The Impact of Foreign Students in British Universities

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Abstract

The impact of immigration on natives' labour markets has been largely studied. Limited work has been done so far on the effects of influxes of immigrants on natives' higher education outcomes, especially in the UK, which is a top destination for mobile students. In this study we revisit the existing results of the average effect and further test how the composition of the native student body was altered due to larger inflows of foreign undergraduates enrolled in British universities. Our results from an instrumental variable estimation confirm previous findings that there is no overall effect, but we identify changes in the distribution of natives. We find that it is top performing natives that benefit from larger inflows of foreign students: a 1% increase in the number of foreigners triggers an increase of 0.14% and of 0.23% in the number of top performing natives pursuing an undergraduate degree. Moreover, we investigate two main mechanisms that could explain our results and we find limited evidence that top performing natives are crowded in due to foreigners increasing the university quality.

Keywords: Higher Education, Crowding Out, Immigration
JEL codes: I230, I21, J15

1 Introduction

In the current globalised economy driven by human capital, the number of individuals pursuing higher education abroad continues to surge. Even though the competition for the smartest minds from all over the world is stronger with the recent openness of more universities to foreign students, countries like the UK, which have universities with abiding reputation, are still a top destination for students studying abroad.[1] Aggregated figures

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[1] According to UNESCO data the UK was the second top destination for students studying abroad in 2013 enrolling 10% and following the US which enrolled 19%.

show that over the last years the number of non-UK domiciled students enrolled as first year full-time undergraduate students in all British universities hiked by 75% from 37,515 to 65,805 between academic years 2000/01 and 2009/10.[2]

Economic theory suggests that in a world with fixed university places increases in the number of mobile undergraduate students decreases the number of competing undergraduate native students enrolled in universities. However, universities have some flexibility in altering the supply of places, and, at least in the UK, they have been expanding over time.[3] So, rather than seeing a mechanical relationship in which one extra foreign student displaces one native, fluctuations in university places make it difficult to predict what is the effect of increases in demand from non-UK domiciled students. On the one hand, universities have limited resources and extra foreigners could crowd out natives; on the other hand, these extra foreigners could become an additional source of income for universities through the tuition fees they pay.[4] In this case mobile students could crowd in native students as universities may invest these extra financial resources to expand, by creating more teaching facilities or hiring extra teaching staff. Moreover, even if tuition fees are the same for everyone, independently of their domicile, universities may want to increase enrolment rates of mobile students, as they bring cultural diversity on campus which could contribute to the enhancement of one's university experience. One additional aspect is the quality of the students enrolled: if foreign applicants tend to be of higher ability than natives on average, universities may have incentives to enrol more non-UK domiciled students in order to increase their own competitiveness.

Thus, as the direction of the impact is ambiguous, in this paper we empirically assess how the large inflows of foreign undergraduate students attending British universities has affected the enrolment of native students. Specifically, we combine very rich individual level administrative data on eight cohorts of English students and on non-UK domiciled students to analyse the overall effect. Then, we extend the analysis by investigating how this increased competition from foreigners has altered the distribution of native students enrolled in universities. We focus on analysing if there are unequal effects between natives by their academic performance in pre-university national level exams to investigate if it is the more or the less able students who experience a greater effect. Moreover, we also distinguish between natives from different demographic groups in order to understand if it is the poor or the richer native students who benefit from or are negatively impacted by the larger influx of foreign students.

We use an instrumental variable (IV) approach to account for the fact that foreign and native students are subject to similar university specific demand shocks, such as the fact that a university may become more attractive to both categories of students because it is expanding. The used instrument parallels that proposed by Card (2001), which is widely used in the labour economics literature. In particular, we use historical shares of students from a sending country enrolled into a university combined with current national changes in the stock of students from this country to instrument the current flows of foreign un-

[2]In this paper the group of the EU and non-EU domiciled students is referred to interchangeably as non-UK domiciled students, foreign students or mobile students.

[3]According to the Higher Education Statistical Agency, between 2000/01-2009/10 the total number of first year full time undergraduate students enrolled in all British universities increased from 383,365 to 516,480.

[4]In the UK students domiciled outside the EU pay higher tuition fees compared to native and EU students. The British government estimated that non-EU students contributed £3.9bn in tuition fees after scholarships and £6.3bn in living expenses in 2011/12 (BIS (2013)).

dergraduate students attending a university. This supply-push component of recent foreign inflows to a particular university, which is arguably exogenous to university demand conditions, allows us to identify the causal effect of non-UK domiciled inflows of students in the presence of unobserved university demand shocks on various university related outcomes for natives. Moreover, as since the introduction of tuition fees in 1998/99 the funding system of British universities has undergone a series of changes such as moving from upfront to deferred tuition fees, the introduction of tuition fee loans or changes in maintenance grants and loans, we employ an estimation with flexible controls for time fixed effects to ensure our empirical analysis is not affected by these changes.

Our IV results show that even though there is no statistically significant impact overall, there is variation in the effect by native groups. We find the top performing native students are crowded in by foreign students: a 1% increase in the number of foreign students triggers an increase in the number of native students with grades above the median GCSE English grades and above the median GCSE Mathematics grades by 0.14% and 0.23% respectively. Additionally, a 1% increase in enrolled undergraduate foreigners increases the number of male native students by 0.13%. Our findings show a crowding in of natives from the top distribution of the income, although the effect is differential only at the 10% significance level. As for ethnic origins, we show that UK minorities whose first language is not English and mainly those of Asian origins are also more likely to enrol into university. Our distributional analysis by natives' demographic composition complements our distributional analysis by natives' ability, as there is a large literature that shows that in England students of Asian origins tend to score better than UK-born white pupils in the exam taken at the end compulsory school (Dustmann, Machin & Schonberg (2010), Rutter (2016), Strand (2014), Hutchinson, Johnes, Mao, Perera, Sellen & Treadaway (2016)).

Since the introduction of tuition fees in 1998/99 the funding system of English universities has undergone a series of changes, encouraging a transition to a free market. In particular, although tertiary education institutions have quotas for the number of EU domiciled and native students they enrol, there are no restrictions on the number of non-EU domiciled students they enrol.[5] As these non-EU students pay considerably higher tuition fees compared to natives and EU students, universities have more incentives to attract them, potentially using these extra resources to attract more top performing native students. Thus, we investigate this potential mechanism, but we find no evidence that the effect is triggered by the higher resources available to universities through the tuition fee paid by non-EU domiciled students. We further investigate whether foreign students crowd in top native students as their enrolment increases the quality of the university attended and thus increasing its appeal. We find limited evidence that foreigners increased slightly the ranking of universities.

The rest of the paper is structured as follows. Section 2 presents the literature review. Section 3 describes the British education system. Section 4 details the data. Section 5 explains the estimation strategy and offers solutions to potential estimation challenges. Section 6 reports the results, while section 7 tests the robustness of the results. Section 8 explores the mechanisms. Section 9 discusses the results and concludes.

[5]The transition to a free market is more striking for the period after the increase in tuition fees in 2012. Tertiary education institutions receive considerable less direct funding from the government, have no restrictions on student numbers anymore and also charge considerably higher tuition fees. Thus, universities are competing even more for additional funds and have more incentives to attract higher payers of tuition fees, who tend to be foreign students.

2 Literature review

The effect of immigrant inflows on receiving markets and natives has generated a large debate in the literature. The impact of immigration on labor market outcomes in particular has proven a controversial issue. On the one hand, Card (1990), Card (2001), Card (2005), Manacorda, Manning & Wadsworth (2012) and Ottaviano & Peri (2012) argue that immigration has had little and often insignificant effects on native workers' wages and employment rates (Dustmann, Fabbri & Preston (2005)); on the other hand, Borjas, Freeman & Katz (1996) and Borjas (2003) find a pronounced negative effect on natives' wages.

Surprisingly, however, the impact of immigration on the higher education system has not been largely studied. Increasing enrolment rates of foreign students can alter the educational opportunities of natives: one extra foreigner could displace natives from tertiary education or even discourage natives from pursuing degrees popular among foreign students, especially if after graduation mobile students are very likely to join the labour market in the host country. Thus, the issue of crowding out effects has significant policy implications in the current context of increasing numbers of students pursuing a degree abroad.

To our knowledge, the only other study analysing the issue of foreign students in the UK is the work by Machin & Murphy (2014). They use aggregated data on enrolment in British universities to examine whether non-EU domiciled students crowd out native students. Their findings suggest that there is no overall effect among undergraduate native students, but that taught-postgraduate students are crowded in. The authors find that the higher tuition fees paid by these non-EU students help universities to attract more native students. In our paper we revisit this overall effect for undergraduate students and we further analyse the distributional effects of the impact of foreign students on natives by using detailed individual level data. We mainly focus on the academic performance and the demographic structure of enrolled natives. Moreover, through analysing how the ethnic composition of the native student body is affected by the inflow of foreign students, we contribute to the understanding of how the integration of British-born minorities, different in culture and religion, has responded to increasing numbers of mobile students in the UK. In this sense our paper is related to the study of Dustmann, Fabbri, Preston & Wadsworth (2003) who argue that labour market outcomes of ethnic minority individuals who are born in the UK are better than those of immigrants (relative to the UK-born whites), but that many communities are still disadvantaged compared to the white UK-born population.

The other studies at tertiary education level focus mainly on the US and find modest evidence that increasing competition from foreign students has affected the university opportunities of natives. Jackson (2015) uses data from the US Census between 1970 and 2000 to find that state-level increases in the number of immigrant university students do not reduce enrolment rates of US natives. Furthermore, Borjas (2007) analyses enrolment trends in US graduate programs between 1978 and 1998 and finds no crowding out effect on average, although there is heterogeneity in the impact across ethnic groups with white native men being negatively affected by the large number of foreign students. Hoxby (1998) studies whether immigrants push disadvantaged American natives out of higher education, by exploiting a policy change in the fee structure within the Californian higher education system

between 1986 and 1992. The results show that black and Hispanic students are displaced by less disadvantaged foreign-born pupils.

In another related paper, Kato & Sparber (2013) analyse the effect of a restriction in visas available to foreign-born workers on the quality of undergraduate applications that US universities receive from international students. Whilst on a different research question, the study shows that the decrease in the number of issued visas triggered a drop in the number of applications of high-ability foreign students. In our paper we will also aim to investigate how sensitive the average quality of native undergraduate students enrolled in British universities is to larger inflows of foreign students.

Studies at other levels of education have found both overall and distributional statistically significant effects of immigrants on natives. Gould, Lavy & Paserman (2009) use the mass migration inflow of immigrants in Israel in the 1990s to examine the impact of immigrant concentration in elementary school on the long-term academic outcomes of native students in high school. The results point to lower likelihood of natives passing the high school matriculation examination that are key for university enrolment. Hunt (2012) examines the impact of immigration on natives' high school completion in the United States. The author finds that native-born black pupils, especially, are more encouraged to complete high school in order to avoid competing with immigrant high school dropouts in the labour market. Betts (1998) studies whether immigration affects the probability of high school graduation of American-born minorities. Results suggest that the native-born blacks are more likely to have lower retention rates. Our paper is the first to investigate the differential effects by natives' ethnic characteristics in the UK at the tertiary education level.

3 Institutional setting

In England, full-time education is compulsory for all children aged between 5 and 16 years old and it is organised in five Key Stages (KS). A national level examination, called General Certificate of Secondary Education (GCSE), marks the end of compulsory education. Students have the freedom to choose which and how many subjects to take, but everyone takes written exams in around ten different subjects and sits the GCSE English and Mathematics.

At the end of compulsory education students decide to either finish formal education or continue their studies for two more years, choosing between a vocational or an academic track. At the end of these two years, most English students who want to pursue a bachelor degree and who are by now 18/19 years old take a national level exam, called the General Certificate of Education Advanced Level (A-levels), in three or four subjects. The choice of subjects tends to be closely related to one's university degree preferences and university admissions are mainly determined by the scores obtained at the A-levels.[6]

When applying to a British university students choose specific fields of study and their degree can vary in length based on the location and the subjects studied, with most lasting three years in England, Wales and Northern Ireland and four years in Scotland.[7]

[6]Some universities like Cambridge or Oxford also ask prospective students to attend an interview as part of the admission process.

[7]The application process is centralised and each students applies through UCAS to up to five university-

Although there is a large number of universities/subjects to choose from, institutions compete to attract students. Every summer a number of British university league tables are published.[8] Through providing information on the quality of each university or/and various field specific departments based on a set of objective criteria they aim to help prospective students in choosing the universities and subjects to apply for. The importance of British university league tables to prospective students has been documented in the literature, with Soo (2013); Broecke (2015) and Gibbons2015 finding that improvements in university rankings are associated with increases in the number of applications and underlining that students sort into universities based on university ranking.

At admission, British universities distinguish between students based on domicile, splitting them in two main categories: home and overseas students. The former group includes all students domiciled in the UK or in a EU country, while the latter refers to all students domiciled in countries which are not part of the EU. This distinction is crucial as the two groups are subject to different regulation in terms of tuition fees levels, available places and funding opportunities. In a nutshell, universities have upper boundaries for tuition fees levels as well as student number caps imposed by the government for home students, but no regulation is in place for overseas students.[9]

In 1998, universities in the UK started charging their undergraduate students upfront mean-tested annual tuition fees of up to £1,000.[10] In 2006 universities in England, Wales and Northern Ireland introduced variable fees, with each institution having the discretion over the amount of fees they charged up to a maximum of £3,000 for home students. In the following years the maximum level was inflation-indexed. This fee regulation applied to all home students who were also eligible to apply for tuition fees loans offered by the Student Loan Company and payable after graduation in instalments, once earnings have reached £15,000 annually.[11] A different tuition fee regime has been in place in Scotland since 2001 due the devolution, but in general, universities tended to charge much larger tuition fees for non-EU students. For instance in 2011, according to The National Survey of UK Tuition, undergraduates in universities in England, Wales and Northern Ireland paid on average an annual fee of £3,375.[12] Yet, undergraduates from countries outside the EU were charged fees ranging from £6,000 to £23,000 depending on the university and/or the type of degree pursued.[13]

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field of study groups. Applications are analysed separately by each institution-department and offers are made conditional on the grades obtained at the A-level exam, which is taken after the university admission process is ended. Students need to choose their top two preferences of the offers received before sitting the A-level and if they meet the grade requirements they can enrol into university. Students that did not meet the thresholds imposed by either of their two options may still find a free spot at university which did not fill in all their positions by going into clearing.

[8]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.

[9]This refers to the period under analysis in our paper: academic years 2004/05-2011/12.

[10]Students were exempt from fees if their families earned less than £23,000 per year and were charged reduced fees on a decreasing scale if their families earned between £23,001 and £35,000 per year. Students whose families earned at least £35,001 were charged full tuition fees.

[11]Source: Student Loan Repayment. Website: www.studentloanrepayment.co.uk

[12]Scottish universities imposed no fee on students from Scotland or the EU studying full time on their first degree, and £1,820 on English, Welsh and Northern Irish residents.

[13]Source: The complete university guide. Website: http://www.thecompleteuniversityguide.co.uk

The university places available to home students (i.e. natives and EU students) were also regulated by the government during the period under analysis. Specifically, if universities went over or below the threshold of 3-5% of the student numbers proposed by government bodies, they will face funding penalties in subsequent years for their home students. Yet, the decision of how many non-EU students to enrol in a given year is mainly based on demand and the capacity of teaching as well as constraints imposed by the Home Office, due to visa restrictions, as each university has to become a sponsor and apply for a confirmation for acceptance for studies from the Home Office for each potential student not domiciled inside the European Economic Area.

Thus, in this diverse education system universities have the financial incentive to increase the number of overseas students as they pay larger tuition fees. This raise in available funds could help universities to invest in their teaching or research quality and increase their overall capacity and improving facilities. However, in the short run they face capacity constraints which could lead to displacement of the UK and/or EU students as well as penalties from the government.

4 Data

We use two main sources of individual level data. The linked National Pupil Dataset (NPD) - Higher Education Statistical Agency (HESA), which is jointly provided by the English Department for Education (DfE) and HESA, contains information on all British domiciled pupils who finished compulsory education in English state schools and pursued an undergraduate degree in a British university. The Student Record contains administrative information on all non-UK domiciled undergraduate students enrolled in a British university and it is provided directly by HESA.

Our main analysis focuses on eight cohorts of undergraduate students who enrolled in a British university between academic years 2004/05-2011/12. Additionally we also use data on foreign students between 1998/99-2003/04. In order to control for changes in the supply of places due to university merges, openings or closures, a balanced panel of universities which reported a positive number of enrolled students at undergraduate level over the period 1998/99-2011/12 is considered (See Appendix B for full details). This leads to 139 universities in total. In order to increase the precision of the estimation we group the 20 JACS fields of study identified in the data in five groups: Medicine, Dentistry and Allied Subjects; STEM; Social Sciences; Languages and History; Arts, Education, Other (See Appendix B for a detailed description).

We restrict the sample to first year full-time undergraduates. Table (1) summarises the data contained in the two data sets provided by HESA, which mainly refers to university related information, by domicile. Panel A shows the details for those UK domiciled students who finished their secondary education in an English state school between 2001/02-2008/09 and enrolled as first year undergraduate students in a British university between 2004/05-2011/12. When considering the quality of the university attended, only 22% are pursuing a degree in one of the 20 leading British universities which form the Russell Group.[14] Given

[14]The Russell Group was formed in 1994 by 17 British research universities: University of Birmingham, University of Bristol, University of Cambridge, University of Edinburgh, Imperial College London, Uni-

that the cohorts of natives in our data are students who finished their compulsory secondary school in England, it is expected that majority enrol in an English university (96%). Regarding the field of study pursued, 29% enrol in Social Sciences, followed by those in Medicine, Dentistry and Allied subjects and STEM degrees, with shares of around 23% and 19%, respectively.

Panel B, shows that the share of students from non-EU countries represents around 61% of all non-UK domiciled students. Graph (1) shows that both types of students have registered increasing flows over time, while graph (2) exhibits that indeed the most representative are non-EU students, with the Chinese being by far the largest number on average. They are followed by those from Hong Kong, the US, France, Germany and Cyprus. Moreover, about a third of foreigners are enrolled in the Russell group universities and 85% pursue a degree in an English university. As for the field of study, the largest share of foreigners pursue a degree in Social Sciences (approximately 42%) followed by around 23% enrolled in a STEM degree.

The NPD data provides additional information on natives: both demographic characteristics available in the annual census and the results at GCSE taken at the end of KS4.[15] On average, about half a million pupils finish secondary education in an English state school every year and they represent around 93% of all English pupils, the remaining being enrolled in independent schools. Out of these approximately 34% continue into the tertiary education level. Table (2) presents summary statistics of selected key variable for these students enrolled in higher education. Panel A shows information on student background characteristics at age 16. Out of all natives enrolled in university approximately 55% are female. 80% of pupils are white and the largest minority group is represented by students of Asian origin (around 11.2%). 86% of UK-born students speak English as their first language. The data also identifies students eligible for free school meals, which is considered as a good proxy for family income: 7% of those enrolled in university were eligible for the free school meal at age 16.[16] The Income Deprivation Affecting Children Index (IDACI) is an index of poverty calculated by the Office of the Deputy Prime Minister, measuring the proportion of children under 16 years old that live in low income households within a local area. It is a continuous measure between 0 and 1, with higher values corresponding to students living in more impoverished areas. That is, children from worse off areas are less likely to enter university (17%).

Panel B shows details on the academic performance at the GCSEs. Students enrolled in university take on average 10 subjects at the GCSE level and have quite high grades, with 88% taking at least 5 A*-C. Moreover, they have high grades in English and Mathematics, the two compulsory subjects for all students, given that the mean grade for all their cohort sitting the GCSE is 0 (See appendix B for the conversion of the grades into numerical

versity of Leeds, University of Liverpool, London School of Economics and Political Science, University of Manchester, Newcastle University, University of Nottingham, University of Oxford, University of Sheffield, University of Southampton, University College London and University of Warwick. Cardiff University and King's College London became part of the group in 1998. Queen's University Belfast also joined the group in 2006. Since 2012 the group extended to include 24 universities, with the addition of Durham University, University of Exeter, Queen Mary University of London and University of York. Thus, in our paper we refer to the Russell Group as all 20 universities that formed the group before 2011/12.

[15]The School Census replaced the Pupil Level Annual Schools Census in 2006 for secondary schools.

[16]This is a binary indicator of whether a pupil's family has claimed eligibility for free school meal. Only pupils from families that receive income benefits are eligible.

grades), and those that end up in tertiary education have on average a grade of around 0.7. Finally, students in university also attended better secondary schools, which have higher average test scores in English and Mathematics at the GCSE compared to the overall cohort for which the average standardised scores are 0.

In summary, this rich data allows us to follow natives through the education system and to analyse how the increasing inflow of non-UK domiciled students has affected the enrolment of these natives, as well as which categories of natives are more likely to be affected and how.

5 Empirical strategy

In this section we discuss the empirical strategy used to estimate the effect of the increasing inflows of foreign undergraduate students on English students. We begin by presenting the main estimation and then we describe the instrumental variable strategy used to control for potential endogeneity of the flows of foreign students.

5.1 Main estimation

The goal of this paper is to estimate the effect of changes in number of foreign students enrolled in British universities on UK domiciled students' enrolment rates. To do so, we estimate the following equation:

$$ln\ N_{ut} = \alpha_0 + \alpha_1 ln\ F_{ut} + d_t + d_u + d_u * t + \epsilon_{ut} \tag{1}$$

where $ln\ N_{ut}$ is the natural logarithm of the total number of natives enrolled in university u in academic year t; $ln\ F_{ut}$ is the natural logarithm of the total number of non-UK domiciled enrolled; d_t and d_u are university and time fixed effects, respectively; $d_u * t$ captures the interaction between university fixed effects and a time trend; ϵ_{ut} is the residual.

The full array of fixed effects account for the university and time specific conditions that would bias results if omitted. The interaction between the university fixed effects and a time trend controls for time-varying university specific characteristics. Moreover, by controlling for this array of fixed effects we believe that our estimation is not affected by the various changes in the British higher education funding system which took place during the period covered in the analysis (for instance, increases in the level of tuition fees and changes in the nature of the fees from upfront to a deferred system or increases in maintenance grants and loans).[17]

[17] As briefly explained in section 2.3 various changes in the funding of higher education in the UK have been in place since the late 1990s. The first major change was the introduction of income contingent tuition fees in the academic year 1998/99, which forced to pay up to approximately £1,000 at the beginning of each academic year. The Higher Education Act 2004, effective from 2006/07, changed the regime again through the introduction of variable tuition fees. English, Welsh and Northern Irish universities had discretion over the level of the tuition fees charged, up to a maximum of £3,000 per annum (inflation indexed), with Scotland implementing different policies. Although these fees were not means tested, all native students were eligible to apply for tuition fee loans, independent of their economic situation and the value of the loan would cover the entire cost of tuition fee, payable in instalments, after graduation and once their income level exceeded £15,000 and the interest rate was very small, close to zero. During the period under analysis, the maintenance grants which were halved in 1998 and then abolished in 1999, were reintroduced in 2004/05.

We cluster standard errors at university level. The coefficient of interest is α_1. The inclusion of both the dependent and the independent variables in logarithmic forms allows the coefficient of interest, α_1, to be interpreted as an elasticity. An estimate of $\alpha_1 >= 0$ implies that extra foreign students crowd in natives across universities, while an estimate of $\alpha_1 < 0$ implies a crowding out effect.

When estimating equation (1) we assume that universities make centralized adjustments to student numbers across fields of study. However, when applying for an undergraduate degree in a British university, students choose the specific degree they want to pursue, not only the university. Thus, we further explore the variation in the numbers of students enrolled in each university - field of study group:

$$ln\ N_{uft} = \beta_0 + \beta_1 ln\ F_{uft} + d_u + d_f + d_t + d_{tf} + d_{uf} + d_{tu} + d_{uf} * t + \epsilon_{uft} \quad (2)$$

where $ln\ N_{uft}$ is the natural logarithm of the total number of natives enrolled in university u and field of study f in academic year t; d_u, d_f and d_t are time, university and field of study fixed effects respectively; d_{tf}, d_{uf} and d_{tu} are the two-way interactions of time and field of study, university and field of study, time and university, respectively; $d_{uf} * t$ captures the interaction between university and field of study fixed effects and a time trend; ϵ_{uft} is an idiosyncratic error term.

Equation (2) encompasses the fact that some students may shift within university across fields of study due to larger inflows of foreign students. The fixed effects imply that the coefficient of interest, β_1, is identified by the variations over time within narrowly defined university - field of study cells. This should directly identify the effect of foreign students on the group of natives most closely competing with them. A non-negative estimate of β_1 implies that larger influxes of non-UK domiciled students crowd in students within universities across fields of study.

In estimating both equations (1) and (2) we face the problem that the number of foreign students enrolled is arguably endogenous to the number of native students enrolled, and Ordinary Least Squares (OLS) estimates of α_1 and β_1 would be biased. One major source of unobserved heterogeneity is represented by unobserved shocks to university available places. For instance, if universities expand and invest in building new teaching facilities and in hiring more teaching staff, they can enrol simultaneously higher levels of native and foreign students. In this case, one might find a positive spurious correlation between native and foreign numbers. Thus, in the following subsection we propose solutions for this issue.

5.2 Instrumental variable estimation

We use an instrumental variable strategy to address the problem of endogeneity of foreign students inflows. The ideal instrument is correlated with current flows of foreign students in universities, but uncorrelated with all the other factors that determine current flows of native students enrolled in universities.

We use the approach pioneered by Card (2001), Card (2005), Card (2009) in the labour economics literature on immigration, which uses the fact that immigrants from a particular

In addition, there have been a number of increases in means tested maintenance loans throughout the period of analysis.

source country tend to move into cities where migrants from their country have settled down in the past, to define an instrument to control for this potential endogeneity. The intuition is that the current flow of immigrants to a city is correlated with historical population shares into that city: a city with historically high shares of immigrants from a particular sending country is prone to receive more immigrants from that country when the national level of immigrants from the source country increases, compared to a city with historically low shares. Thus, the current inflow of immigrants from each sending country is instrumented by historical shares of immigrants into that city multiplied by the current national level of foreigners from the source country. The main assumption is that the national level inflows of foreigners from each country is exogenous to city conditions.

In the context of higher education, the conceptual analogue is that students from a particular sending country are more likely to go to universities and pursue degrees in subjects more popular among previous students from their own country. The main channel through which this prediction works is the network created among foreign students from the same country with prospective students from home. Thus, for α_1 we use the predicted flow of foreign students in university u defined as the sum over all countries of origin of the product between the share of foreigners from each country c in university u at time t_0 and the total number of foreigners from country c at time t as an instrument for the total flow of foreigners in a given university - time cell:

$$Z_{ut} = \sum_c \frac{F_{uct_0}}{F_{ct_0}} F_{ct} \tag{3}$$

where F_{uct_0} stands for the total number of foreigners domiciled in country c and enrolled in university u at time t_0; F_{ct_0} captures the total number of foreigners domiciled in country c and enrolled in all British universities at time t_0; F_{ct} is the total number inflow of foreigners domiciled in country c at current time t; time t_0 is defined as the period 1998/99-2003/04 in our estimation.[18]

The relevance of the instrument rests on the notion the current relative flow of foreign students in a university is related to historical shares of foreigners in that university. In other words, enclaves of students from a specific country in a university in the past are good predictors of the current flow of students from that specific country in the university. Panel A in figure (3) plots the current inflow rate of foreign students in each university against the corresponding supply-push flows, while panel B plots the same measures but aggregated at university-field of study level. For reference, we have superimposed a 45-degree line on the figure. The correlation between the actual and supply-push inflows is strong, even though there are universities with lower or smaller inflows than predicted based on earlier foreign inflows. The first stage estimates presented in table (3) further bring evidence that our instrument is strong, satisfying the relevance criteria.

[18] We use a similar instrument for β_1: the predicted flow of foreign students in university u and field of study f defined as the sum over all countries of origin of the product between the share of foreigners from each country c in university u and field of study f at time t_0 and the total number of foreigners from country c at time t as an instrument for the total flow of foreigners in a given university - field of study - time cell:

$$Z_{uft} = \sum_c \frac{F_{ufct_0}}{F_{ct_0}} F_{ct} \tag{4}$$

where F_{ufct_0} is the total number of foreigners domiciled in country c and enrolled in university u and field of study f at time t_0.

The key identification assumption is that inflows of foreign students enrolled at least six years ago are uncorrelated with other unobserved determinants of current enrolment rates of natives. Because our source of identification depends on flows of non-UK domiciled students enrolled at least six years ago, it is arguably exogenous to the sources of potential endogeneity outlined above.

6 Results

In this section we examine how the increase in the number of undergraduate first year foreign students enrolled in British universities affected the enrolment of native students. We proceed by first describing the overall effect, both across universities and within university - field of study pairs. We then analyse how the composition of the native student body was affected, both in terms of their their academic performance and demographic characteristics. It is worth noting that our main results are based on the group of natives enrolled directly after finishing secondary education, although we test in the next section how robust our results are when we include those natives that took gap years before pursuing an undergraduate degree.

6.1 Overall effect

Table (4) shows estimates of the effect of the increasing inflow of foreigners on natives' enrolment. Both OLS and IV estimates are presented. In the first four columns data is aggregated at university-year level and the table reports estimates of α_1. In the last four columns data is aggregated at university-field of study-year level in order to account for the fact that universities have an additional margin of adjustment across fields of study; we report the estimates of β_1. In columns (1) and (3) and in columns (5) and (7) we do not control for the university specific and university-field of study specific, respectively, time variant components, whereas in columns (2) and (4) and in columns (6) and (8) we control for them. None of the four coefficients reported in columns (1)- (4) is statistically significant, suggesting that there is no effect of the influx of foreign students on natives' enrolment across universities. What emerges from comparing the OLS and the IV estimates in the last four columns, is that even though the OLS estimates seem to be positive and statistically significant, the IV estimates are not, showing that there is no evidence of either crowding in or crowding out within universities and across fields of study. We interpret these findings as resulting from the government quotas on the number of native students that was in place during the period under study.

It is worth noting that our findings are in line with the ones of Machin & Murphy (2014) who also find no evidence of any effect of overseas students on undergraduate natives enrolled in British universities, through using a similar estimation strategy to ours, but a different time period.[19]

[19]Machin & Murphy (2014) use an estimation in which both the dependent and the independent variable are expressed in first differences in order to account for university time varying characteristics. In our estimation, although our dependent and independent variable are expressed in levels, by including the $d_u * t$ or the $d_{uj} * t$ among the regressors we account for this.

Even though we find no overall effect, there could still be distributional effects for native undergraduate students. For example, the quality of the native student body in terms of their academic performance could be altered by the larger inflows of foreign students. One hypothesis is that the marginal native student is crowded out by foreign students if universities have limited resources and recruit more able non-UK domiciled students. Another possible hypothesis is that high influxes of able foreign students increase the perceived quality of the universities they attend, attracting more top performing students. Thus, in the following subsection we investigate which type of native students benefit or suffer from the higher competition from foreign students.

Given that the UK has a diverse demographic group of students, we then proceed by investigating if there are distributional effects by demographic characteristics. We mainly focus on gender, social economic status and ethnic origins.

6.2 Distributional effects

For the distributional analysis we adapt equations (1) and (2) in two ways. First, the outcome variable is the natural logarithm of the total number of natives with the specific characteristic j analysed. Second, we identify differentially the effect of the inflow of foreigners for each group of natives, estimating the model without a constant:

$$lnN_{jut} = \sum_j \gamma_j X_j + \sum_j \omega_j lnF_{ut} X_j + d_t + d_u + d_u * t + \epsilon_{jut} \tag{5}$$

where lnN_{jut} is the natural logarithm of natives with characteristics j enrolled in university u in academic year t (for instance, the total number of enrolled native female students) ; X_j a categorial variable equal to 1 for characteristic j.

A similar equation is estimated for the analysis of the effect across fields of study:

$$lnN_{juft} = \sum_j \delta_j X_j + \sum_j \sigma_j lnF_{ut} X_j + d_u + d_f + d_t + d_{tf} + d_{uf} + d_{tu} + d_{uf} * t + \epsilon_{uft} \tag{6}$$

where lnN_{juft} is the natural logarithm of natives with characteristics j enrolled in university u and field of study f in academic year t.

Our variables of interest are ω_j and $\sigma_j$which measure the differential effect of the inflow of foreign students on natives distribution based on characteristic j across universities and across fields of study, respectively.[20]

6.2.1 Native students' academic performance

We begin our analysis by focusing on the distributional effects of the native student body. We measure students' academic performance before entering university using the standardised GCSE test scores in Mathematics and English. Specifically, we use the entire cohort of students eligible for the GCSEs (both enrolled and not enrolled in university) to separate

[20]It is worth mentioning that this type of estimation requires the data to be expanded, based on the number of categories considered for each characteristic under study.

students in two groups: those who scored below and those who scored above the median grades in either English or Mathematics.

In table (5) we present the results from estimating equation (5) and (6), with j referring to the distribution of the GCSE grades. In columns (1) - (4) we report estimates of ω_j and in columns (5) - (8) we present estimates of σ_j.In panel A we measure native students' ability using the English test scores. The IV estimates are statistically significant across all estimations in the university - field of study - time aggregation for top native pupils, as natives with test scores above the median tend to be crowded in. Specifically, as it can be seen in column (8) a 1% raise in the number of foreign students increases the number of native students with grades above the median GCSE English grades by 0.14%.

Panel B focuses on the Mathematics test scores and shows that marginal native students are crowded out, while the top students are crowded in by mobile students. However, the effect is statistically significant only for the best native students. Our preferred IV estimates presented in column (8) indicate that an increase of 1% in the number of foreign students increases the number of natives students with grades above the median GCSE English grades by around 0.23%.

Findings so far lend support to the idea that even though on average foreign students do not affect the enrolment of natives in British universities on average, they crowd in top natives students across fields of study. We next test whether these students come from top performing secondary schools.

6.2.2 Quality of the secondary school attended

As the top native students benefit of the larger inflows of mobile students, we now investigate if these students come from the best secondary schools, when we measure a school's quality using the average standardised test scores in the GCSE Mathematics and English at school level.

Table (6) presents the estimates obtained. Panels A and B distinguish between two different measures of the quality of the school: the average GCSE English at school level and the average GCSE Mathematics at school level, respectively. Results are in line with the previous ones as it is students from top schools that are crowded in, school which are also more likely to teach the best pupils. When comparing the findings from column (8) in panels A and B, the magnitude of the effect is not very different for English and Mathematics test scores, implying that a 1% increase in the number of foreign students triggers a 0.10% increase in the number of native students coming from top secondary schools.

All in all, our results suggest that top performing students benefit from the increased competition from foreign students, and it is mainly those who attended the best state English secondary schools that are crowded in across fields of study.

6.2.3 Gender

We now extend the analysis to explore whether the demographic composition of the student body has been altered by the larger inflows of foreign students. We begin by exploring

the distributional effects by gender given the largely documented educational gender gap (OECD (2012)).

Table (7) presents the estimates of the effect of the increase in foreign students on natives' gender composition. Both the OLS and the IV estimates presented in columns (1) - (4) suggest that men are crowded in by foreign students. However, our preferred IV estimates are not statistically significant and the low value of the F statistic reported in column (4) suggests that the instrument is too weak. Moreover, the IV estimates for female and male are different from each other only at the 10% significance level, as the reported p-value shows.

Columns (5) and (8) show the results obtained through exploring the variation at university-field of study level across time. Both the OLS and the IV estimates are statistically significant for men, implying a positive effect of the inflow on foreign students on native male. The IV estimates show that a 1% increase in the number of enrolled undergraduate foreigners increases the number of native males by around 0.13%. Furthermore, the estimates are different between male and female at all statistical significance levels, with a p-value of zero. The large F statistics also points to a strong instrument.

Thus, although there is no change of the distribution of natives by gender across universities due to the larger inflow of foreign students, male students are crowded-in across fields of study. We believe that these findings are in line with the ones from the analysis by academic performance when we found that top performing native students are crowding in with a larger magnitude of the effect for students performing well in Mathematics, given that among those enrolled in university native men score higher on average in GCSE Mathematics compared to women.

6.2.4 Social Economic Status

Given that financial constraints can be a detriment to university enrolment, in table (8) we present the analysis of how the higher competition from foreigners has impacted the composition of the native student body by social economic status. We use two different dimensions to define the social economic status of natives: the eligibility for free school meal at age 16 and the IDACI score.

The eligibility for free school meal is a good proxy of a student's family financial situation, as it is only students from families with various income support or benefits that are eligible for this. Panel A shows how the effect of larger foreigners enrolled differs for natives based on their free school meal eligibility. The IV estimates presented in columns (3) and (4) show no statistically significant effect for either group of natives, when we use the variation at university level. Moreover, the estimates are not statistically different from each other. When we explore variation in the number of students at university - field of study level, the IV estimates reported in columns (7) and (8) show that it is mainly students who are not eligible for free school meal who are crowded in. However, the large p-values suggest that estimates for the two groups are not statistically different from each other even at the 10% significance level.

The other measure of the social economic status that we use is the IDACI score, which is defined at local level and quantifies the proportion of children under 16 living in families

that are income deprived. Thus, the larger the score, the more deprived is the area where the student was domiciled at age 16. The results presented in Panel B show that the less deprived native students are crowded in by large inflows of foreign undergraduate students, although the IV estimates are statistically significant only in columns (7) and (8). However, the estimates for the two groups are different from each other only at the 10% significance level.

We can conclude that there is limited evidence of a differential effect for natives by social economic status, with the results suggesting that if anything, it is the richer pupils that are crowded in by foreign students across fields of study.

6.2.5 Ethnicity

Given the wide ethnic diversity of English-born pupils, we further analyse how the distribution of natives by ethnic characteristics is affected by the inflow of foreign students. First, we distinguish between students for whom English is the main language spoken at home and those for whom it is not. Then we qualify students by their ethnicity: White, Asian, Black or other. Results are reported in table (9).

In panel A, the IV estimates are statistically significant across all estimations in the university - field of study - time aggregation for native pupils whose first language spoken at home is not English. As column (8) shows a 1% increase in the number of foreign students implies a 0.18% increase in the number of natives whose first language is not English pursuing an undergraduate degree. Moreover, the low p-value suggests that the estimated coefficients are statistically different by language groups. Thus, natives whose first language is not English are not crowded in across universities, but across fields of study.

Panel B brings further evidence to support this finding. Results reported in columns (1) - (8) point out that it is native students of Asian origin that seem to be crowded in by foreign students. The IV estimates are statistically significant at 1% across all estimations. That is, as columns (4) and (8) show, a 1% increase in the number of foreigners enrolled triggers an increase in the number of native students of Asian origins by 0.29 and 0.21% across universities and across fields of study, respectively. Furthermore, even though the results are not statistically significant for the other ethnic groups, the low p-value suggests that there are distributional effect across ethnic groups.

Our results suggest that English-born students whose first language is not English and who are mainly of Asian origin are crowded in across fields of studies. Moreover, UK students of Asian origin are also crowded in across universities. Findings in this subsection lend support to the idea that UK pupils from ethnic minorities, and especially of Asian origin, outperform white British pupils by the time they sit their GCSE, despite lower average attainment at earlier ages (Strand (2008), Dustmann, Machin & Schonberg (2010), Rutter (2016), Strand (2014), Hutchinson, Johnes, Mao, Perera, Sellen & Treadaway (2016)).

Our analysis of distributional effects of the foreign inflow of undergraduate students brings evidence that although there is no effect across universities, there are distributional effects within universities, across fields of study.

7 Robustness checks

In this section we check how robust our results are to various estimations. First, we consider all native students, even if they enrolled with gap years. Then, we also account for changes in the population of English students that could have gone to university or any behavioural changes in their university going.

7.1 Gap and no gap year

Our rich individual level data allows to track English pupils and to distinguish between those who enrol into university straight after secondary school and pupils who delay their entrance, through taking gap years. So far in the analysis we have differentiated between cohorts of pupils, focusing only on students who entered university without taking any gap year. However, in this section we check if our results are robust to the inclusion of native students who took gap years in our sample. The rational behind a differential effect is that native students select into taking their gap year. For instance, they could be students who are financially constraint and cannot pursue a full time undergraduate degree immediately after graduating their secondary school.

Panel A of table (10) presents the results of estimating equations (1) and (2), when the outcome variable includes all full time first year undergraduate natives who enrolled with or without a gap year. The findings are very similar to the ones reported in table (4), suggesting that those native students enrolled with gap years are not differentially affected by the inflow of mobile students, compared to native students who enrolled straight after finishing secondary school.

7.2 Population at risk

So far we have not accounted for the population of English pupils that could have gone to university. It could be the case that less natives are enrolled in universities due to decreasing natives population or behavioural changes in natives' university going. Thus, we further control for the population at risk among natives, accounting for those that could have enrolled as well.

We propose a way to predict the native population at risk in order to account for changes in the population of English students that could have gone to university or any behavioural changes in their university going. In theory, each individual could go to any of the 139 British universities in the choice set. However, as individuals have different characteristics the probability that one attends each of the institutions is different for each person. To operationalise the notion of population at risk, we pool the data on all English pupils who finished their compulsory education and sat their GCSEs between 2001/02-2008/09, independently of whether they enrolled in university between 2004/05-2011/12 or not, and estimate for each person, based on individual characteristics (demographics and pre-university academic performance) their probability to attend each university. Using this pooled data, we estimate a multinomial logit model of the following form:

$$Pr(y_i = u) = \frac{exp(X'\gamma_u)}{1 + \sum_u exp(X'_i\gamma_u)} \tag{7}$$

with $y_i = 0, 1, ...139$ a categorical variable equal to 0 if native student i does not go to university or if enrolled with a gap year, and u if they go to university u; X_i are individual level characteristics which vary only across individuals and not across universities.[21] From this model we predict for each individual i their probability to enrol into each of the 139 universities and we define the population at risk for each university as the sum of these predicted probabilities.

Thus, in panel B of table (10) we estimate an amended version of equation (2), through also controlling for the population at risk. It is worth noting that due to computational limitations, we were not able to compute the population at risk at university-field of study level. However, given that the similarity of our estimates to the one presented in columns (1) - (4) in table (4), we believe our results will not change in the aggregation at university - field of study level with the inclusion of this control.

To sum up, in this section we have shown that our results are not altered when we also consider natives who take gap years or when we control for changes in the university going behaviour of natives or in their cohort size.

8 Mechanisms

So far we have not discussed the potential mechanism that could explain our results. It could be the case that top performing native students are crowded in by foreign students as the latter bring additional financial resources to universities. In particular, if this was the case we would expect the effect of the inflow of foreign students domiciled outside the EU to be positive as they are paying much larger tuition fees. We test for this hypothesis by distinguishing between foreign students by their domicile. Moreover, we further test this hypothesis by distinguishing between Russell Group and Non-Russell Group universities as the former group includes universities with high international reputation which attract large inflows of international students and also charge higher tuition fees compared to the rest.

Apart from financial resources, foreign student could also crowd in top performing natives if they increase the quality of the university attended. This could happen if, for instance, non-UK domiciled students are very able students. We test for this hypothesis by investigating the effect of the inflow of foreign students on university ranking.

8.1 EU vs Non-EU students

Given that universities distinguish between EU and non-EU students in terms of the level of tuition fees and the regulations for places available and financial support, we further analyse

[21] These variables are demographic characteristics (gender, ethnicity, eligibility for free school meal, special education needs indicator, IDACI score, first language spoken at home), geographical characteristics (we use the distance to the closest three universities calculated using the postcode of each of the 139 universities and the centroid of the lower layer super output area where each pupil lives at age 16 (available in the NPD), following the approach of Gibbons & Vignoles (2012) who show that geographical distance is a key factor in the university choice in England) and academic performance measures (the standardised test scores in English and in Mathematics at the GCSEs as well as the mean test scores in English and Mathematics at school level).

the robustness of our results when the inflow of foreigners is differentiated between EU and non-EU domiciled students. In panel A of table (10) we measure the inflow of foreign students only as the inflow of non-EU domiciled students, while in while panel B we focus only on EU students rather than the total foreigners as we have done so far. In each panel we present estimates of α_1 and β_1 from equations (1) and (2) when we use different measures of the mobile students.

What emerges from the comparison across columns and these two panels, is that in the IV estimations, which are our preferred estimations, the overall effect is not statistically significant for either measure of foreign inflows. When comparing these results to the ones reported in table (4) the estimates are quite similar, suggesting that our findings are not driven by the higher financial resources brought by non-UK domiciled students.

8.2 Russell Group vs. Non-Russell Group university

We proceed by distinguishing between Russell Group and Non-Russell Group universities as the former group includes universities with high international reputation which attract large inflows of international students and also charge higher tuition fees compared to the rest. For this we divide universities based on their belonging to the Russell Group which includes the best 20 research universities in the UK, which were part of the group until 2011/12. Results are reported in panel C of table (11). Columns (1) and (2) present the estimates of ω_j from estimating (5). The IV results show a crowding out from top universities due to larger inflows of foreign students. Our preferred estimate, reported in column (2), is significant only at the 10% significance level. Moreover, the low F statistic, which is considerably below 10, indicates that the results should be interpreted with caution as the instrument is weak.

In columns (3) and (4) the analysis is done using data grouped at university-field of study and estimates of σ_j are reported. The large F statistics suggests a strong instrument. The positive estimates presented in column (4) for the non-Russell group and the negative effect for the Russell group suggest that our baseline estimates are not triggered by the larger fees paid by foreign students enrolled in top universities, although none of the estimates is statistically significant.

8.3 University ranking

We proceed by exploring another potential mechanism. In particular, we want to understand whether the large inflows of foreign students crowds in top performing natives as they had a positive effect on the ranking of the university attended. For this we use an additional data set, called the Sunday Times Good University Guide between 2004/05-2011/12.[22] This league table is published yearly and ranks around 120 British universities each year. As discussed in section 2.3 the importance of British league tables to prospective students has been documented in the literature, with students sorting into universities based on these rankings. We use the overall university ranking which is derived using a comprehensive list of scores including expenditure per student, student-staff ratio, job prospects, university

[22]The data was kindly provided by Alastair McCall, editor of the The Sunday Times Good University Guide.

entry scores, teaching or research quality. The ranking represents a comparable index of university quality, allowing us to further bring light on whether universities are becoming more competitive due to the higher inflow of foreign students.

Panel D in table (11) shows the estimates of α_1 from estimating equation (1) when the outcome variable is the overall ranking of university. As we have data only at university level, we cannot run the analysis at university-field of study level. Both the OLS and the IV estimates presented in columns (1) and (2), respectively, are positive. The latter suggests that a 1% increase in the number of foreign students triggered an increase in the university ranking of around 0.07. However, the estimate is only significant at the 10% significance level and the F statistics is just below 10. Thus, we interpret this result as suggestive that the influx of foreign students increased the quality of universities, but the effect is of small magnitude and only just significant.

Our analysis indicates that the crowding in effect we identify for top performing natives is not due to the larger financial resources brought by non-EU domiciled students. We find limited evidence that the inflow of mobile students triggered a slight increase in the quality of universities.

9 Discussion and conclusion

In this paper we study whether the inflows of first year full-time undergraduate foreign students enrolled in British universities had any impact on the enrolment of native undergraduate students. We combine very rich individual level administrative data on eight cohorts of English students and on non-UK domiciled undergraduate students to run the analysis. We employ an IV estimation in order to control for the potential endogeneity of the influxes of mobile students. Specifically, we use historical shares of students from a sending country enrolled into a university together with current national changes in the stock of students from this country to instrument the current flows of foreign undergraduate students attending a university. By using a rich array of fixed effects we also ensure that the various of changes in the higher education funding that took place during the period under analysis did not affect our results.

Our results confirm previous findings in the literature that there are no effects on average. As these overall effects could mask distributional effects we extend the analysis to offer the first analysis of changes in the composition of enrolled native undergraduates due to the larger number of enrolled foreign students in British universities. Our results show that it is mainly the top performing native students and English pupils from top secondary schools that benefit from the increased enrolment rates of foreign students in British universities. Moreover, we find that male natives and natives whose first language is not English, as well as natives of Asian ethnic origins are crowded in by foreign students. Our distributional analysis by natives' demographic composition complements our distributional analysis by natives' ability, as there is a large literature that shows that in England students of Asian origins tend to score better than UK-born white pupils in the GCSE.

Given that all our results are identified within universities across fields of study, we believe that our findings support the idea that some students shift within university, across fields

of study due to the larger inflows of foreign students. Our results suggest that universities benefit from enrolling more foreign students as they seem to attract more able native students, becoming more competitive. From an equity point of view, universities also attract more natives from minority groups which were under-represented in higher education.

Our analysis of potential mechanisms shows that the crowding in effect we identify for top performing natives is not due to the larger financial resources brought by students domiciled outside the EU who pay on average much higher tuition fees compared to natives and EU-domiciled students. We find limited evidence that the inflow of foreign students crowds in top natives through increasing the quality of the university. Potential alternative mechanisms for our distributional effects could be that the high quality foreign students enrolled trigger also an increase in the perceived quality of the universities they attend and consequently attract more able native students. Moreover, it could be the case that top performing students prefer to enhance their student experience by enrolling into a university with a culturally rich international environment.

Regarding the policy implications of our paper, we believe that our findings are suggestive that governments should encourage the increase in the number of foreign students into universities as they benefit the top performing native students and also do not have any detrimental effect on the marginal native students. Moreover, immigration policies should account for these effects at higher education level and not only at the labour market level, maybe through not including students in migrants' quotas.

References

Bertrand, M., Dufloo, E., & Mullainathan, S. (2004). How Much Should We Trust Differences-in-Differences Estimates? *Quarterly Journal of Economics*, *1*(119), 249–275.

Betts, J. (1998). *Educational Crowding Out: Do Immigrants Affect the Educational Attainment of American Minorities?* Russell Sage Foundation.

BIS (2013). International Education Global Growth and Prosperity: An Accompanying Analytical Narrative. Technical Report BIS/13/1082.

Borjas, G. (2007). Do foreign students crowd out natives from graduate programs? In R. Ehrenberg & P. Stephan (Eds.), *Science and the University* (pp. 134–149). Wisconsin: University of Wisconsin Press.

Borjas, G., Freeman, R., & Katz, L. (1996). Searching for the Effect of Immigration on the Labor Market. *The American Economic Review*, *86*(2), 246–251.

Borjas, G. J. (2003). The Labor Demand Curve Is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market. *Quarterly Journal of Economics*, *4*(118).

Broecke, S. (2015). University rankings: do they matter in the UK? *Education Economics*, *23*(2), 137–161.

Card, D. (1990). The Impact of the Mariel Boatlift on the Miami Labor Market. *Industrial and Labor Relations Review*, *2*(43), 245–257.

Card, D. (1995). Using Geographic Variation in College Proximity to Estimate the Return to Schooling. In L. Christofides, E. Grant, & R. Swidinsky (Eds.), *Aspects of Labor Market Behaviour: Essays in Honour of John Vanderkamp Toronto*. Toronto: University of Toronto Press.

Card, D. (2001). Immigrant Inflows, Native Outflows, and the Local Market Impacts of Higher Immigration. *Journal of Labour Economics*, *19*(1), 22–64.

Card, D. (2005). Is The New Immigration Really So Bad? *Economic Journal*, *115*, F300–F323.

Card, D. (2009). Immigration and Inequality. *American Economic Review*, (99), 1–21.

Chevalier, A. (2014). Does Higher Education Quality Matter in the UK? Discussion Paper No.8363, IZA.

Chevalier, A. & Jia, X. (2015). Subject specific league tables and students' application decisions. Discussion Paper Series WP 2015/03, UCD Geary Institute for Public Policy.

Dustmann, C., Fabbri, F., & Preston, I. (2005). The Impact of Immigration on the British Labour Market. *The Economic Journal*, *115*(507), F324–F341.

Dustmann, C., Fabbri, F., Preston, I., & Wadsworth, J. (2003). Labour Market Performance of Immigrants in the UK Labour Market. *Home Office Online Report*, (05/03).

Dustmann, C., Machin, S., & Schonberg, U. (2010). Ethnicity and Educational Achievement in Compulsory Schooling. *The Economic Journal*, *120*(546), F272–F297.

Gibbons, S., Neumayera, E., & Perkinsa, E. (2015). Student satisfaction, league tables and university applications: Evidence from Britain. *Economics of Education Review*, *48*, 148 – 164.

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

Gould, E., Lavy, V., & Paserman, D. (2009). Does Immigration Affect the Long-Term Educational Outcomes of Natives? Quasi-Experimental Evidece. *The Economic Journal*, *119*, 1243–1269.

Heiss, F. (2002). Structural choice analysis with nested logit models. *The Stata Journal*, *2*(3), 227–252.

Hoxby, C. M. (1998). *Do Immigrants Crowd Disadvantaged American Natives Out of Higher Education?*, (pp. 282–321). Russell Sage Foundation.

Hunt, J. (2012). The Impact of Immigration on the Educational Attainment of Natives. *NBER Working Paper No. 18047*.

Hutchinson, J., Johnes, R., Mao, L., Perera, N., Sellen, P., & Treadaway, M. (2016). Education in England. Annual report 2016, Education Policy Institute.

Jackson, O. (2015). Does Immigration Crowd Natives Into or Out of Higher Education? *Working Paper Federal Reserve Bank of Boston*, (15-18).

Kato, T. & Sparber, C. (2013). Quotas and Quality: The Effect of H-1B Visa Restrictions on the Pool of Prospective Undergraduate Students from Abroad. *The Review of Economics and Statistics*, *95*(1), 109–126.

Long, B. T. (2004). How have college decisions changed over time? An application of the conditional choice model. *Journal of Econometrics*, (121), 271–296.

Machin, S. & Murphy, R. (2014). Paying Out and Crowding Out? The Globalisation of Higher Education. CEP Discussion Paper CEPDP1299, Center of Economic Performance.

Manacorda, M., Manning, A., & Wadsworth, J. (2012). The Impact of Immigration on the Structure of Wages: Theory and Evidence from Britain. *Journal of the European Economic Association*, *10*(1), 120–151.

OECD (2012). The ABC of Gender Equality in Education: Aptitude, Behaviour, Confidence. Report, OECD.

Ottaviano, G. I. & Peri, G. (2012). Rethinking the Effects of Immigration on Wages. *Journal of the European Economic Association*, *1*(10), 152–197.

Rutter, J. (2016). Back to Basics: Towards a Successful and Cost-Effective Integration Policy. Report, Institute for Public Policy Research.

Soo, K. (2013). Does anyone use information from university rankings? *Education Economics*, *21*(2), 176–190.

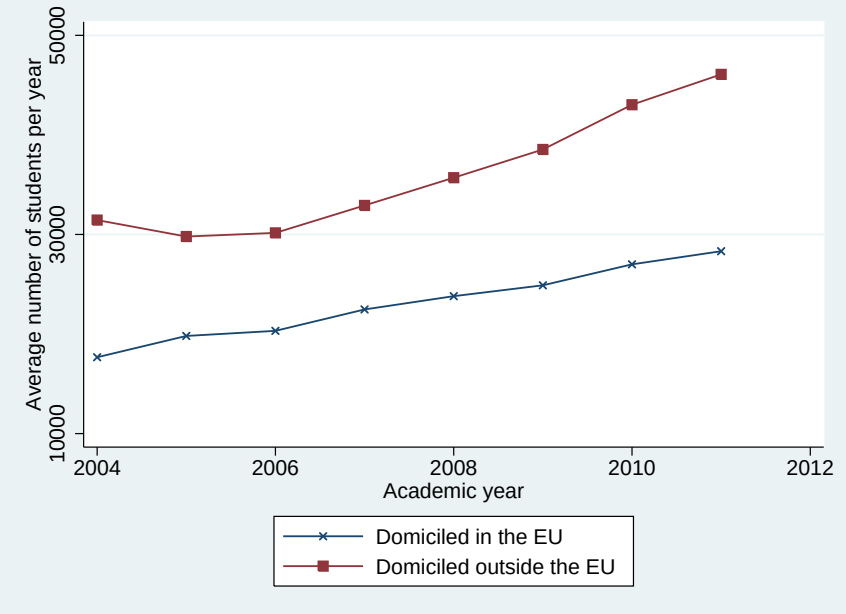
Strand, S. (2008). Minority ethnic pupils in the Longitudinal Study of Young People in England: Extension Report on Performance in Public Examinations at Age 16. *DCSF Research Report RR-029*.

Strand, S. (2014). Ethnicity, Gender, Social Class and Achievement Gaps at Age 16: Intersectionality and 'Getting it' for the White Working Class. *Research Papers in Education*, *29*(2), 131–171.

Strand, S. (2015). Ethnicity, Deprivation and Educational Achievement at Age 16 in England: Trends over Time. *DFE Research Report 439B*.

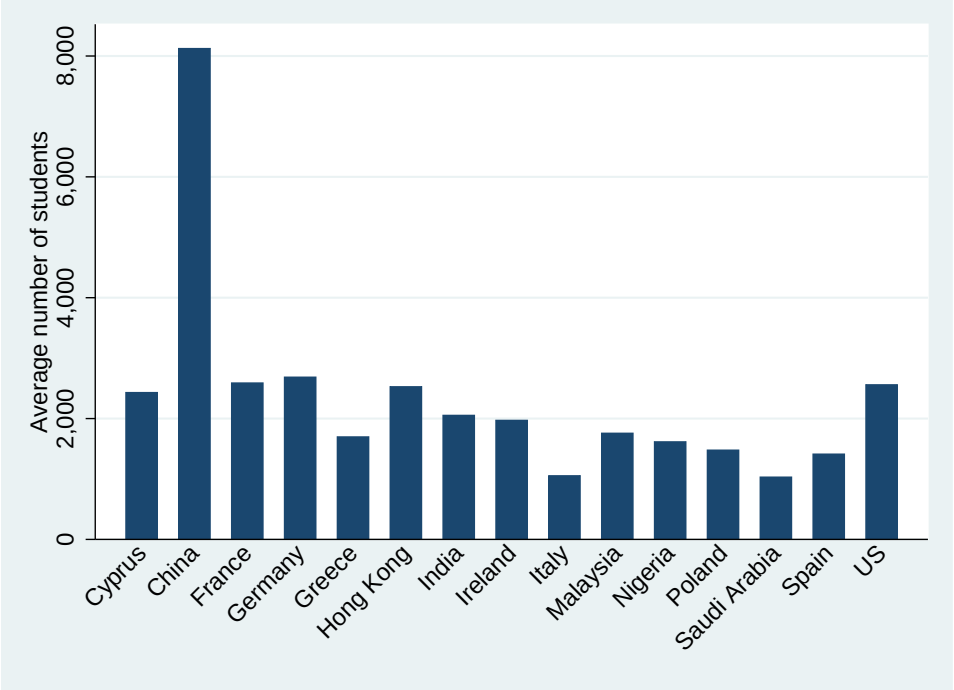
Tables and figures

Figure 1: Flows of foreign students by domicile



Notes: The figure depicts the average number of foreign undergraduate students enrolled in English universities between 2004/05-2011/12, distinguishing between those domiciled in the EU and those domiciled outside the EU. Source: Author's calculations using HESA student record data.

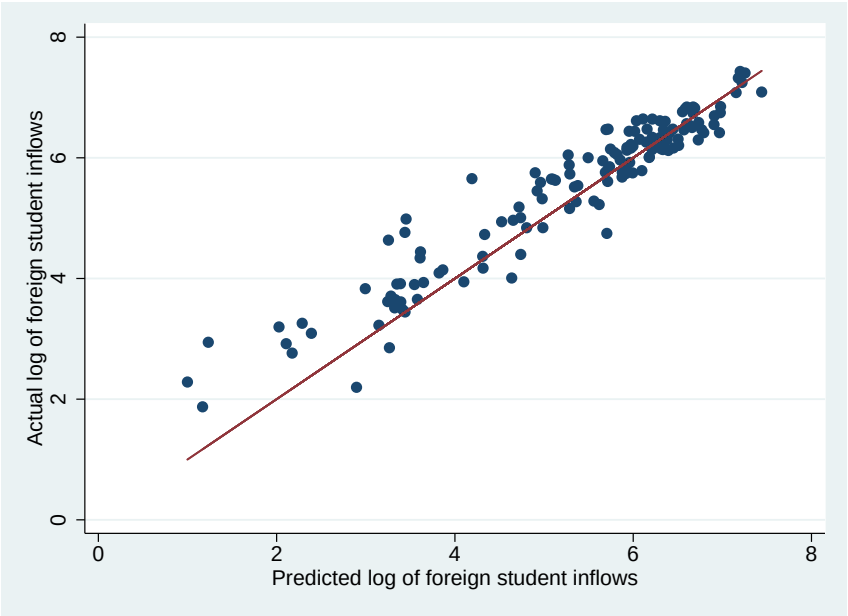
Figure 2: Top nationality among full-time first year undergraduate students



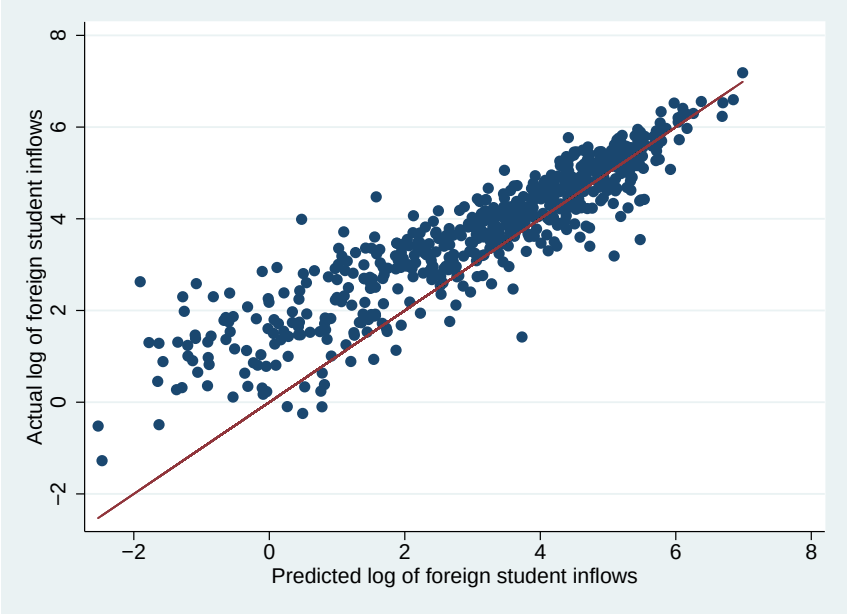
Notes: The figure depicts the top 15 nationalities among foreign undergraduate students enrolled in English universities between 2004/05-2011/12. Source: Author's calculations using HESA student record data.

Figure 3: Actual and supply-driven inflows of foreign students

Panel A: University level



Panel B: University-field of study level



Notes: The graph in panel A plots the actual inflow of foreign undergraduate students enrolled in English universities between 2004/05-2011/12 against the predicted inflows; the aggregation is at university level. The graph in panel A plots the actual inflow of foreign undergraduate students enrolled in English universities between 2004/05-2011/12 against the predicted inflows; the aggregation is at university - field of study level. Source: Author's calculations using linked NPD-HESA and the HESA student record data.

Table 1: University related characteristics by domicile

	Mean	SD	N
Panel A: Students domiciled in the UK			
Enrolled in a Russell group university	0.220	0.414	1,426,587
University by location			
English University	0.959	0.199	1,426,587
Welsh University	0.0296	0.169	1,426,587
Scottish University	0.0110	0.104	1,426,587
Northern Ireland University	0.001	0.027	1,426,587
Field of study			
Medicine, Dentistry and Allied Subjects	0.226	0.418	1,426,587
STEM	0.193	0.394	1,426,587
Social Sciences	0.294	0.456	1,426,587
Languages and History	0.114	0.317	1,426,587
Arts, Education, Other	0.173	0.378	1,426,587
Panel B: Students domiciled outside the UK			
Domiciled in an EU country	0.390	0.488	471,935
Domiciled in a non-EU country	0.610	0.488	471,935
Enrolled in a Russell group university	0.318	0.466	471,935
University by location			
English University	0.853	0.354	471,935
Welsh University	0.043	0.202	471,935
Scottish University	0.091	0.288	471,935
Northern Ireland University	0.013	0.113	471,935
Field of study			
Medicine, Dentistry and Allied Subjects	0.130	0.337	471,935
STEM	0.227	0.419	471,935
Social Sciences	0.415	0.493	471,935
Languages and History	0.101	0.301	471,935
Arts, Education, Other	0.126	0.332	471,935

Notes: The table shows university specific characteristics for all foreign 1st year undergraduate students enrolled in British universities domiciled in EU and outside the EU and for English pupils who sat the GCSEs in English state school and who enrolled as first year full time undergraduate in a British university at age 18/19 between 2004/05-2011/12. All reported variables are categorial variables equal to 1 for the specific variable. Source- author's own calculations using the NPD-HESA linked data.

Table 2: Demographic characteristics and academic performance of natives

	Mean	SD	N
Panel A: Demographics			
Female	0.549	0.498	1,426,587
White	0.802	0.398	1,426,587
Black	0.049	0.215	1,426,587
Asian	0.112	0.315	1,426,587
Other	0.037	0.189	1,426,587
English as first language	0.862	0.345	1,426,587
Free school meal	0.073	0.260	1,426,587
IDACI score	0.170	0.161	1,426,587
Panel B: GCSE academic performance			
No subjects sat GCSE	10.230	1.417	1,426,587
At least 5 A*-C GCSE	0.881	0.324	1,426,587
At least 5 A*-G GCSE	0.994	0.077	1,426,587
Std GCSE English	0.704	0.665	1,426,587
Std GCSE Mathematics	0.692	0.699	1,426,587
Average std GCSE English at school level	0.175	0.462	1,426,587
Average std GCSE Mathematics at school level	0.175	0.472	1,426,587

Notes: The table shows demographic and secondary school characteristics measured at age 16 for all English pupils who sat the GCSEs in English state school and who enrolled as first year full time undergraduate in a British university at age 18/19 between 2004/05-2011/12. The IDACI score is a number between 0 and 1: the higher it is, the worse off the children are. Source: author's own calculations using the NPD-HESA linked data.

Table 3: First stage estimates

	University level		University-field level	
	(1)	(2)	(3)	(4)
ln predicted Foreigners	0.610***	0.569***	0.416***	0.364***
	(0.112)	(0.161)	(0.039)	(0.042)
F statistic	29.423	12.439	115.906	75.458
Universities	139	139	139	139
Observations	1,112	1,112	4,915	4,915
University FE	X	X	X	X
Time FE	X	X	X	X
Field of study FE			X	X
University FE X Time FE			X	X
Field of study FE X Time FE			X	X
University FE X Field of study FE			X	X
University FE X Time trend		X		
University FE X Field of study FE X Time trend				X

Notes: The regressions in columns (1) - (2) use data on 139 universities, observed over 8 years. The regressions in columns (3) - (4) use data on 139 universities grouped in 5 fields of study, observed over 8 years. The outcome variable is the logarithm of the total number of English students who sat their GCSE in a state secondary school between 2001/02-2008/09 and who enrolled as first year undergraduates in each university without a gap year, between 2004/05-2011/12. Robust standard errors clustered at university level in parentheses. F statistics is based on the Kleinbergen-Paap Wald F statistics. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Overall effect of foreign students on natives' enrolment

	University level				University-field level			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln Foreigners	-0.023	0.016	-0.002	-0.093	0.071***	0.040**	0.060	0.039
	(0.046)	(0.058)	(0.136)	(0.152)	(0.021)	(0.017)	(0.043)	(0.045)
F statistic			29.423	12.439			115.906	75.458
Universities	139	139	139	139	139	139	139	139
Observations	1,112	1,112	1,112	1,112	4,915	4,915	4,915	4,915
University FE	X	X	X	X	X	X	X	X
Time FE	X	X	X	X	X	X	X	X
Field of study FE					X	X	X	X
University FE X Time FE					X	X	X	X
Field of study FE X Time FE					X	X	X	X
University FE X Field of study FE					X	X	X	X
University FE X Time trend		X		X				
University FE X Field of study FE X Time trend						X		X

Notes: The regressions in columns (1)-(4) use data on 139 universities, observed over 8 years. The regressions in columns (5)-(8)use data on 139 universities grouped in 5 fields of study, observed over 8 years. The outcome variable is the total number of English students who sat their GCSE in a state secondary school between 2001/02-2008/09 and who enrolled as first year undergraduates in each university between 2004/05-2011/12. Robust standard errors clustered at university level in parentheses. F statistics is based on the Kleinbergen-Paap Wald F statistics. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Effect on natives' enrolment by students' ability

	University level				University-field level			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: GCSE English								
ln Foreigners X Below median	-0.061	0.026	0.021	0.085	-0.009	-0.033	-0.002	-0.007
	(0.067)	(0.072)	(0.151)	(0.145)	(0.026)	(0.025)	(0.044)	(0.048)
ln Foreigners X Above median	0.113*	0.200***	0.177	0.241**	0.142***	0.119***	0.147***	0.142***
	(0.061)	(0.065)	(0.124)	(0.122)	(0.026)	(0.024)	(0.042)	(0.046)
F statistic			16.368	9.191			58.143	40.681
P-value	0.022	0.027	0.076	0.086	0.001	0.001	0.002	0.003
Universities	139	139	139	139	139	139	139	139
Observations	2,224	2,224	2,224	2,224	9,830	9,830	9,830	9,830
Panel B: GCSE Mathematics								
ln Foreigners X Below median	-0.136**	-0.087	-0.052	-0.049	-0.051**	-0.071***	-0.042	-0.044
	(0.062)	(0.074)	(0.156)	(0.165)	(0.025)	(0.024)	(0.046)	(0.048)
ln Foreigners X Above median	0.123**	0.172**	0.191	0.194	0.202***	0.182***	0.226***	0.225***
	(0.061)	(0.071)	(0.145)	(0.158)	(0.026)	(0.023)	(0.046)	(0.046)
F statistic			16.368	9.191			58.143	40.681
P-value	0.001	0.001	0.020	0.024	0.000	0.000	0.000	0.000
Universities	139	139	139	139	139	139	139	139
Observations	2,224	2,224	2,224	2,224	9,830	9,830	9,830	9,830
University FE	X	X	X	X	X	X	X	X
Time FE	X	X	X	X	X	X	X	X
Field of study FE					X	X	X	X
University FE X Time FE					X	X	X	X
Field of study FE X Time FE					X	X	X	X
University FE X Field of study FE					X	X	X	X
University FE X Time trend		X		X				
University FE X Field of study FE X Time trend						X		X

Notes: The regressions in columns (1)-(4) use data on 139 universities, observed over 8 years. The regressions in columns (5)-(8)use data on 139 universities grouped in 5 fields of study, observed over 8 years. The outcome variable is the total number of English students who sat their GCSE in a state secondary school between 2001/02-2008/09 and who enrolled as first year undergraduates in each university between 2004/05-2011/12 separated by their GCSE English test scores and by their GCSE Mathematics test scores in panels A and B, respectively. All regressions in panel A control for the English test score dummy: below the median GCSE English and above the median test score in GCSE English as the regressions are estimated without a constant. All regressions in panel B control for the Mathematics test score dummy: below the median GCSE Mathematics and above the median test score in GCSE Mathematics as the regressions are estimated without a constant. Robust standard errors clustered at university level in parentheses. F statistics is based on the Kleinbergen-Paap Wald F statistics. The P-value corresponds to the F test of estimates presented in each panel being equal to each other. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Effect on natives' enrolment by the quality of the attended secondary school

	University level				University-field level			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: GCSE English								
ln Foreigners X Below median	0.035	0.109*	0.073	0.023	0.044**	0.018	0.049	0.037
	(0.059)	(0.063)	(0.130)	(0.123)	(0.020)	(0.018)	(0.040)	(0.039)
ln Foreigners X Above median	0.039	0.114**	0.055	0.006	0.103***	0.077***	0.104**	0.091**
	(0.052)	(0.057)	(0.122)	(0.117)	(0.020)	(0.016)	(0.042)	(0.038)
F statistic			16.368	9.191			58.143	40.669
P-value	0.911	0.914	0.692	0.701	0.003	0.004	0.020	0.024
Universities	139	139	139	139	139	139	139	139
Observations	2,224	2,224	2,224	2,224	9,830	9,830	9,830	9,830
Panel B: GCSE Mathematics								
ln Foreigners X Below median	0.025	0.093	0.068	0.011	0.035*	0.010	0.043	0.035
	(0.061)	(0.061)	(0.141)	(0.142)	(0.021)	(0.018)	(0.039)	(0.038)
ln Foreigners X Above median	0.045	0.113**	0.067	0.010	0.105***	0.080***	0.109***	0.101***
	(0.054)	(0.055)	(0.133)	(0.136)	(0.020)	(0.016)	(0.040)	(0.036)
F statistic			16.368	9.191			58.143	40.669
P-value	0.640	0.651	0.982	0.983	0.001	0.001	0.004	0.006
Universities	139	139	139	139	139	139	139	139
Observations	2,224	2,224	2,224	2,224	9,830	9,830	9,830	9,830
University FE	X	X	X	X	X	X	X	X
Time FE	X	X	X	X	X	X	X	X
Field of study FE					X	X	X	X
University FE X Time FE					X	X	X	X
Field of study FE X Time FE					X	X	X	X
University FE X Field of study FE					X	X	X	X
University FE X Time trend		X		X				
University FE X Field of study FE X Time trend						X		X

Notes: The regressions presented in columns (1)-(4) use data on 139 universities, observed over 8 years. The regressions in columns (5)-(8)use data on 139 universities grouped in 5 fields of study, observed over 8 years. The outcome variable is the total number of English students who sat their GCSE in a state secondary school between 2001/02-2008/09 and who enrolled as first year undergraduates in each university between 2004/05-2011/12 separated by their secondary school average GCSE English test scores and by their GCSE Mathematics test scores in panels A and B, respectively. All regressions in panel A control for the English test score dummy: below the median average GCSE English test score at school level and above the median average GCSE English test score at school level as the regressions are estimated without a constant. All regressions in panel B control for the Mathematics test score dummy: below the average GCSE Mathematics test score at school level and above average GCSE Mathematics test score at school level as the regressions are estimated without a constant. Robust standard errors clustered at university level in parentheses. F statistics is based on the Kleinbergen-Paap Wald F statistics. The P-value corresponds to the F test of estimates presented in each panel being equal to each other. *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Effect on natives' enrolment by gender

	University level				University-field level			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln Foreigners X Male	0.059	0.126**	0.102	0.027	0.117***	0.091***	0.126***	0.126***
	(0.050)	(0.054)	(0.129)	(0.130)	(0.017)	(0.016)	(0.037)	(0.037)
ln Foreigners X Female	-0.001	0.066	0.054	-0.022	0.017	-0.010	0.009	0.009
	(0.054)	(0.056)	(0.129)	(0.132)	(0.019)	(0.018)	(0.035)	(0.034)
F statistic			16.368	9.191			58.143	40.681
P-value	0.029	0.035	0.074	0.083	0.000	0.000	0.000	0.000
Universities	139	139	139	139	139	139	139	139
Observations	2,224	2,224	2,224	2,224	9,830	9,830	9,830	9,830
University FE	X	X	X	X	X	X	X	X
Time FE	X	X	X	X	X	X	X	X
Field of study FE					X	X	X	X
University FE X Time FE					X	X	X	X
Field of study FE X Time FE					X	X	X	X
University FE X Field of study FE					X	X	X	X
University FE X Time trend		X		X				
University FE X Field of study FE X Time trend						X		X

Notes: The regressions in columns (1)-(4) use data on 139 universities, observed over 8 years. The regressions in columns (5)-(8)use data on 139 universities grouped in 5 fields of study, observed over 8 years. The outcome variable is the total number of English students who sat their GCSE in a state secondary school between 2001/02-2008/09 and who enrolled as first year undergraduates in each university between 2004/05-2011/12 separated by gender. All regressions control for the gender dummies (female and male) as the model is estimated without a constant. Robust standard errors clustered at university level in parentheses. F statistics is based on the Kleinbergen-Paap Wald F statistics. The P-value corresponds to the F test of estimates presented in each panel being equal to each other. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Effect on natives' enrolment by social economic status

	University level				University-field level			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Free school meal eligibility								
ln Foreigners X Eligible for free school meal	0.084	0.166**	0.122	0.136	0.026	0.007	0.044	0.054
	(0.058)	(0.064)	(0.117)	(0.109)	(0.023)	(0.022)	(0.043)	(0.042)
ln Foreigners X Non-Eligible for free school meal	0.070	0.151**	0.082	0.096	0.122***	0.103***	0.109***	0.120***
	(0.052)	(0.066)	(0.125)	(0.108)	(0.024)	(0.023)	(0.041)	(0.039)
F statistic			16.368	9.191			58.143	40.669
P-value	0.803	0.809	0.502	0.516	0.007	0.008	0.119	0.131
Universities	139	139	139	139	139	139	139	139
Observations	2,224	2,224	2,224	2,224	9,830	9,830	9,830	9,830
Panel B: IDACI score								
ln Foreigners X Below median IDACI	-0.002	0.058	0.041	-0.025	0.070***	0.043**	0.068	0.061
	(0.052)	(0.055)	(0.128)	(0.127)	(0.021)	(0.018)	(0.042)	(0.039)
ln Foreigners X Above median IDACI	0.067	0.127**	0.136	0.070	0.089***	0.062***	0.111***	0.104**
	(0.054)	(0.057)	(0.127)	(0.129)	(0.022)	(0.020)	(0.041)	(0.040)
F statistic			16.368	9.191			58.143	40.681
P-value	0.133	0.146	0.041	0.048	0.404	0.419	0.085	0.095
Universities	139	139	139	139	139	139	139	139
Observations	2,224	2,224	2,224	2,224	9,830	9,830	9,830	9,830
University FE	X	X	X	X	X	X	X	X
Time FE	X	X	X	X	X	X	X	X
Field of study FE					X	X	X	X
University FE X Time FE					X	X	X	X
Field of study FE X Time FE					X	X	X	X
University FE X Field of study FE					X	X	X	X
University FE X Time trend		X		X				
University FE X Field of study FE X Time trend						X		X

Notes: The regressions presented in columns (1)-(4) use data on 139 universities, observed over 8 years. The regressions presented in columns (5)-(8) use data on 139 universities grouped in 5 fields of study, observed over 8 years. The outcome variable is the total number of English students who sat their GCSE in a state secondary school between 2001/02-2008/09 and who enrolled as first year undergraduates in each university between 2004/05-2011/12 separated by their free school meal eligibility and by their IDACI score in panels A and B, respectively. All regressions control for the language dummies (eligible for free school meal and not eligible for free school meal) or the IDACI score(below the median of the IDACI score and above the median of the IDACI score) in panel A and B, respectively as they are estimated without a constant. Robust standard errors clustered at university level in parentheses. F statistics is based on the Kleinbergen-Paap Wald F statistics. The P-value corresponds to the F test of estimates presented in each panel being equal to each other. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Effect on natives' enrolment by ethnic origins

	University level				University-field level			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: First language spoken at home								
ln Foreigners X English not 1st language	0.248***	0.262***	0.286**	0.214	0.147***	0.119***	0.180***	0.184***
	(0.073)	(0.073)	(0.138)	(0.168)	(0.027)	(0.025)	(0.047)	(0.046)
ln Foreigners X English 1st language	-0.114	-0.100	-0.135	-0.207	-0.005	-0.033	-0.045	-0.040
	(0.073)	(0.086)	(0.164)	(0.187)	(0.027)	(0.025)	(0.047)	(0.044)
F statistic			16.368	9.191			58.143	40.671
P-value	0.001	0.001	0.000	0.000	0.001	0.001	0.000	0.000
Universities	139	139	139	139	139	139	139	139
Observations	2,224	2,224	2,224	2,224	9,830	9,830	9,830	9,830
Panel B: Ethnic group								
ln Foreigners X Asian	0.304***	0.303***	0.275**	0.299***	0.173***	0.158***	0.207***	0.213***
	(0.070)	(0.061)	(0.131)	(0.112)	(0.022)	(0.021)	(0.031)	(0.032)
ln Foreigners X White	-0.077	-0.078	-0.171	-0.148	0.031	0.015	-0.007	-0.001
	(0.080)	(0.084)	(0.153)	(0.128)	(0.034)	(0.034)	(0.047)	(0.046)
ln Foreigners X Black	0.063	0.063	0.006	0.030	-0.008	-0.024	-0.004	0.003
	(0.059)	(0.055)	(0.121)	(0.113)	(0.022)	(0.021)	(0.034)	(0.034)
ln Foreigners X Other	0.049	0.048	-0.021	0.002	0.000	-0.015	-0.005	0.001
	(0.054)	(0.048)	(0.115)	(0.103)	(0.017)	(0.015)	(0.029)	(0.030)
F statistic			8.197	4.758			29.133	21.071
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Universities	139	139	139	139	139	139	139	139
Observations	4,448	4,448	4,448	4,448	19,660	19,660	19,660	19,660
University FE	X	X	X	X	X	X	X	X
Time FE	X	X	X	X	X	X	X	X
Field of study FE					X	X	X	X
University FE X Time FE					X	X	X	X
Field of study FE X Time FE					X	X	X	X
University FE X Field of study FE					X	X	X	X
University FE X Time trend		X		X				
University FE X Field of study FE X Time trend						X		X

Notes: The regressions in columns (1)-(4) use data on 139 universities, observed over 8 years. The regressions in columns (5)-(8)use data on 139 universities grouped in 5 fields of study, observed over 8 years. The outcome variable is the total number of English students who sat their GCSE in a state secondary school between 2001/02-2008/09 and who enrolled as first year undergraduates in each university between 2004/05-2011/12 separated by first language spoken at home and by their ethnic group in panels A and B, respectively. All regressions in panel A control for the language dummies: English as first language spoken at home and English not the first language spoken at home as the regressions are estimated without a constant. All regressions in panel B control for ethnicity dummies: White, Asian, Black and other as the regressions are estimated without a constant. Robust standard errors clustered at university level in parentheses. F statistics is based on the Kleinbergen-Paap Wald F statistics. The P-value corresponds to the F test of estimates presented in each panel being equal to each other. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Robustness checks

	University level				University-field level			
	OLS	OLS	IV	IV	OLS	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Gap and no gap years								
ln Foreigners	-0.035	0.008	0.019	-0.137	0.052***	0.046***	0.040	0.044
	(0.036)	(0.042)	(0.121)	(0.134)	(0.018)	(0.015)	(0.036)	(0.029)
F statistic			29.397	12.439			115.788	75.458
Universities	139	139	139	139	139	139	139	139
Observations	1,112	1,112	1,112	1,112	4,915	4,915	4,915	4,915
Panel B: Population at risk								
ln Foreigners	-0.026	0.014	0.008	-0.103				
	(0.046)	(0.058)	(0.132)	(0.152)				
ln Predicted Population	-0.392**	-0.292*	-0.381**	-0.343**				
	(0.160)	(0.163)	(0.181)	(0.167)				
F statistic			30.353	12.241				
Universities	139	139	139	139				
Observations	1,112	1,112	1,112	1,112				
University FE	X	X	X	X	X	X	X	X
Time FE	X	X	X	X	X	X	X	X
Field of study FE					X	X	X	X
University FE X Time FE					X	X	X	X
Field of study FE X Time FE					X	X	X	X
University FE X Field of study FE					X	X	X	X
University FE X Time trend		X		X				
University FE X Field of study FE X Time trend						X		X

Notes: The regressions reported in columns (1)-(4) use data on 139 universities, observed over 8 years. The regressions presented in columns (5)-(8) use data on 139 universities grouped in 5 fields of study, observed over 8 years. In panel A, the outcome variable is the total number of English students who sat their GCSE in a state secondary school enrolled in each university between 2004/05-2011/12 with or without taking gap years. In panel B, the outcome variable is the total number of English students who sat their GCSE in a state secondary school between 2001/02-2008/09 and who enrolled as first year undergraduates in each university between 2004/05-2011/12. Robust standard errors clustered at university level in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

Table 11: Mechanisms

	University level		University-field level	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A: Non-EU students				
ln Non-EU	-0.003	-0.060	0.012	-0.001
	(0.038)	(0.087)	(0.014)	(0.042)
F statistic		13.950		58.297
Universities	139	139	139	139
Observations	1,112	1,112	4,915	4,915
Panel B: EU students				
ln EU	0.044	0.134	0.056***	0.038
	(0.040)	(0.082)	(0.016)	(0.047)
F statistic		8.638		79.612
Universities	139	139	139	139
Observations	1,112	1,112	4,915	4,915
Panel C: Russell Group vs. Non-Russell Group				
ln Foreigners in Non-RG universities	0.017	-0.089	0.043**	0.050
	(0.061)	(0.153)	(0.019)	(0.051)
ln Foreigners in RG universities	-0.000	-0.274*	0.017	-0.025
	(0.088)	(0.165)	(0.033)	(0.078)
F statistic		6.575		33.948
P-value	0.870	0.237	0.499	0.424
Universities	139	139	139	139
Observations	1,112	1,112	4,915	4,915
Panel D: University ranking				
ln Foreigners	1.564	6.656*		
	(1.355)	(3.726)		
F statistic		9.646		
Universities	122	122		
Observations	945	945		
University FE	X	X	X	X
Time FE	X	X	X	X
Field of study FE			X	X
University FE X Time FE			X	X
Field of study FE X Time FE			X	X
University FE X Field of study FE			X	X
University FE X Time trend	X	X		
University FE X Field of study FE X Time trend			X	X

Notes: The regressions reported in columns (1)-(4) use data on 139 universities, observed over 8 years. The regressions presented in columns (5)-(8) use data on 139 universities grouped in 5 fields of study, observed over 8 years. The outcome variable each of the three panels is the total number of English students who sat their GCSE in a state secondary school enrolled in each university between 2004/05-2011/12. In panel A, we measure the inflow of foreign students as the total number of non-EU domiciled students enrolled. In panel B, we measure the inflow of foreign students as the total number of EU domiciled students enrolled. In panel C, we distinguish between Russell and Non-Russell group universities. In Panel D, the outcome variable is the rank of the university. Robust standard errors clustered at university level in parentheses.*** p<0.01, ** p<0.05, * p<0.1.