), 11 Webbink, D., and Hartog, J. (2004) Can students predict starting salaries? Yes! Economics of Education Review, 23(2), 103-113

Willis, R. J., and Rosen, S. (1979) Education and self-selection. The Journal of Political Economy, 87(5), 7-36

Wolter, S. C. (2000) Wage expectations: A comparison of Swiss and US students. Kyklos, 53(1), 51 - 69

Wolter, S. C., and Zbinden, A. (2001) Labour market expectations of Swiss university students, International Journal of Manpower, 23(5), 458 - 470

Wyness, G. (2010) Policy Changes in UK Higher Education Funding, 1963-2009. Institute of Education, Department of Quantitative Social Science (DoQSS) Working paper

Appendix

2: A1: Guardian methodologies over the period

Weights	Year							
Criteria used	2004	2005	2006	2007	2008	2009	2010	2011
(NSS) Course satisfaction								5%
(NSS)Teaching quality					10%	10%	10%	10%
(NSS)Feedback					5%	5%	5%	10%
Staff score			15%	15%				
Teaching Quality Assessment	40%	22%						
Spend per student	10%	15%	10%	10%	17%	17%	17%	15%
Student Staff ratio	10%	15%	20%	20%	17%	17%	17%	15%
Job prospects	15%	15%	17%	17%	17%	17%	17%	15%
Value added	15%	10%	10%	10%	17%	17%	17%	15%
Entry tariff	10%	15%	20%	20%	17%	17%	17%	15%
Inclusiveness		8%	8%	8%				

2: A2 – Number of institutions for each subject group over the period

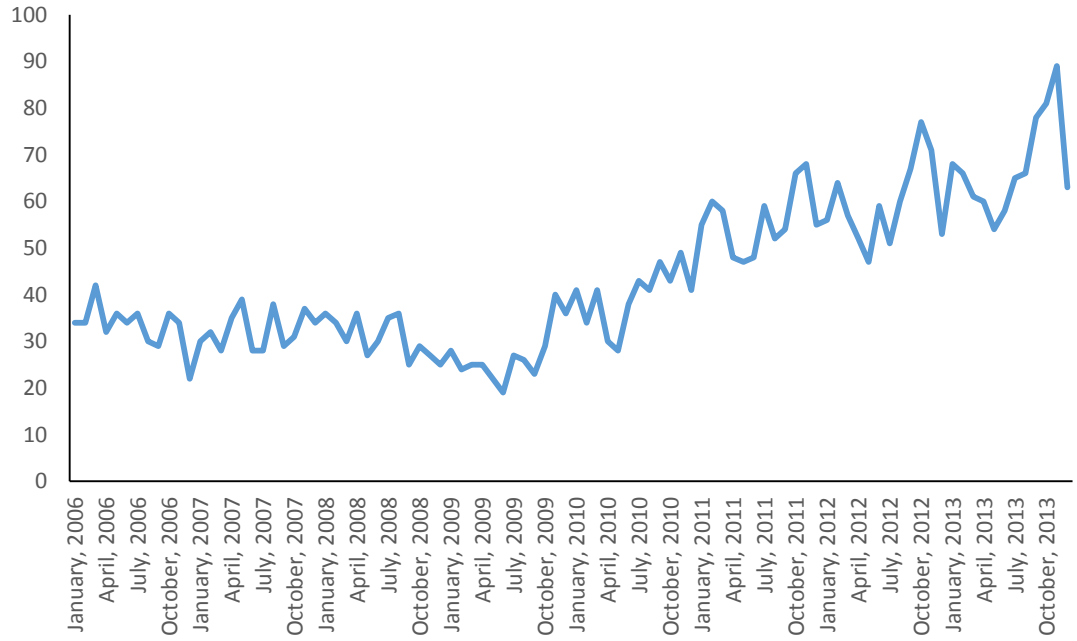
Subject \Year	2004	2005	2006	2007	2008	2009	2010	2011	Total number of institutions	Average number of institutions
Group A Medicine & Dentistry	23	25	25	27	30	30	30	30	32	28
Group B Subjects allied to Medicine	87	88	94	91	85	81	84	87	106	87
Group C Biological Sciences	110	112	113	114	112	110	110	111	119	112
Group D Vet Sci,Ag & related	24	29	30	24	18	16	19	19	37	22
Group F Physical Sciences	92	90	93	89	81	79	79	78	102	85
Group G Mathematical & Comp Sci	110	109	112	109	108	101	101	105	117	107
Group H Engineering	89	86	88	81	81	77	79	77	95	82
Group J Technologies	14	14	14	15	10	10	11	12	23	13
Group K Architecture,Build & Plan	60	57	59	57	54	48	54	53	66	55
Group L Social Studies	107	112	112	111	109	102	108	107	120	109
Group M Law	83	86	89	89	85	85	89	90	96	87
Group N Business & Admin studies	110	112	115	116	111	108	110	110	123	112
Group P Mass Comms and Documentation	60	66	77	77	73	70	73	73	91	71
Group Q Languages & Linguistics	101	105	106	108	105	98	102	104	114	104
Group V Hist & Philosophical studies	86	96	97	98	93	88	91	93	104	93
Group W Creative Arts & Design	111	115	123	118	115	111	113	113	132	115
Group X Education	67	66	69	68	64	61	62	62	78	65

2: A3- List of subject groups included in the dataset

JACS Subject Groups (UCAS)	**Subjects** (Guardian)	**Cost centres** (HESA)
Group A Medicine & Dentistry	Medicine, Dentistry	(01) Clinical medicine; (02) Clinical dentistry
Group B Subjects allied to Medicine	Anatomy and physiology, Nursing and paramedical studies, Pharmacology and pharmacy	(04) Anatomy & physiology; (05) Nursing & paramedical studies; (06) Health & community studies; (08) Pharmacy & pharmacology
Group C Biological Sciences	Biosciences, Psychology, Sports and exercise science	(07) Psychology & behavioural sciences; (10) Biosciences; (38) Sports science & leisure studies
Group D Vet Sci,Ag & related	Agricultural and forestry, Veterinary science	(03) Veterinary science; (13) Agriculture & forestry
Group F Physical Sciences	Chemistry, Physics, Archaeology and forensics, Earth and marine sciences, Geography and environmental studies	(11) Chemistry; (12) Physics; (14) Earth, marine & environmental sciences; (28) Geography; (37) Archaeology
Group G Mathematical & Comp Sci	Mathematics, Computer sciences and IT	(24) Mathematics; (25) Information technology & systems sciences & computer software engineering
Group H Engineering	Chemical engineering, Civil engineering, Electrical & electronic engineering, General engineering, Mechanical engineering	(16) General engineering; (17) Chemical engineering; (19) Civil engineering; (20) Electrical, electronic & computer engineering; (21) Mechanical, aero & production engineering
Group J Technologies	Materials and mineral engineering	(18) Mineral, metallurgy & materials engineering
Group K Architecture, Build & Plan	Architecture, Building and town and country planning	(23) Architecture, built environment & planning
Group L Social Studies	Anthropology, Economics, Politics, Sociology, Social work, Social policy & administration	(29) Social studies
Group M Law	Law	(29) Social studies
Group N Business & Admin studies	Business and management studies, Tourism, transport and travel	(26) Catering & hospitality management; (27) Business & management studies

Group P Mass Comms and Documentation	Media studies, communications and librarianship	(30) Media studies
Group Q Languages & Linguistics	Classics, English, Modern languages & linguistics, American studies	(35) Modern languages
Group V Hist & Philosophical studies	History & history of art, Philosophy, Religious studies and theology	(31) Humanities & language based studies;
Group W Creative Arts & Design	Art & design, Drama and dance, Music	(33) Design & creative arts
Group X Education	Educational studies	(41) Continuing education; (34) Education

Figure 3: A1 Google search frequency for “Graduate salary”.



Source: Google trends for “Graduate salary” (http://www.google.co.uk/trends/?hl=en). The figures are based on the monthly number of searches on Google containing the term “Graduate salary”, and originates from the UK, over the period of 2006 – 2013.

T3: A1 Missing (expected) incomes

VARIABLES	(1) expected wage upon graduation	(2) expected wage at 30 with degree	(3) estimated wage for (uni) class peers at 30	(4) expected wage at 30 without degree	(5) family income
male	-0.0370***	0.0413*	-0.0609***	0.0388**	-0.107***
	(0.0112)	(0.0217)	(0.0205)	(0.0165)	(0.0221)
home fee status	0.0128	-0.227***	0.000458	-0.208***	0.00797
	(0.0121)	(0.0414)	(0.0188)	(0.0586)	(0.0536)
age on entry	-0.00423	-0.0217*	-0.00969	-0.0133	0.0203
	(0.00502)	(0.0117)	(0.0109)	(0.0100)	(0.0127)
ln (UCAS tariff)	0.0564***	-0.0809	-0.0201	-0.0232	-0.0321
	(0.0198)	(0.0506)	(0.0393)	(0.0262)	(0.0458)
missing UCAS tariff	0.0129	0.0683	0.0667**	0.0883*	0.00699
	(0.0175)	(0.0434)	(0.0288)	(0.0457)	(0.0307)
mother university	0.00890	-0.0148	0.0182	0.00698	0.0539*
	(0.0203)	(0.0547)	(0.0330)	(0.0492)	(0.0280)
father university	0.00196	0.00635	-0.0293	-0.0608	0.0108
	(0.0153)	(0.0460)	(0.0421)	(0.0442)	(0.0465)
parents own house	0.00877	0.0833	0.0359*	0.0679	-0.00859
	(0.0237)	(0.0690)	(0.0212)	(0.0577)	(0.0471)
ln (family income)	0.0124	0.0722***	0.0223**	0.0684***	
	(0.0152)	(0.0229)	(0.00995)	(0.0159)	
famincmis	0.107***	0.102**	0.143***	0.150***	
	(0.0226)	(0.0401)	(0.0239)	(0.0411)	
year 2008	-0.00329	0.0276***	-0.00479	0.0120	-0.0269***
	(0.00524)	(0.0107)	(0.00687)	(0.00773)	(0.00489)
year 2009	-0.0171***	0.0118	-0.00768	-0.00878	-0.0397***
	(0.00438)	(0.0113)	(0.0108)	(0.0112)	(0.00730)
year 2010	-0.0299***	-0.0707***	-0.0557***	-0.118***	-0.218***
	(0.00633)	(0.00476)	(0.00598)	(0.00667)	(0.00880)
year 2011	-0.0340***	-0.0329	-0.00808	-0.000560	-0.153***
	(0.00902)	(0.0233)	(0.0128)	(0.0331)	(0.0175)
year 2012	-0.0152***	0.00515	0.00266	-0.00540	-0.151***
	(0.00573)	(0.00674)	(0.00798)	(0.00957)	(0.00789)
year 2013	-0.0303***	0.0541***	-0.000786	-0.0468***	-0.235***
	(0.00559)	(0.00997)	(0.0111)	(0.00596)	(0.00792)
ethnicity dummies	x	x	x	x	x
Observations	946	973	973	973	973

Note: Probit marginal effect estimates. Dependent variable equal to 1 if income information missing. *Ethnicity1_ white British*, *year 2007* are used as reference groups. Column (1) has smaller number of observations since *ethnicity 9_ Pakistani* predicts failure perfectly (i.e. All Pakistani students in our sample reported their expected starting salaries). Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

3: A2 Possible changes in the composition of students since 2012

VARIABLES	first year student in or after 2012			
home fee status	0.0361	-0.630*	-0.448	-0.0551
	(0.0573)	(0.348)	(0.885)	(0.144)
male	0.0419	0.00613	0.00398	0.00449
	(0.0357)	(0.0298)	(0.0299)	(0.0306)
home x male	-0.0563			
	(0.0647)			
home x age on entry		0.0339		
		(0.0230)		
home x ln (UCAS tariff)			0.0754	
			(0.165)	
home x ln (family income)				0.0134
				(0.0223)
age on entry	-0.00949*	-0.0298**	-0.00870	-0.00927*
	(0.00536)	(0.0143)	(0.00569)	(0.00543)
ln (UCAS tariff)	-0.199**	-0.197**	-0.244*	-0.203**
	(0.0808)	(0.0797)	(0.125)	(0.0825)
missing UCAS tariff	0.0174	0.0184	0.0193	0.0174
	(0.0820)	(0.0804)	(0.0850)	(0.0826)
ln (family income)	-0.00735	-0.00779	-0.00833	-0.0145
	(0.0212)	(0.0210)	(0.0187)	(0.0317)
missing family income	-0.0695	-0.0709	-0.0689	-0.0719
	(0.0510)	(0.0517)	(0.0504)	(0.0508)
Observations	1,046	1,046	1,046	1,046

Note: Probit marginal effect estimates. Dependent variable equal to 1 if student enrolled in or after 2012. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

4: A1 missing institutions in 2012

Institutions	Notes
Anglia Ruskin	Post 1992 new university
Brunel	
Chichester	University status Oct 2005
City	
De Monfort	Post 1992 new university
Edge Hill	University status May 2006
Glamorgan	Post 1992 new university-merged into University of South Wales April 2013
Gloucestershire	University status 2001
Imperial College London	
Kingston	Post 1992 new university
Lampeter	Merged with Trinity University College in 2010 to form University of Wales, Trinity Saint David
Lincoln	Post 1992 new university
Liverpool John Moores	Post 1992 new university
London South Bank	Post 1992 new university
Loughborough	
Middlesex	
Newport	Merged into University of South Wales April 2013
Paisley	Merged with Bell College to form University of West of Scotland, August 2007
Teesside	Post 1992 new university
Trinity Saint David	
UMIST (University of Manchester Institute of Science and Technology)	Merged with Victoria University of Manchester to form University of Manchester in 2004
Victoria Manchester	Merged with UMIST to form University of Manchester in 2004
Warwick	

West of Scotland	
Westminster	Post 1992 new university
Wolverhampton	Post 1992 new university
York St John	University status 2006

4: A2 Non EU students' fee sensitivity, fixed effects estimates

VARIABLES	(1) log (total non-EU students - by institution, country of domiciles, academic year)		
Overseas fees	0.0245	0.0242	-0.0170
	(0.0157)	(0.0149)	(0.0128)
year dummies	x		x
trend		x	
institution specific trends			x
Constant	0.616***	-44.84***	0.962***
	(0.153)	(9.541)	(0.122)
Observations	43,908	43,908	43,908
Number of groups (observations by institution, country of domicile)	10,828	10,828	10,828
Adjusted R-squared	0.023	0.021	0.061

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4: A3 Non EU students' fee sensitivity, fixed effects estimates, controlling for quality

VARIABLES	log (total non-EU students - by institution, country of domiciles, academic year)		
overseas fees	0.0165	0.0169	-0.0189
	(0.0151)	(0.0139)	(0.0123)
ranking score	0.0858***	0.0430***	0.0444**
	(0.0288)	(0.0153)	(0.0213)
institution specific trends			x
year dummies	x		x
trend		x	
Constant	0.120	-64.97***	0.680***
	(0.251)	(12.61)	(0.175)
Observations	43,908	43,908	43,908
Number of groups (observations by institution, country of domiciles)	10,828	10,828	10,828
Adjusted R-squared	0.026	0.022	0.062

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4: A4 Non EU students' fee sensitivity, fixed effects estimates, controlling for quality and economic conditions

VARIABLES	log (total non-EU students - by institution, country of domiciles, academic year)		
Overseas fees	0.0144	0.0126	-0.0148
	(0.0155)	(0.0138)	(0.0126)
ranking score	0.0939***	0.0591***	0.0475**
	(0.0309)	(0.0180)	(0.0234)
inflation rate (GDP deflator)	0.000647	-0.0000798	0.0007636*
	(0.0004157)	(0.0003952)	(0.0004253)
GDP growth	0.0020385**	-0.0010714	0.0021069**
	(0.0009306)	(0.0009659)	(0.0009275)
exchange rate fluctuation	-0.000000622***	-6.46e-07***	-6.63e-07***
	(1.53e-07)	(1.51e-07)	(1.49e-07)
institution specific trends			x
year dummies	x		x
trend		x	
Constant	0.0373	-86.36***	0.562***
	(0.281)	(14.87)	(0.195)
Observations	37,401	37,401	37,401
Number of groups (observations by institution, country of domiciles)	9,744	9,744	9,744
Adjusted R-squared	0.033	0.028	0.073

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1