The determinants of international demand for UK higher education

Final Report for the Higher Education Policy Institute and Kaplan International Pathways

LE London Economics

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KAPLAN INTERNATIONAL PATHWAYS

January 2017

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Table of Contents

Executive Summary

London Economics were commissioned by the Higher Education Policy Institute (HEPI) and Kaplan International Pathways (Kaplan) to undertake an analysis of the determinants of overseas demand for UK higher education.

Using a range of data on UK higher education enrolments from 2003/04 to 2014/15 (for 189 originating countries), as well as a wide number of possible explanatory variables, the econometric analysis suggests that there are a range of factors that determine demand for UK higher education. These include domestic factors, such as **UK fee levels**, but also external factors including the **exchange rate**, **fee levels charged by competitor countries**, **energy prices**, **overseas economic growth**, and **policy interventions** within a country.

The analysis demonstrates that although some factors have a relatively immediate effect on the demand for UK higher education (such as overseas GDP per capita), other factors (such as the exchange rate and UK fee levels) have both an immediate effect but also a longer-term (lagged) impact. The econometric analysis was more robust in identifying the relationship between these macroeconomic characteristics and **undergraduate enrolment** compared to postgraduate enrolment. This is driven by the nature of the postgraduate market[1], as well as the lack of consistent information on higher education fees for postgraduate students charged by competitor countries.

To illustrate the impact of some of these macroeconomic factors on demand for UK higher education, we modelled a range of scenarios.

- We found that modelling a 10% **depreciation** of Sterling (as recently occurred following the decision of the United Kingdom to exit the European Union), holding all other factors constant, would result in a large and significant positive impact on the finances of UK higher education institutions (by about **£226.4 million** in relation to students' 1st year of study).
- The **removal of student tuition fee support** from undergraduate EU-domiciled students would have a negative effect on demand for higher education, as EU students would see the cost of higher education increase substantially. This reduction in institutional income was estimated to be **£24.0 million**.
- **Harmonising the fees** charged to EU and international students would have an ambiguous effect on UK higher education institutions. Amongst those institutions considered to be the highest calibre institutions, the harmonisation of fees for EU students to international-student levels would see an increase in aggregate revenues *despite* the very significant reduction in student enrolments. However, there were less than ten institutions positively affected in a financial sense. For the remaining (more than 100) higher education institutions, fee harmonisation had a

[1] In particular, one of the key determinants of university choice at postgraduate level (which is not captured due to lack of available data) relates to the availability of tuition fee funding (at national level as well as at institutional level), as well as the availability of other information relating to student support or bursary opportunities at institutional level (e.g. in relation to accommodation subsidies or graduate teaching opportunities). The decision to enrol in an overseas higher education provider at undergraduate and postgraduate level might be a joint decision, and as such, a number of factors at undergraduate level might be influential in determining later postgraduate enrolment. As a result, a number of variables – although intuitively expected to have a similar effect at postgraduate level as at the undergraduate level analysis – are likely to have limited statistical significance.

negative effect on institution finances. The aggregate impact of **fee harmonisation** reduced institutional income by **£15.5 million**.

In total, the combined effect of the currency depreciation (+£226.4 million), the removal of EU undergraduate fee support (-£24.0 million), and fee harmonisation (-£15.5 million) was *positive* – amounting to £186.9 million. However, there was significant variation across different clusters of higher education institutions[2].

In an economic sense, the analysis is based on the necessary **assumption that all other factors in the model remain constant**. The analysis is based on historic information – and does not take into account the change in sentiment that might be felt toward the United Kingdom since the decision to leave the European Union or recent elections in the United States. Furthermore, the general attractiveness of the sector – especially for postgraduate students – might be adversely affected by the fact that UK higher education institutions will undoubtedly find it increasingly challenging to retain high calibre research staff and accrue research related funding.

Most importantly, the analysis presented here assumes that there are **no immigration caps**, nor any differential treatment of higher education institutions in relation to the ability to secure student visas. As such, the positive impact of the depreciation of Sterling assumes that an additional **19,750** students will be allowed to study in the United Kingdom[3]. However, given the current political environment, if it is decided that institutions cannot benefit from this increased demand because of an international student number cap, or as a result of tougher rules facing some institutions, then the **£226.4 million** potential gain that might be achieved by UK higher education institutions may not be realised or only realised in part – thus representing a potential loss.

What does this mean for the UK economy?

The **£226.4 million** per annum potential loss identified only captures the tuition fee income in students' first year of study. This increases to **£463 million** per annum if we consider the fee income accrued over the total duration of study. If we further include the economic output associated with students' non-tuition fee expenditure over the course of their studies (**£604 million**), the total potential loss to the UK economy stands at **£1.067 billion** per annum.

Universities have extensive supply chains. Known as the indirect and induced effects, UK higher education institutions (and their staff and students) support these supply chains through their purchases. If we also consider these indirect and induced effects on the wider UK economy associated with this source of export income, the estimate of potential loss increases to approximately **£1.995 billion** per annum.

[2] Institutions were classified based on the system developed by Boliver (2015) "Are there distinctive clusters of higher and lower status universities in the UK?", *Oxford Review of Education*, 41:5, 608-627, DOI: 10.1080/03054985.2015.1082905. The research suggests that as a result of the differences in research activity, teaching quality, economic resources, academic selectivity, and socioeconomic student mix, it is possible to classify UK higher education institutions into four distinct clusters.

[3] This is the estimated additional student inflow associated with a 10% depreciation of Sterling

1 Introduction

By any accepted measure, the United Kingdom has an outstanding higher education system that has proved immensely attractive to international students. With many world-class universities, strength in depth and the benefit of teaching in English – not to mention the historic links between the UK and many other countries – UK higher education institutions have successfully recruited hundreds of thousands of students from around the world each year. The benefits have been enormous and wide ranging, and include higher export earnings, more diverse campuses and educational advantages.

With more than **232,000** first year overseas students in the UK in 2014-15, accounting for approximately 10% of all internationally-mobile students, the United Kingdom higher education sector was forecast to generate more than **£10 billion**[4] in revenues in 2015 comprising tuition fee income, non-tuition fee income, transnational education, research-related grants and contracts, licensing and consulting fees. Over and above these 'hard' financial metrics, the sector also promotes long-term relationships with the rest of the world, resulting in trade and diplomatic gains for the nation. Earlier work by HEPI suggests one-quarter of the countries globally have a president, prime minister or monarch who was educated in the UK tertiary education system[5]. In addition, there are educational benefits that earlier work conducted for HEPI and Kaplan illustrates are clearly recognised by home and overseas students alike[6].

London Economics were commissioned by HEPI and Kaplan International Pathways (Kaplan) to undertake an analysis of the determinants of overseas demand for UK higher education, and to consider what the impact of a number of macroeconomic characteristics might be on future enrolment levels and UK higher education institutional tuition fee income. The analysis presented here looks only at the impact of different economic and policy factors on teaching and learning income and does not consider the impact on research funding.

The structure of the report is as follows:

- **Section 2** outlines the data adopted for the analysis, as well as the methodological approach. Information on the evolution of student enrolments over time is also presented.
- **Section 3** details the results from the econometric analysis and provides an explanation of which factors determine the demand for UK higher education from overseas.
- **Section 4** explores the impact of a number of alternative scenarios on both student numbers and the financial position of UK higher education institutions, both in aggregate, and disaggregated using a third-party classification of university clusters.
- **Section 5** provides a conclusion.

[4] 2010-11 prices (see London Economics (2011) Estimating the value to the UK of educational exports, BIS research Report 46 (here)
[5] 'Now that's what we call soft power: 55 world leaders educated in the UK', 1 October 2015 (here)
[6] HEPI / Kaplan, 'What do prospective students think about international students?' March 2015 (here)

2 Data and methodological approach

Our analysis considers the impact of a range of economic variables on the level of enrolment at UK higher education institutions, as well as the subsequent impact of a number of changes in these factors on the financial position of the sector. The analysis focuses on teaching income, and although research income from overseas makes a key financial contribution to the sector, this is not considered in the current report.

2.1 Data

To undertake the analysis, a decade-long database covering **189** countries was constructed using data from a range of sources.

2.1.1 Student enrolments

The number of first-year non-UK students entering UK higher education by country of domicile is taken from bespoke data provided by the Higher Education Statistics Agency (HESA) and covers the period from 2000/01 to 2014/15. Students' countries of domicile are identified from their permanent address. Students coming to the United Kingdom to undertake pre-higher education studies were excluded in the analysis (given their absence from the HESA data). Furthermore, exchange students (including Erasmus students) are excluded from the HESA enrolment data received[7].

2.1.2 Tuition fees and fee income

Measures of average tuition fees for international competitors

The number of overseas students entering UK higher education is likely to be determined by the level of tuition fees in other countries. To control for this impact, key competitor countries are identified using data on inbound internationally-mobile students recorded by UNESCO[8].

Figure 1 shows the distribution of total inbound internationally-mobile students by country of study in 2013 and the growth in student numbers since 2003. The United States was the destination country for approximately **one-fifth** of all internationally-mobile students in 2013, with the top eight countries accounting for approximately **58%** of all internationally-mobile students. For the purposes of this study, these two measures (total number and growth in number) were used to identify 'competitor' higher education countries to the UK. Using this approach, we selected the **United States, Australia, France, Germany** and **Canada** as our main competitor countries.

Tuition fee data for these five competitor countries is taken from OECD *Education at a Glance* reports. Given the different structure of the higher education markets in each of

[7] This is based on the HESA standard registration population, which excludes dormant students (those who have suspended study but have not formally de-registered); incoming visiting and exchange students, postdoctoral student instances; instances where the whole of the programme of study is outside of the UK; instances where the student has spent, or will spend, more than 8 weeks in the UK but the study programme is primarily outside the UK; National College for Teaching and Leadership (NCTL) Subject Knowledge Enhancement (SKE) student instances; students on sabbatical, and writing-up students.

[8] UNESCO define an internationally mobile student as an individual who has physically crossed an international border between two countries in order to participate in an education programme in a destination country, which is different from his or her country of origin. This excludes students who are in exchange programmes and undertake part of their studies at educational institutions abroad but are credited at their home institutions.

these countries (for example, the balance between public and private sector provision), a weighted average fee is calculated for each country in a given year (initially in US Dollars), where the weights correspond to the percentage of full-time students by type of institution (public, government-dependent private and private).

For years with missing data, a linear interpolation is used resulting in consistent data covering the period from 2003 to 2013. Fees are assumed to be unchanged between 2013 and 2014. In many cases, it is important to note that the reported figures are based on domestic students only; however, in some cases, the fees are a reported average for both domestic and international students. For consistency, we make use of domestic fee levels, and because the analysis is focusing on the impact of relative changes in fee levels, we are implicitly making the assumption that the relativities between countries for domestic students is the same as that for international students[9].

The reported fees are for 'tertiary-type A' students only (i.e. undergraduate students).

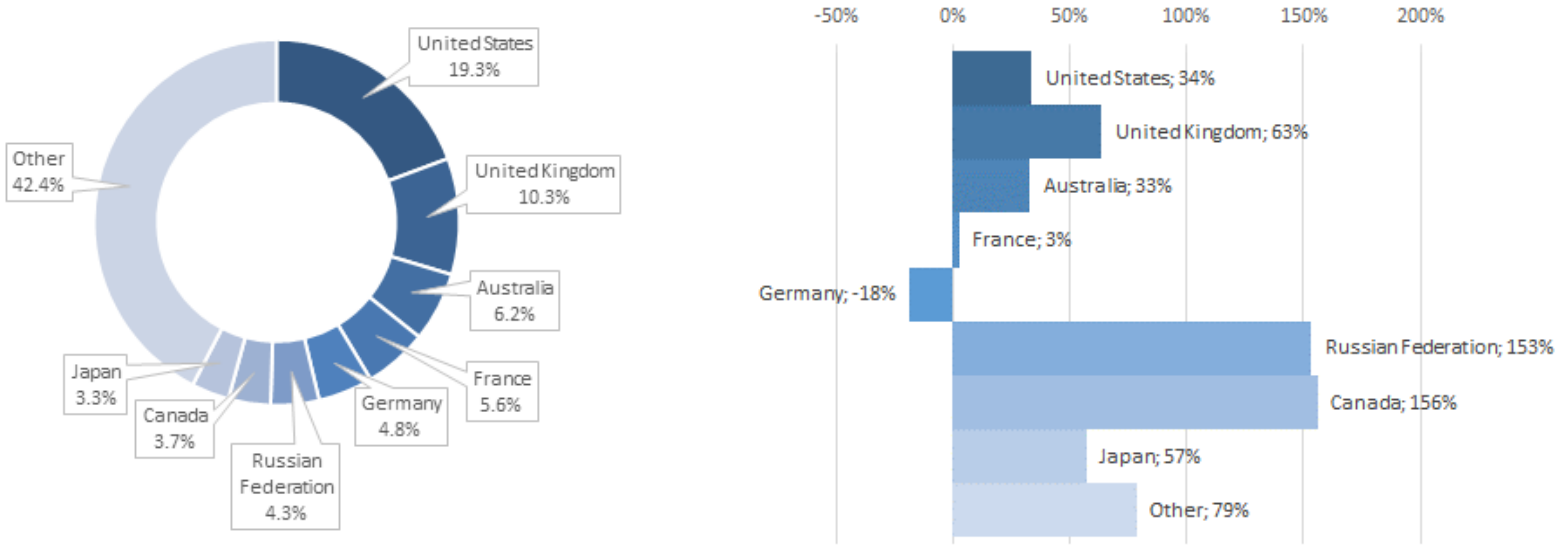
Finally, these weighted average fees are converted into Sterling for the purposes of the analysis in order to remove any impact of exchange rate movements (captured by incorporation of the exchange rate variable itself into the model – see below). In addition to the use of 'straightforward' fee levels, these international fee levels were also combined with *regional metrics* in order to understand the extent to which changes in competitor fee levels might be expected to have an effect on enrolments, not just in aggregate, but from those regions specifically where there may be a traditional or geographic links to the destination country. For instance, in all analyses, we combine average tuition fee levels in France with African originating countries to reflect the traditional flow of (French-speaking) students from Africa to French higher education institutions.

Measures of average tuition fees in the United Kingdom

To generate an average fee level for the United Kingdom, we used HESA data. Total tuition fee income across the sector is generally provided by **domicile** (Home/EU or non-EU-international) and the **level of study** (undergraduate or postgraduate). Using this information, average UK tuition fees in each academic year are derived using information on the total income generated by UK higher education institutions from the relevant category of tuition fee income[10] and the number of corresponding students in a given year[11].

[9] This simplifying assumption was required due to the lack of consistent data across competitor countries on the level of tuition fees for international students only. While this assumption might not be entirely realistic, the effect of this simplification should be mitigated by the fact that the analysis focuses on the impact of *changes* in tuition fee levels (in the UK and competitor countries) *over time*.
[10] This also includes income from education grants and contracts.
[11] The number of all students is used rather than the number of new students only as a breakdown of student data by cohort is unavailable. Hence, particular changes in the fee regime for new students in a given year follow through in subsequent years, as new students replace existing students. This has the result of somewhat smoothing the path of tuition fees over time.

Figure 1 Distribution of total inbound internationally-mobile students by country of study in 2013 (Left) and the growth in numbers between 2003 and 2013 (Right)



Note: 2012 figure used for Russian Federation

Source: London Economics' analysis of UNESCO data

For some student groups (non-EU international students), a distinction between fee income by the level of study (i.e. undergraduate versus postgraduate) was not available from HESA information. For these categories of fee income where no further breakdown was available, we calculated an 'average' fee across the entire category. This implies that the tuition fees charged at undergraduate and postgraduate level are the same. While this clearly does not reflect reality, the simplifying assumption was necessary given the absence of better data, and provides a basis upon which to make comparisons and develop further analysis.

The analysis presented in Section 3 of this report uses HESA information to generate average UK-wide tuition fee levels across the sector[12]. In the Annex, we also present the corresponding results where OECD information is used (in the same way as for competitor countries' tuition fee levels). Importantly, the results in general are very similar[13].

2.1.3 Macroeconomic variables

A number of macroeconomic variables are sourced from the World Bank's Global Economic Monitor and Development Indicators database. In particular:

- exchange rates (local currency units per Pound Sterling in the relevant academic year);
- Gross Domestic Product (GDP) per capita (in US dollars);
- energy price index (based on current prices);
- non-energy price index (based on current prices);
- precious metals price index (based on constant prices); and
- total population

Note that data on exchange rates, GDP per capita and population vary by country and time, whereas the energy, non-energy and precious metals price indices vary by time only.

2.1.4 Other variables

The amendments to the Tier 1 post-study work visa system in 2012 also influenced the number of non-UK students entering the UK higher education system (see Figure 3). The impact of this reform is captured using a dummy variable, which equals 1 in 2012 (and thereafter) and zero otherwise. It is noted that this is a catch-all approach, and as such might capture a range of events or other determinants of UK higher education enrolment that occurred in parallel to the change in student visa arrangements in 2012[14] (such as the significant growth in students from China undertaking postgraduate qualifications in the UK).

It is important to note that either because of the time period involved or the absence of specific data, there are a number of unobserved factors that have influenced the historic attractiveness of different countries for internationally-mobile students. The same applies to more recent political outcomes. For instance, whilst the decision of the United Kingdom

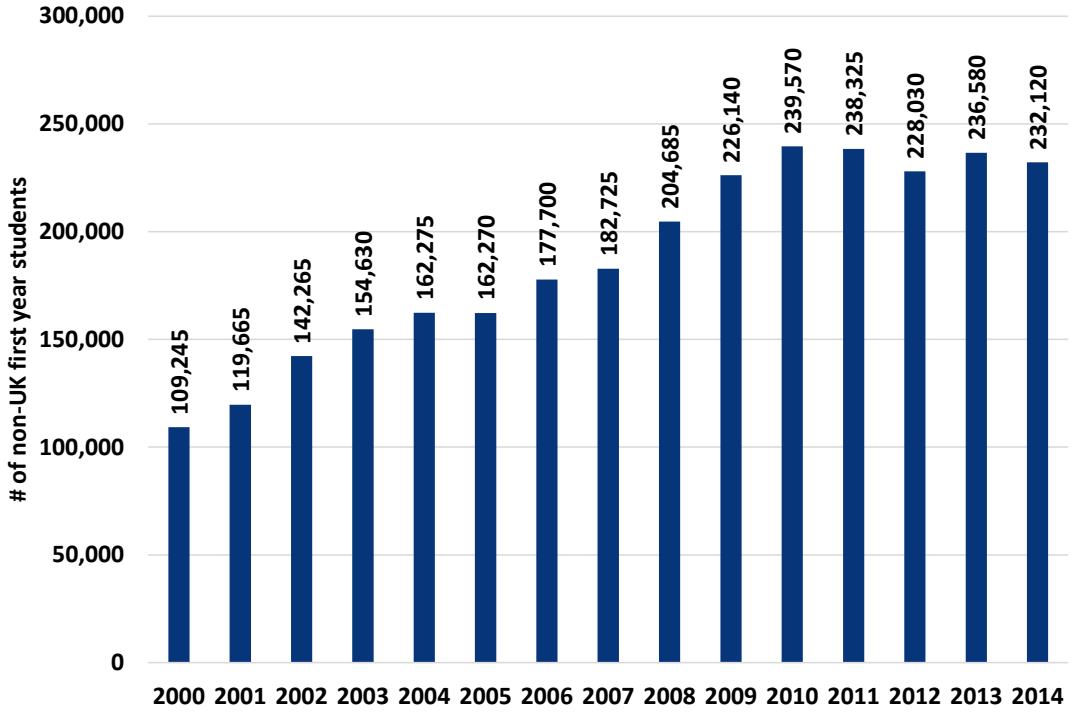
[12] It is not possible to differentiate the very different tuition fee and student support arrangements in existence depending on the Devolved Administration. As such, UK-wide averages are used.
[13] To assess the impact on UK higher education institutions (Section 4), UK tuition fees are calculated by student domicile and level of study at the institution level in order to ascertain the impact of a range of different scenarios.
[14] Note that there was a significant increase in domestic tuition fees in 2012-13; however, the incorporation of the dummy variable will not capture the possible increase in international fees that might have occurred, as this will already be captured in the model specification through the measure of UK fee levels.

to exit the European Union will have a deterrent effect on both higher education students and staff enrolling or working at UK higher education institutions, the recent election in the United States might have a similar impact on the decision of internationally-mobile students to study in the US, to the benefit of other countries (e.g. Canada, the United Kingdom and Australia)[15]. Currently, there is no sensible means of capturing these effects, but readers should be aware of these data limitations.

2.2 Descriptive Statistics

Looking at the information contained in Figure 2, the analysis of HESA data demonstrates a significant increase in overseas student enrolments since 2000-01. From approximately **109,000** students at the start of the period, enrolment more than doubled to approximately **240,000** in 2010-11, and remained relatively stable thereafter. In 2014-15, the number of overseas students was estimated to be **232,000**.

Figure 2 UK higher education non-UK domiciled enrolments 2000/01 to 2014/15



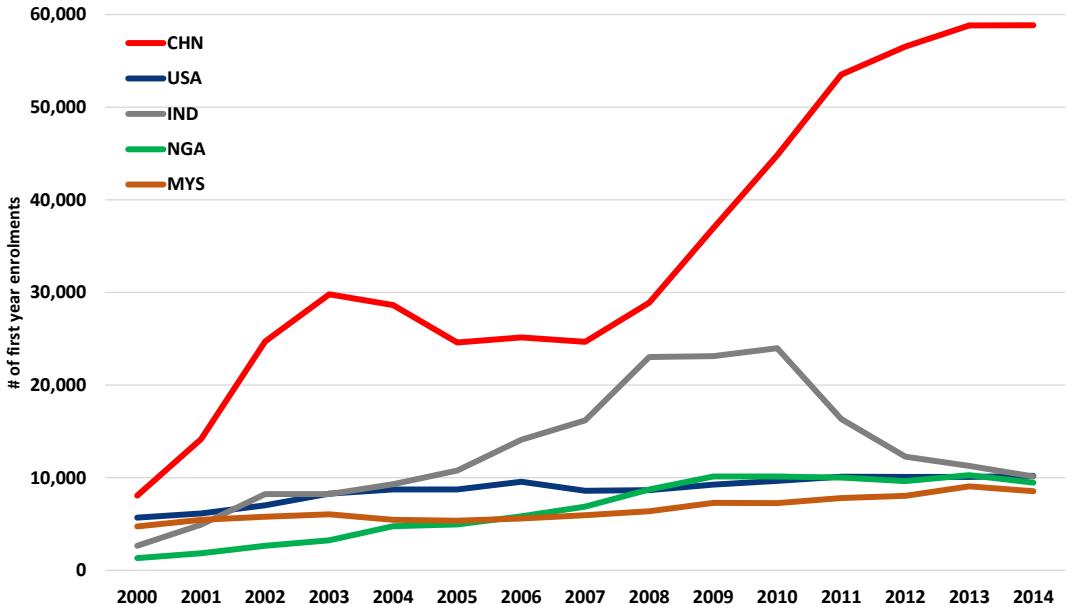
London Economics' analysis of HESA data

In relation to the composition of overseas students, the analysis presented in Figure 3 (and Annex) illustrates that one of the main sources of growth in student numbers has been a six-fold increase in students from China over the period (from less than **10,000** in 2000/01 to approximately **59,000** in 2014/15). In contrast to this increasing reliance on China, although there was significant growth in the number of students originating from India between 2000/01 and 2008/09, this tailed off between 2008-09 and 2010/11 and declined thereafter (in part because of the change in post-study work visa arrangements announced in April 2012). In 2014/15, there were approximately **10,000** students from India

[15] While there is no empirical evidence available given the very recent date of the election, the above-presented information on internationally mobile students by country of study (see Figure 1) highlights these countries as some of the key competitors in the market for international students.

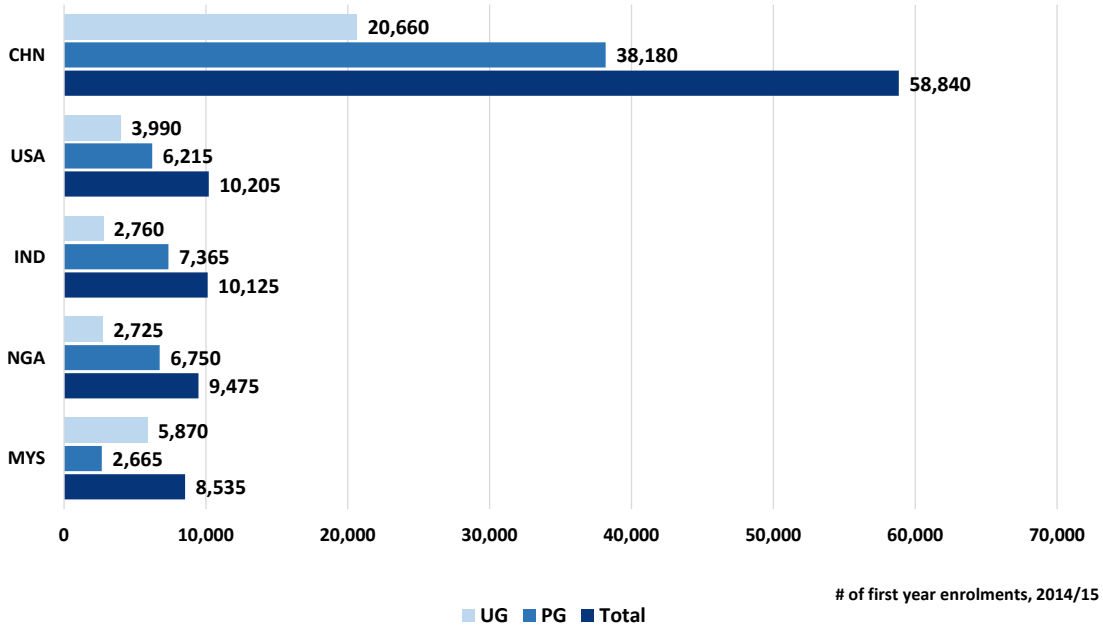
commencing their studies in the United Kingdom – a comparable number to the United States, Nigeria and Malaysia (the other three countries in the top 5).

Figure 3 UK higher education enrolments 2000/01 to 2014/15 (Top 5 originating countries)



London Economics' analysis of HESA data

Figure 4 UK higher education enrolments 2000/01 to 2014/15 (Top 5 originating countries)



London Economics' analysis of HESA data

In terms of the composition of overseas students by qualification intention, amongst Chinese students, almost twice as many students commencing their studies were undertaking postgraduate qualifications (**38,180**) compared to undergraduate studies (**20,660**). Students from Nigeria, the United States and India are also more likely to be

postgraduate students, while students from Malaysia were more likely to be undergraduates.

2.3 Econometric Approach

When using panel data (i.e. different countries over time), this is best achieved using a **fixed effects specification**[16]. This approach essentially strips out the 'fixed' country-level effects that may play a role in determining the international demand for higher education but are constant across time. For instance, there may be different perceptions in relation to higher education internationally that may play a role in choosing whether and where to study overseas. For example, if there is a high economic and social value placed on higher education in Singapore (which has not changed over time), then a fixed effects specification strips this underlying factor out of the analysis, leaving the model to consider those other additional factors that might influence demand (such as exchange rates).

In this setting, the econometric model explores the relationship between the number of first-year non-UK domiciled student enrolments (i.e. the dependent variable) and key macroeconomic determinants (i.e. explanatory variables). These explanatory variables include items such as higher education tuition fee levels (in the UK and competitor countries), economic factors (such as GDP per capita) and other variables (such as policy interventions) within a country, controlling for any time-invariant characteristics between countries.[17]

For a given country *i* in year *t*, the model can be specified as:

$$Y_{it} = \alpha + \beta' X_{it} + \mu_i + u_{it}$$

- Y_{it} is the number of first year non-UK students from country *i* in year *t* (in logs);
- X_{it} is a vector of higher education tuition fees (in the UK and competitor countries), macroeconomic factors and other variables in country *i* in year *t* (in logs, if applicable);
- μ_i is the country-specific effects for *i*;
- u_{it} is the error term; and
- α and β are constant and coefficient vectors, respectively.

Two dependent variables are considered by distinguishing the level of study undertaken by each non-UK domiciled student. In other words, estimations for undergraduate and postgraduate students are performed separately. Given an annual dataset, the inclusion of additional **lagged** (or delayed) effects of some determinants are also explored.

Data – further re-coding

- The estimation sample is an annual unbalanced panel, covering **189** countries across **12** years, from 2003 to 2014.

[16] The fixed effects, μ_i, can be controlled for by including dummies for each country in the estimation, or alternatively, they can be eliminated by subtracting the within-country means from each variable. The latter approach is used to provide a parsimonious estimation.
[17] An example of time-invariant characteristic may be the difference in cultural views towards education across countries.

- Energy, non-energy and precious metals price indices are highly correlated[18] (i.e. move closely in parallel); therefore, to overcome collinearity issues[19], only the energy price index is included in the estimations.
- To provide a more simple interpretation of coefficient estimates, all variables are log-transformed[20]. Hence, on average across all countries in the sample, a 1% change in the explanatory variable, X_1, is associated with β_1% change in Y, the number of non-UK domiciled first-year students entering UK higher education. Hence, the coefficient estimates can be viewed as the **elasticity of demand** for UK qualifications from overseas[21].

[18] With correlation coefficients of 0.9797 between energy and non-energy price indices and 0.9239 between energy and precious metal price indices.
[19] Collinearity refers to instances where two (or more) independent variables are highly correlated with each other (i.e. they move in tandem), making it difficult to distinguish the separate effect of changes in each of these independent variables on the dependent variable of interest.
[20] Excluding any dummy variables included in the estimation.
[21] Note in relation to estimation issues: A variable time series is non-stationary if its mean and/or variance is not constant over time. A linear regression may suggest that there is statistical evidence of a relationship between a set of variables, which are independent. However, if these variables are non-stationary, the estimated relationship is likely to be spurious. Panel unit root tests are carried out on the two dependent variables to test for the presence of non-stationarity. Specifically, Fisher-type panel unit-root tests are used, which test the null hypothesis that all panels (in this case, countries) contain a unit root. The results from the panel unit root tests suggest that the series for non-UK first-time undergraduate students do not contain a unit root (that is, they are stationary). Therefore, no change in specification is required. However, the series for postgraduate students *fails* to reject the null hypothesis of non-stationarity. Therefore, the model is estimated in first-difference to overcome the issue of spurious estimation. Since variables are log-transformed, the coefficient interpretation remains unchanged in this instance.

3 Results and findings

3.1 Undergraduate students

In Table 1, we present the results of our preferred specification relating to undergraduate higher education enrolments.

UK higher education fee levels

In relation to the average **undergraduate fee charged by UK higher education institutions** (denominated in Sterling), the results from the econometric analysis suggest that fees have both an immediate and delayed effect on enrolment (as might be expected). Specifically, the coefficient on UK undergraduate fees of **-0.327**, which is highly statistically significant, suggests that a 1% increase in average UK fee levels would result in a **0.33%** reduction in enrolment in the same period.

However, in addition, there is a lagged effect. Again statistically significant at the 1% level, the analysis indicates that the 1% increase in UK undergraduate fees would result in a **0.22%** reduction in undergraduate enrolment in the subsequent year (on top of the **0.33%** reduction in enrolment in the first year), meaning that the aggregate reduction in enrolment would be approximately **0.55%**. In other words, in the year following an increase in fees, the elasticity of demand for UK undergraduate qualifications from overseas with respect to price stands at **-0.55**.

Table 1 Econometric results on determinants of higher education enrolment in the UK (undergraduate level)

Independent variables	Coefficient	Standard Error	Confidence interval (95%)	
Index Exchange Rate (*period t*)	-0.212*	0.1087	-0.4251	0.0015
Index Exchange Rate (*period t-1*)	-0.196**	0.0908	-0.3746	-0.0181
Energy Index (*no/small oil producer*)	-0.114*	0.0694	-0.2500	0.0223
Energy Index (*large oil producer*)	0.375***	0.1334	0.1132	0.6366
GDP per capita (USD) (country *i*)	0.485***	0.0657	0.3557	0.6137
UK Undergraduate fees (in GBP) (*period t*)	-0.327***	0.0824	-0.4884	-0.1652
UK Undergraduate fees (in GBP) (*period t-1*)	-0.221***	0.0735	-0.3652	-0.0767
US Undergraduate fees (in GBP) (*period t*)	0.658***	0.1861	0.2927	1.0228
US Undergraduate fees (in GBP) (*period t-1*)	0.442***	0.1651	0.1182	0.7661
Population (*country i*)	-0.242	0.2058	-0.6454	0.1620
Post study visa (*dummy*)	-0.203***	0.0428	-0.2869	-0.1189
Constant	1.235	3.2133	-5.0671	7.5375
Number of observations	1,959			

Note: ***/**/* statistically significant at the 1%/5%/10% level respectively

a. All variables are in log, unless a dummy variable

b. UK undergraduate and US undergraduate fees are denominated in Sterling

c. A number of the variables have been transformed using a logarithmic function. This has been done to allow for a more simple interpretation. Specifically, a β coefficient on a relevant variable can be interpreted as a β% percentage change in the number of undergraduate enrolments in the United Kingdom following a 1% change in the relevant variable. Taking an example, the coefficient of 0.4847 on (log) of per capita Gross Domestic Product suggests that an average increase of 1% in overseas per capita Gross Domestic Product will have a 0.4847% increase in the number of undergraduate enrolments in UK higher education institutions.

d. A number of model specifications were considered including specifications that incorporated undergraduate fees in Germany, France, Australia and Canada. Furthermore, in a number of specifications, these undergraduate fee levels were interacted with regional measures (for instance to understand whether the change in undergraduate fees in Australia might have an effect on students domiciled in Asia). These models generated statistically insignificant results.

Source: London Economics' analysis

Higher education fee levels in competitor countries

The analysis of the impact of UK higher education fees on enrolment is only a small part of the story. Considering the impact of competitor countries, as detailed in Section 2, our model specifications included the (Sterling-denominated) cost of education in Canada, Australia, France and Germany. Although the analysis of undergraduate enrolment found that none of these variables were statistically significant, the analysis demonstrates that **undergraduate fees in the United States** are significant in determining UK higher education enrolment at undergraduate level.

With a coefficient of **0.658**, which is again highly statistically significant, the analysis indicates that a 1% increase in the average undergraduate fee charged by US higher education institutions would result in a **0.66%** increase in UK higher education enrolment in the same year. However, as before, there is also a lagged effect, with the impact of the change in US fees charged carrying over to the next period. In particular, the analysis indicates that the same 1% increase in US fees would result in a **0.44%** increase in UK higher education enrolment in the subsequent period (resulting in a **1.1%** increase cumulatively). In economic terms, the results suggest that higher education in the United States and United Kingdom at undergraduate level are **substitutes**, with the cross price elasticity of demand standing at approximately **1.1**. In other words, a 10% increase in the sterling denominated US undergraduate fee level would be expected to increase UK higher education demand by **11%** in the year following the price change.

Exchange rates

Direct effects

Until now, the findings have focussed on the fee levels in the United Kingdom and United States - **denominated in Sterling**. However, it is important to also consider the impact of changes in the exchange rate. In the estimation results provided in Table 1, the variable relating to the exchange rate represents an index, where the underlying variable is the amount of local (i.e. foreign) currency required to purchase £1. This means that if there is a depreciation of Sterling, then less foreign currency is required to purchase £1.

In the model of higher education enrolments presented above, this suggests that from an overseas perspective, if the level of Sterling-denominated fees in the UK remains unchanged, a depreciation of Sterling (represented by a reduction in the underlying variable) makes UK higher education fees more affordable. In empirical terms, the reduction in the independent exchange rate variable would be expected to have the opposite effect on enrolment (i.e. a negative sign), which would represent an increase in enrolments. This is indeed the case.

The analysis suggests that a 1% depreciation of Sterling would be expected to result in a **0.21%** increase in UK undergraduate enrolment in the same year. However, as before, the exchange rate also enters the model as a lag. This implies that the depreciation of Sterling against a weighted average of all overseas currencies would persist into the subsequent year. Specifically, the analysis estimates the effect to be **0.196**, which implies that in the year following the depreciation, the cumulative direct effect associated with the 1% depreciation of Sterling is **0.41%** (holding other factors constant). This means that a **10%**

depreciation of Sterling would result in a **2.1%** increase in enrolment in the same year with a *further* **2.0%** effect in the subsequent year (and a total effect of **4.1%**).

Indirect effects

The consideration of the impact of the exchange rate (coefficient) in isolation does not take into account the interdependency between different higher education systems. Although the depreciation of Sterling has made UK higher education more attractive, it is equally the case that the appreciation of the US Dollar relative to Sterling makes US higher education less attractive. Given the fact that the model denominated US higher education fees in Sterling, an appreciation of the US Dollar *increases* the price of US higher education fees in Sterling. As such, it is also necessary to consider the additional indirect impact represented by the relevant coefficients relating to 'US Undergraduate fees (in GBP)'. Following a depreciation of Sterling by 10%, in addition to the **4.1%** direct effect, we would expect to see an increase in undergraduate enrolment in the UK of **11%** as a result of the indirect effect (via US fee levels).

Energy prices

For energy producers, increases in energy prices are likely to increase wealth within that country and thereby may lead to an increase in demand for education (both in the UK and elsewhere), with the opposite being true of smaller oil producers or non-producers of energy products.

To address this possibility, as the price of oil is one of the key components contained within the energy price index, we have refined the model by interacting the energy price index with whether the country in question is a 'leading' (top 20 global) oil producer. In Table 1 (and Table 2 for postgraduate students), these countries are labelled 'large oil producers', while those countries with a lower level of oil production or with no oil production are captured in the 'no/small oil producer' category[22].

The analysis is informative. The results of the econometric analysis suggest that for countries that are large oil producers, a 1% increase in the energy price index results in a **0.38%** increase in UK higher education enrolment at undergraduate level. At the same time, amongst countries with a lower (or no) oil production, the same 1% increase in the energy price index will result in a **0.11%** decline in demand for UK higher education at undergraduate level.

To estimate the aggregate effect across the two 'types' of country, it is necessary to consider the relative magnitude of these country segmentations. Using information from 2014/15, the number of undergraduate students entering UK higher education institutions from the top 20 oil producing nations was estimated to be **40,168** compared to **59,142** from nations not in the top 20. This suggests that increases in energy prices have a small positive impact on enrolment in UK higher education institutions at undergraduate level: following a 10% increase in energy prices, we might expect an average increase of **0.84%** in UK higher education enrolment at undergraduate level.

[22] International Energy Statistics 2015 (here)

The results relating to the impact of energy prices on the top 20 oil-producing nations is statistically significant at the 1% level, while the corresponding results for states outside the top 20 is also statistically significant, but only at the 10% level.

Gross Domestic Product (per capita)

In relation to other macroeconomic variables, we also consider the impact of overseas wealth – measured by GDP per capita (denominated in US Dollars and adjusted for relative prices). Following a 1% increase in GDP per capita internationally, the results indicate that (as expected) we would see an increase in UK undergraduate higher education enrolment by **0.49%**. The impact of gross domestic product per capita is statistically significant at the 1% level.

Policy interventions

Finally, we also consider the possible impact of the change to visa arrangements encapsulated by the April 2012 decision to remove the automatic ability of international students to undertake two years of post-study work in the United Kingdom. To achieve this, we included a dummy variable in the model – simply identifying whether the post study visa arrangements were in place in the relevant year. The analysis suggests that the introduction of the policy in 2012 - holding other factors constant - was associated with a **20.3%** decline in enrolment at undergraduate level. The impact of the 2012 policy intervention dummy is statistically significant at the 1% level.

Note that this is not a perfect means of capturing the effect of the policy decision to restrict post study working arrangements, since the variable is a dummy variable equal to one in 2012 and onwards[23], and zero otherwise. Hence, undoubtedly, a number of other factors of relevance in 2012 that might have impacted international demand for UK higher education will affect the coefficient on the dummy.

3.2 Postgraduate students

Although the process for estimating the determinants of higher education demand at postgraduate level was broadly[24] the same as for undergraduates, the variables that were eventually selected in the final model specification did not necessarily coincide. It is also important to note that the explanatory power of the postgraduate model is not as good as that associated with the undergraduate model (where the predictive power of the model was remarkably good).

There are a number of reasons for this.

- The first relates to the fundamental nature of the postgraduate market. In particular, one of the key determinants of where to study at postgraduate level relates to the availability of funding opportunities – both at a national level (in the domestic or host country) – but also at institutional level. Compounding this issue, the availability of other related subsidies or opportunities from institutions (for instance, in relation to accommodation subsidies or graduate teaching opportunities) are likely to play a significant role in student choice. The result is that

[23] For non-EU countries only (as the visa change applied exclusively to international students).
[24] Specifically, because of the existence of non-stationarity in the dependent variable (i.e. there is an underlying mean (reverting or non-mean reverting) trend over time). As a result of this, the model was estimated in 'first difference'.

from a student's perspective, we have no accurate means of assessing the extent to which headline costs of study diverge from actual costs.

- There are other issues that might be influential in determining the level of postgraduate study too. Specifically, the fact that the decision to enrol in an overseas higher education provider at undergraduate and postgraduate level might be a joint decision. As such, a number of undergraduate specific factors might be influential in determining postgraduate enrolment.

The result of this difference in the structural operation of the postgraduate market means that a number of variables – although intuitively expected to have a similar effect as at the undergraduate level analysis – are likely to be either less statistically significant or insignificant.

The second issue relates to the lack of information on competitor country postgraduate fees. In a number of countries, tuition fees are essentially zero; determined at sub-national level; highly variable depending on the nature of the institution; or completely unregulated. As a result, the analysis presented here uses the **undergraduate** fees in competitor countries in the absence of reliable postgraduate fee information[25].

However, despite the fact that some of the coefficients might be statistically indistinguishable from zero, it is still informative to consider the point estimates, as this does provide a broad indication of the relationship between the variables.

Fee levels

Table 2 indicates that the UK postgraduate fee levels are a key determinant of enrolment. Statistically significant at the 5% level, the findings indicate that a 1% increase in the level of UK postgraduate fees is associated with a **0.21%** reduction in the level of enrolment in the same year. However, unlike the analysis relating to undergraduate study, the estimated model does not find a statistically significant lagged effect of UK fees on postgraduate enrolment (possibly reflecting the (on average) shorter duration of postgraduate degrees).

Unlike the undergraduate model, and perhaps counter-intuitively, we do not find any impact of US fee levels on UK postgraduate enrolment. However, the analysis does indicate that there is a (very) small enrolment impact in the UK following changes in German higher education fees (both in the same period and in the subsequent period).

Exchange rates

Although not statistically significantly different from zero, the analysis suggests there is a positive association between an exchange rate depreciation and higher education enrolment. In particular, assuming that there was a 1% depreciation in Sterling, the analysis suggests that there would be an increase in postgraduate enrolment by **0.20%** in the same period, and a further **0.14%** in the subsequent period. Therefore, the model implies that a 10% depreciation of the Sterling is associated with a **3.5%** increase in postgraduate enrolment in the year following the initial depreciation of the currency.

[25] Note that we undertook a number of analyses using all combinations of UK and international competitor undergraduate and postgraduate fee levels for completeness. However, the results did not change significantly

Table 2 Econometric results on determinants of higher education enrolment in the UK (postgraduate level)

Independent variables	Coefficient	Standard Error	Confidence interval (95%)	
Exchange Rate (*period t*)	-0.204	0.1428	-0.4847	0.0757
Exchange Rate (*period t-1*)	-0.141	0.0956	-0.3285	-0.0467
Energy Index (*no/small oil producer*)	0.019	0.0586	-0.9547	0.1345
Energy Index (*large oil producer*)	-0.016	0.1401	0.2908	0.2587
GDP per capita (USD) (country *i*)	0.034	0.1267	-0.2831	0.2141
UK Postgraduate fees (GBP) (*period t*)	-0.213**	0.0924	-0.3948	-0.0320
GER Postgraduate fees (GBP) (*period t*)	0.005***	0.0017	0.2927	1.0228
GER Postgraduate fees (GBP) (*period t-1*)	0.005*	0.0027	0.1182	0.7661
Population (*country i*)	0.358	1.3283	-2.2478	2.9632
Post study visa (*dummy*)	0.072**	0.0301	0.0130	0.1314
Constant	0.011	0.0264	-0.0407	0.0631
Number of observations	1,778			

Note: ***/**/* statistically significant at the 1%/5%/10% level respectively

a. All variables are in log, unless a dummy variable

b. UK postgraduate and US undergraduate fees are denominated in Sterling

c. A number of the variables have been transformed using a logarithmic function. This has been done to allow for a more transparent interpretation. Specifically, a β coefficient on a relevant variable can be interpreted as a β% percentage change in the number of postgraduate enrolments in the United Kingdom following a 1% change in the relevant variable. Taking an example, the coefficient of 0.2134 on (log) of UK postgraduate fees in period *t* suggests that an increase of 1% in UK postgraduate fees (denominated in GBP) in a particular year will have a 0.2134% reduction in the number of postgraduate enrolments in UK higher education institutions in that same year.

d. A number of model specifications were considered including specifications that incorporated undergraduate fees in the US, France, Australia and Canada. Furthermore, in a number of specifications, these undergraduate fee levels were interacted with regional measures (for instance to understand whether the change in undergraduate fees in Australia might have an effect on students domiciled in Asia). These models generated statistically insignificant results.

Source: London Economics' analysis

Other determinants

The analysis suggests that both GDP per capita, population levels and the index of energy prices are not related to postgraduate enrolment levels in the UK. However, the results indicate a statistically significant effect related to the dummy variable used as a proxy for **the amendment of the post-study visa regime** in 2012. Subject to the previous caveats, the analysis indicates that although the new visa restrictions in 2012 resulted in a significant reduction in the number of undergraduate students enrolling in UK higher education institutions, the impact on postgraduate enrolment was positive. In particular, the model suggests that there was a **7.2%** increase in student enrolment at postgraduate level, other factors being held constant. Because of other factors at work on the postgraduate enrolment rate, this result suggests that the rate of increase could have been even higher in the absence of this policy intervention.

4 What does the analysis imply for UK higher education institutions?

4.1 Approach

To understand the possible impact of a range of different scenarios on individual UK higher education institutions, we utilise information from HESA on non-UK enrolments at both undergraduate and postgraduate level (both full-time and part-time). Presented in Figure 5 and Figure 6, the charts demonstrate the very different reliance of different UK higher education institutions (HEIs) on non-UK domiciled students, but also the very different composition of undergraduate and postgraduate students.

For instance, in 2014-15, University College London had **7,845** overseas students, of which **2,105** were from the European Union (**1,345** FT PG and **620** UG FT) and **5,740** were non-UK non-EU international students (**3,740** FT PG and **1,380** UG FT)[26]. In contrast, the UK higher education institution ranked 35th in terms of the number of non-UK domiciled students commencing a qualification in 2014-15 (University of Greenwich) was estimated to have **2,185** overseas students, of which **510** were from the European Union (**385** UG and **125** PG) and **1,675** were non-UK non-EU international students (**960** PG and **715** UG).

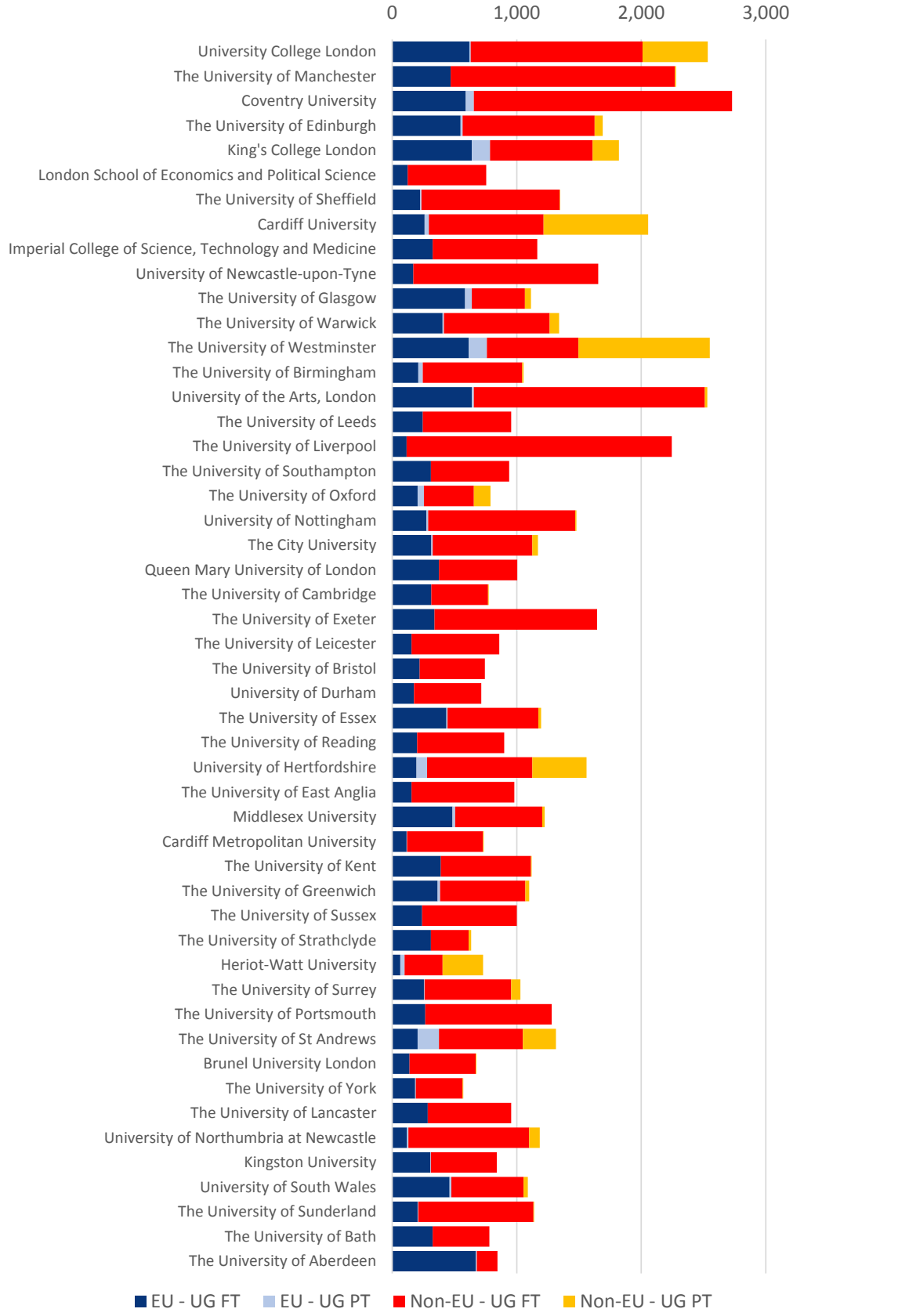
However, it is likely that changes in the wider macroeconomic environment will have a different impact on different institutions depending on their reliance on different types of student and particular characteristics (for instance research focus, location and reputation). In other words, although the example above suggests that University College London's reliance on non-UK domiciled students is greater than at the University of Greenwich (at least in absolute terms), it might be the case that the responsiveness of student enrolments to changes in macroeconomic factors is less (or more) for the University of Greenwich than for University College London.

4.2 How can we classify institutions?

Rather than splitting higher education institutions by mission group membership (which is self-selected and only provides partial coverage), we base our analysis on a classification of UK higher education institutions developed by Boliver (2015).[27] This research suggests that as a result of the differences in research activity, teaching quality, economic resources, academic selectivity, and socioeconomic student mix, it is possible to classify UK higher education institutions into four distinct clusters. Among the pre-1992 universities, Oxford and Cambridge 'emerge as an elite tier', with the remaining Russell Group universities essentially undifferentiated from the majority of other pre-1992 universities (Clusters 2 and 3). However, the cluster analysis indicates that there is a division among the post-1992 universities, with around a quarter of post-1992 universities forming a 'distinctive lower tier' (Cluster 4).

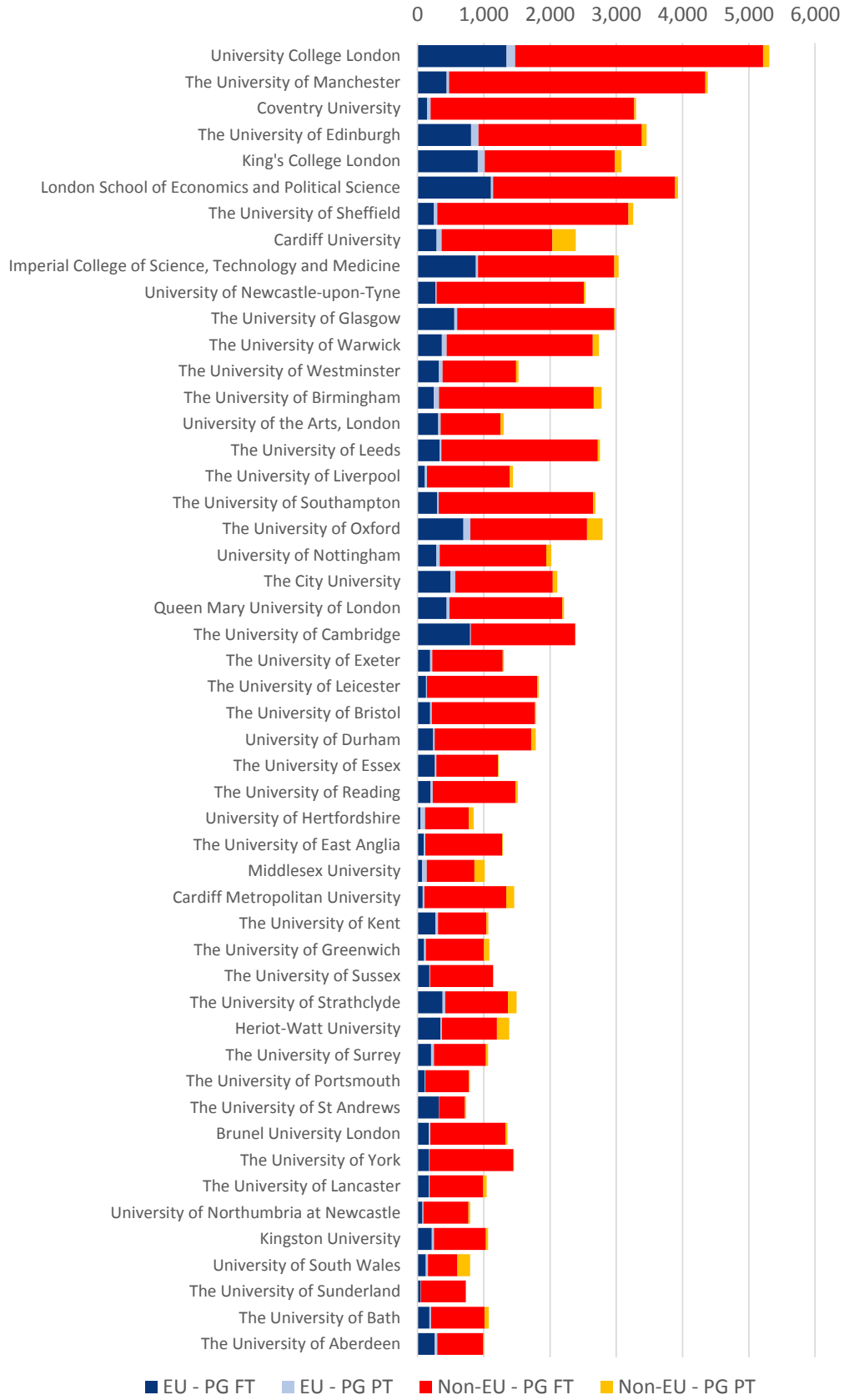
[26] Note that the remaining students in the total consist of part time students, at both undergraduate and postgraduate level.
[27] Boliver, V. (2015) Are there distinctive clusters of higher and lower status universities in the UK?, Oxford Review of Education, 41:5, 608-627, DOI: 10.1080/03054985.2015.1082905

Figure 5 Non-UK undergraduate student enrolments, top 50 UK higher education institutions



Source: London Economics' analysis of HESA data

Figure 6 Non-UK postgraduate student enrolments, top 50 UK higher education institutions



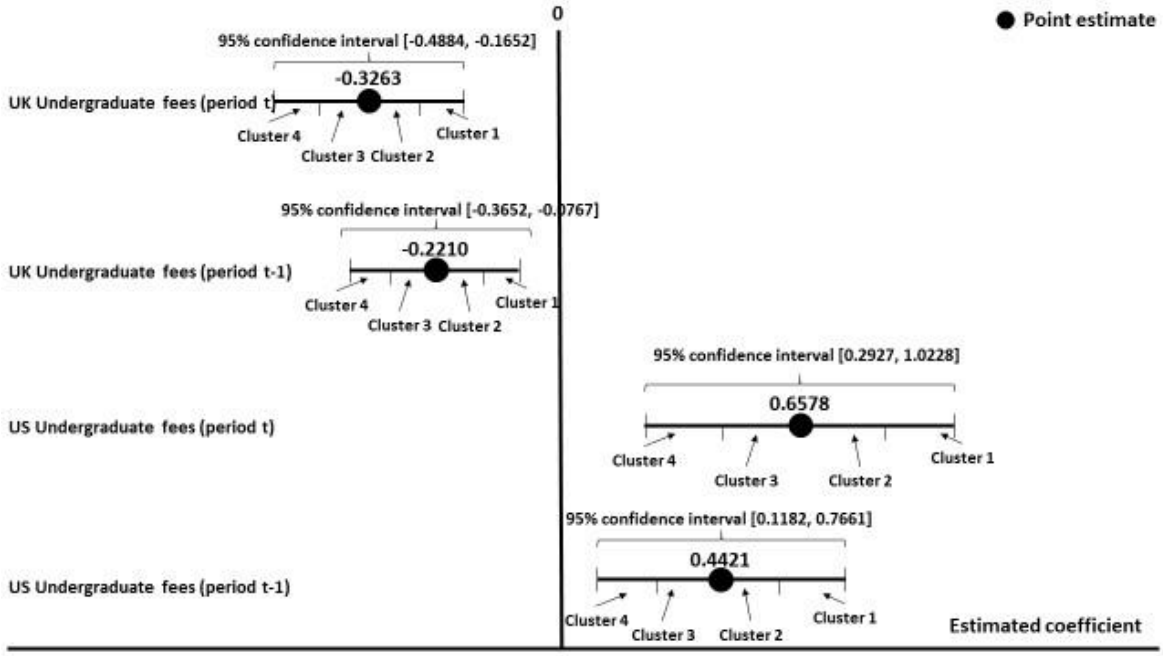
Source: London Economics' analysis of HESA data

Using this analysis, we group UK higher education institutions into four clusters that are presented in full in the Annex.[28] **Cluster 1** consists of **2** institutions (University of Oxford and University of Cambridge). **Cluster 2** consists of **39** mainly pre-1992 institutions (Russell Group and/or former 1994 Group institutions or unaffiliated institutions). **Cluster 3** consists of **67** institutions covering members of the 1994 Group, Million+, University Alliance, Guild HE and unaffiliated institutions). **Cluster 4** consists of **17** institutions covering members of Million+, University Alliance, Guild HE and unaffiliated institutions)[29].

To understand what the effect might be of different macroeconomic factors, we use the point estimates and confidence intervals from the econometric analysis. We then split the confidence interval generated for a given variable in the econometric analysis into four equal segments and assign the clusters of universities to the mid-point of each segment (see Figure 7).

In the example below, using the price elasticity of demand with respect to UK fees (within the same year, i.e. period t), we assume that institutions in **Cluster 1** are least negatively affected by price increases, and institutions from **Cluster 4** most negatively affected by increases in average fees. Clearly, this is a simplification and does not take into account the different geographical markets and competition that some higher education institutions face. However, using average UK fees as an example, institutions in Cluster 1 would be assigned an elasticity of demand of **-0.205**, so that a 10% increase in average fee levels would result in a **2.1%** reduction in higher education enrolment at undergraduate level.

Figure 7 Example of alternative measures of responsiveness by university cluster



Source: London Economics' analysis

[28] See Annex 1 for complete list of institutions (Boliver 2015).

[29] Note that the analysis by Boliver (2015) includes a total of 127 institutions in its classification. The slightly smaller number of institutions included here (125) is based on the fact that the relevant HESA information on student numbers and tuition fee income was unavailable for the University Campus Suffolk and the University of Wales, Newport (both included in Cluster 4). Hence, instead of 19 institutions, the analysis for Cluster 4 is based on 17 institutions only.

Institutions in Cluster 2 would be assigned an elasticity of **-0.286**; institutions in Cluster 3 would be assigned an elasticity of **-0.367**; and institutions in Cluster 4, assuming that enrolment is the most responsive to changes in the fees charged, are assigned an elasticity of **-0.447.**

This approach is replicated for all variables of interest, where we assume that institutions in Cluster 1 are either the most positively or least negatively impacted by policy or macroeconomic changes, while institutions in Cluster 4 are either the most negatively or least positively impacted, depending on the change being considered.

Throughout the following analysis, relative to the 2014/15 baseline, we report our findings at cluster level, and in aggregate. We also assume that percentage changes in the average fee level adopted as part of the econometric analysis are applied by all institutions, which although is relatively accurate at undergraduate level (given the current regulatory environment) is less realistic at postgraduate level.

Despite the fact that the econometric modelling at postgraduate level was less persuasive, it is clear from an economic perspective that a number of variables – such as a depreciation of Sterling – will intuitively have a positive effect on enrolment. As such, we adopt the comparable approach outlined above for both undergraduate and postgraduate enrolment. Finally, we consider the impact on enrolment and institutional finances once the entire cumulative effect has occurred.

4.3 What is the expected impact of an exchange rate depreciation?

Turning to a currency depreciation, we model the impact of a **10%** reduction in the value of Sterling. Holding all other factors constant, at undergraduate level, our modelling suggests that the **direct effect** of a **10%** depreciation of Sterling would result in a **2.1%** increase in UK higher education enrolment in the same year with a further **2.0%** effect in the subsequent year.

In addition to the **4.1%** direct effect, we would expect to see an increase in undergraduate enrolment in the UK of **11.0%** as a result of the **indirect effect** (essentially other competitor countries appearing less attractive). At postgraduate level, our modelling suggested that the **direct effect** of a **10%** depreciation of Sterling is associated with a **3.5%** cumulative increase in postgraduate enrolment in the year following the initial currency depreciation (on average).

The analysis presented in Table 3 indicates that:

- In Cluster 1, the effect of the 10% depreciation would be to increase the number of EU and non-EU students by **123** (**11%**) and **241** (**11%**) per institution on average (respectively). The total potential financial impact across the cluster stands at approximately **£10.4 million**.
- In Cluster 2, which consists of 39 institutions, the currency depreciation would potentially increase the number of EU and non-EU students by **72** (**11%**) and **224** (**9%**) per institution on average (respectively). The total potential impact in financial terms across the cluster is estimated to be approximately **£152.1 million**, with each institution on average benefitting by approximately **£3.9 million**.

- In Cluster 3, the analysis suggests that the total financial impact of a depreciation would be approximately **£61.1 million**, corresponding to **£0.9 million** per institution. In terms of student numbers, this equates to an increase in student enrolments by **30** (**9%**) and **75** (**8%**) per institution on average (EU and international students, respectively).
- Finally, for the higher education institutions contained in Cluster 4, given the lack of responsiveness of enrolment to exchange rate movements and fee levels, the effect of a Sterling depreciation (per institution) would increase enrolment amongst EU students by **11** (**5%**) and international students by **12** (**4%**). This corresponds to an institutional level impact of approximately **£0.2 million** (and **£2.8 million** in aggregate).

Table 3 Impact of a Sterling depreciation on UK higher education enrolment

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total
Number of institutions	**2**	**39**	**67**	**17**	**125**
Average impact on student numbers (per institution) and total students affected (total column)					
European Union	123 (11%)	72 (11%)	30 (9%)	11 (5%)	**5,282 (10%)**
Non-European Union	241 (11%)	224 (9%)	75 (8%)	12 (4%)	**14,455 (9%)**
Average change in fee income (per institution (£ millions))					
European Union	£0.8m	£0.4m	£0.2m	£0.1m	**£0.3m**
Non-European Union	£4.5m	£3.5m	£0.7m	£0.1m	**£1.5m**
Total change in fee income (per cluster (£ millions))					
European Union	£1.5m	£17.1m	£12m	£1.1m	**£31.7m**
Non-European Union	£8.9m	£135m	£49.1m	£1.8m	**£194.8m**
Total	**£10.4m**	**£152.1m**	**£61.1m**	**£2.8m**	**£226.4m**

Note: Impact on student numbers per institution multiplied by the average change in fee income per institution may not equal the total change in fee income due to rounding.
Source: London Economics' analysis

In aggregate, across all institutions, the analysis indicates that the depreciation of the currency would potentially result in an increase in demand for higher education by approximately **19,750** students (assuming institutions are themselves able to recruit this number). Of this number, approximately **14,450** are estimated to be non-EU international students, with the remaining **5,300** coming from the European Union.

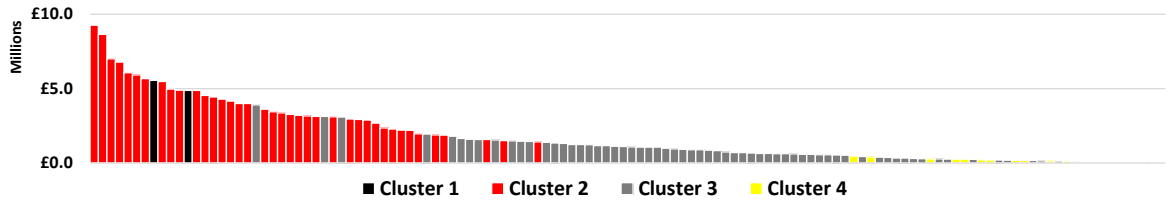
From an institutional perspective, although there is some significant variation, the analysis suggests that the representative institution would see fee income generated from overseas increase by approximately **£1.8 million** in the *first year* of new student enrolment, with additional fee income being generated by these students as they continue their studies. In aggregate, the potential increase in fee revenue generated by UK higher education institutions would be **£226.4 million**.

It is extremely important to note that the estimates presented above do not take into account any revision to the student visa regime currently in operation. Clearly, the analysis of enhanced revenues assumes that an additional **19,750** EU and international students would be allowed to come to the United Kingdom to pursue their studies. However, given the level of uncertainty in relation to the inclusion or exclusion of students from

immigration targets, it is unclear that these financial gains will be realised. If it is decided that institutions cannot benefit from the increased demand for higher education because of an international student number cap, or as a result of tougher rules facing some institutions, the economic loss to the UK economy could be very significant – both because of the potential lost fee income generated by continuing students, but also because of the non-tuition fee income that is associated with overseas students.

In the case of an across-the-board student number cap at current levels, the loss in potential tuition fee income associated with first year enrolment was estimated to be **£226.4m**, while a partial cap on Cluster 3 and Cluster 4 institutions only would result in a **£63.9m** potential loss of tuition fee income.

Figure 8 Impact of a Sterling depreciation on UK higher education institutions' finances



Source: London Economics' analysis

4.4 What is the expected impact of changing EU student support arrangements?

To illustrate the model's results further, we considered the impact of a hypothetical change in student support on overseas student enrolment and the financial position of higher education institutions. In particular, we consider the hypothetical example where European Union students, who currently receive subsidised income-contingent loans for their tuition fees, have this loan subsidy removed[30]. To implement this, we use information from the Department for Education on the proportion of the tuition fee that is written off by the Exchequer (the Resource Accounting and Budgeting (RAB) charge). The most recent estimate of the RAB charge stands at **23%**[31] [32], and by removing this income-contingent loan subsidy, the effective cost of tuition fees increases by **23%** for European Union-domiciled undergraduate students (only).

This situation can be presented in our model as an increase in the price of UK fees charged to EU-domiciled undergraduate students. However, it is important to note that the removal of the loan itself will likely **further depress demand (over and above the direct price effect)**,

[30] Note that subject to eligibility conditions, EU students also potentially receive interest rate subsidies on maintenance loans. However, in this analysis, we have only considered the proportion of the tuition fee loan that is expected to be subsidised by the UK Exchequer (as represented by the RAB charge).

[31] The size of the Exchequer maintenance and fee loan subsidy is measured by the **Resource Accounting and Budgeting** charge (RAB), which calculates the proportion of the nominal loan value that would not be expected to be repaid (in present value terms). Under the current student support regime, non-repayment occurs as a result of debt forgiveness after 30 years or in the case of permanent disability or death. Based on graduate earnings profiles (from the Labour Force Surveys) and the administrative information relating to the criteria for repayment of loans, estimates of the RAB Charge stand at approximately **23%** for full time students, which implies that for every £1,000 in loans that are provided by the government, approximately £770 would be expected to be repaid (in present value terms) with the remaining £230 being 'lost' to the public purse as a result of write-offs

[32] See Hansard Written Questions "*The Resource Accounting and Budgeting (RAB) charge, which represents the value of the part of the loan that is not expected to be repaid, is not calculated separately by the nationality of the students. We estimate that the RAB charge for full time tuition fee and maintenance loans is between 20% and 25%*" Jo Johnson MP 09-06-2016 (here)

as the approach we have considered assumes that EU students have an alternative source of credit available to finance their studies. Given that this is highly unlikely in many cases, the estimates presented here should be considered as a **minimum effect** of the removal of student support.

The analysis presented in Table 4 indicates that:

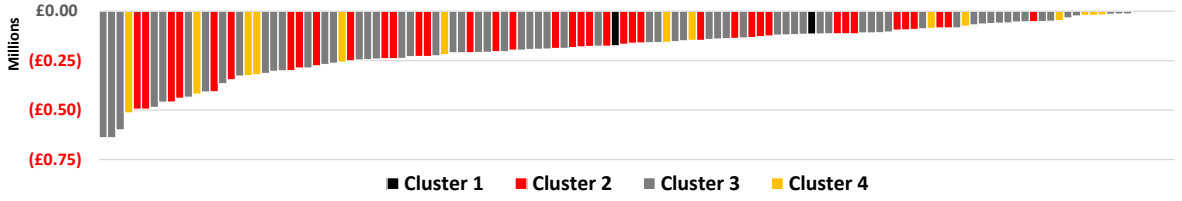
- In Cluster 1, the effect of the removal of the loan subsidy for EU-domiciled undergraduates would be to reduce the number of EU-domiciled students – by **21** (**2%**) in each institution on average. The total impact in financial terms across the cluster would be approximately **£300,000** in the first year of study.
- In Cluster 2, the removal of the loan subsidy would reduce the number of EU students by **32** (**5%**) per institution on average. The total impact in financial terms across the cluster would be approximately **£8.2 million**, with each institution seeing a potential reduction in tuition fee income of approximately **£200,000**.
- In Cluster 3, the analysis indicates that the total financial impact of the removal of EU undergraduate student support would be approximately **£12.9 million**, corresponding to **£200,000** per institution. In terms of student numbers, this equates to a potential reduction in student enrolments by **31** (**9%**) per institution.
- For the higher education institutions contained in Cluster 4, the impact of the change in student support arrangements would result in a reduction in enrolment amongst EU students by **27** (**13%**), which corresponds to an institutional level impact of approximately **£200,000** (and **£2.7 million** in aggregate).

Table 4 Impact of a change in higher education student support arrangements

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total
Number of institutions	**2**	**39**	**67**	**17**	**125**
Average impact on student numbers (per institution) and total students affected (total column)					
European Union	(21) (-2%)	(32) (-5%)	(31) (-9%)	(27) (-13%)	**(3,847) (-7%)**
Average change in fee income (per institution (£ millions))					
European Union	(£0.1m)	(£0.2m)	(£0.2m)	(£0.2m)	**(£0.2m)**
Total change in fee income (per cluster (£ millions))					
European Union	**(£0.3m)**	**(£8.2m)**	**(£12.9m)**	**(£2.7m)**	(£24.0m)

Note: Impact on student numbers per institution multiplied by the average change in fee income per institution may not equal the total change in fee income due to rounding. ***Source: London Economics***

Figure 9 Impact of removal of EU undergraduate student support on UK higher education institutions' finances



Source: London Economics' analysis

In aggregate, across all institutions, the analysis indicates that the removal of student support for EU undergraduates would result in a reduction in enrolment at UK higher education institutions by approximately **3,850** students (**2%** of total non-UK students).

From the perspective of institutions, the analysis suggests that the representative institution would see fee income generated from EU undergraduate students decrease by approximately **£200,000** in the *first year* of new student enrolment, with additional fee income being lost from these students as they would have continued their studies. The total fee revenue accruing to UK higher education institutions (associated with students' first year of study) is estimated to decline by **£24.0 million**.

4.5 What is the expected impact of EU and international student tuition fee harmonisation?

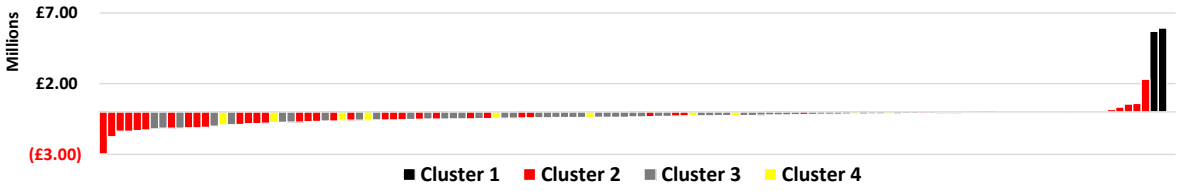
In the final scenario, we consider the impact on institutions if the current requirement to charge European Union-domiciled students the same fees as Home-domiciled students is removed (on top of the removal of student support), with the result that EU-domiciled fees are increased to those being charged to international (i.e. non-EU) students. Note again that the transmission mechanism by which we estimate the impact on enrolment is through the elasticity of demand, which varies by university cluster.

Table 5 Impact of a change in higher education student support arrangements and fee convergence

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total
Number of institutions	**2**	**39**	**67**	**17**	**125**
Average impact on student numbers (per institution) and total students affected (total column)					
European Union	(402) (-37%)	(467) (-68%)	(162) (-48%)	(83) (-42%)	**(31,290) (-57%)**
Average change in fee income (per institution (£ millions))					
European Union	£5.8m	(£0.6m)	(£0.3m)	(£0.3m)	**(£0.3m)**
Total change in fee income (per cluster (£ millions))					
European Union	**£11.6m**	**(£23.1m)**	**(£23.2m)**	**(£4.8m)**	**(£39.5m)**

Note: Impact on student numbers per institution multiplied by the average change in fee income per institution may not equal the total change in fee income due to rounding. ***Source: London Economics' analysis***

Figure 10 Impact of a change in higher education student support arrangements and fee harmonisation on UK higher education institutions' finances



Source: London Economics' analysis

The analysis indicates that for Cluster 1, there would be a large reduction (37%) in student numbers as a result of the increase in fees and removal of student support for EU-domiciled students. However, the percentage reduction in student numbers is **outweighed** by the percentage increase in tuition fees per student for the remaining student body. This would

result in a **(net) increase in average and total tuition fee revenue in Cluster 1**. This is based on the fact that demand for the highly selective institutions in Cluster 1 is assumed to be relatively unresponsive to changes in the tuition fee charged. In particular, the doubling of tuition fees for those EU students enrolling more than compensates for the corresponding reduction in student numbers (by **37%**) .

Across Cluster 1, tuition fee revenue would be expected to increase by approximately **£11.6 million** for students in their first year of intended study.

In Cluster 2, the removal of the loan subsidy combined with the harmonisation of fees between EU domiciled and international students would reduce the number of EU students by **467** (**68%**) per institution on average. Unlike Cluster 1, the total impact in financial terms across the cluster is negative, and estimated to be approximately **£23.1 million**, with the representative institution in this cluster seeing a reduction in tuition fee income of **£0.6 million** on average (with one institution facing a reduction in revenues of almost **£3 million** – see Figure 10). However, there were five institutions identified in the cluster that would see an *increase* in fee revenues (by between **£200,000** and **£2.3 million** per institution). The aggregate reduction in fee income across the cluster results from the fact that the increase in fees between EU and international students in this cluster is less than the reduction in student numbers (except for five specific higher education institutions).

In Cluster 3, the removal of the loan subsidy combined with the harmonisation of fees between EU-domiciled and international students would be expected to reduce the number of EU students by **162** (**48%**) per institution on average. However, unlike Cluster 1, and to a lesser extent in relation to Cluster 2, the effect of fee harmonisation is almost universally negative in terms of financial resources. The total negative impact in financial terms across the cluster is estimated to be approximately **£23.2 million**, with the representative institution seeing a reduction in tuition fee income of **£300,000** on average. Four institutions with a heavy dependence on EU students are identified to have an income reduction of more than **£1 million** following the implementation of the fee harmonisation scenario.

Finally, in relation to Cluster 4, the fee harmonisation policy is estimated to reduce enrolment by **83** students on average (**42%**) corresponding to an aggregate negative impact of **£4.8 million** (or **£300,000** per institution). As before, there is some significant variation depending on each institution's dependency on EU students, with one institution seeing an income reduction of almost **£1 million** following the hypothetical implementation of the fee harmonisation scenario.

Taken together, the harmonisation of fees between EU-domiciled and international students and removal of the loan subsidy for EU students is estimated to reduce student numbers by **31,290** across all institutions (**14%** of total non-UK students), with total tuition fee income decreasing by **£39.5 million**. However, this figure masks the significant difference in the impact on financial resources experienced at the institutional level. A total of eight higher education institutions are expected to be financially better-off.

4.6 What is the combined impact of all three scenarios?

Table 6 shows the impact on student numbers and institution tuition fee income if all three scenarios occurred simultaneously. That is, a depreciation of Sterling, the removal of EU

student support and the harmonisation of fees between EU-domiciled and international students.

For Cluster 1, each institution's EU-domiciled tuition fee revenue is estimated to **increase** by approximately **£6.6 million** (despite the decline in numbers), while an additional **£4.5 million** per institution would be generated from international students. In total, the institutions in this cluster would be approximately **£22.1 million** better off as a result of the three scenarios occurring simultaneously.

The analysis suggests that there would be a **reduction** in EU student income of approximately **£6.1 million** across all institutions in Cluster 2 (corresponding to **394** students on average per institution), although this would be more than offset by a **£135 million** possible increase in tuition fee income from international sources. In aggregate, institutions in Cluster 2 would be **£128.9 million** better off, however, this masks some significant variation across the cluster (making it difficult to use a per-institution average).

In total, for institutions in Cluster 3, the impact of currency depreciation, removal of EU student support and fee harmonisation results in a reduction in fee income from EU sources of approximately **£11.2 million** in total, but at the same time, these institutions would experience an increase in fee income from international sources by almost **£49.1 million**. In aggregate, institutions in Cluster 3 would benefit by **£37.9 million** (corresponding to an average of approximately **£500,000** per institution).

Only partially offsetting the **£3.7 million** reduction in fee income generated from EU students, institutions in Cluster 4 might be expected to see an increase in fee revenues of **£1.8 million** from international students. This corresponds to an average reduction of approximately **£100,000** in tuition fee income per institution.

Table 6 Impact of all proposed changes on institutional fee income

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total
Number of institutions	**2**	**39**	**67**	**18**	**126**
Average impact on student numbers (per institution) and total students affected (total column)					
European Union	**(280) (-26%)**	**(394) (-57%)**	**(132) (-39%)**	**(73) (-36%)**	**(26,008) (-47%)**
Non-European Union	241 (11%)	224 (9%)	75 (8%)	12 (4%)	**14,455 (9%)**
Average change in fee income (per institution (£ millions))					
European Union	£6.6m	**(£0.2m)**	**(£0.2m)**	**(£0.2m)**	**(£0.1m)**
Non-European Union	£4.5m	£3.5m	£0.7m	£0.1m	**£1.5m**
Total change in fee income (per cluster (£ millions)					
European Union	£13.2m	**(£6.1m)**	**(£11.2m)**	**(£3.7m)**	**(£7.9m)**
Non-European Union	£8.9m	£135m	£49.1m	£1.8m	**£194.8m**
Total	**£22.1m**	**£128.9m**	**£37.9m**	**(£1.9m)**	**£186.9m**

Note: Impact on student numbers per institution multiplied by the average change in fee income per institution may not equal the total change in fee income due to rounding. ***Source: London Economics' analysis***

Figure 11 Total impact of all three scenarios on UK higher education institutions' finances

Source: London Economics' analysis

Again, noting the very significant variation across different institutions, the analysis finds that across the sector, the implementation of the three hypothetical scenarios would result in a potential increase in total revenue of approximately **£186.9 million**. This increase in income is comprised of a **£194.8 million** increase in international student fee income alongside a **£7.9 million** decline from EU sources. This analysis assumes that all other factors are held constant.

5 Conclusions

The econometric analysis suggests that there are a range of factors that determine the demand for UK higher education, including both domestic factors such as UK fee levels, but also external factors such as the exchange rate, fee levels charged by competitor countries, energy prices, overseas economic growth, and policy interventions within a country.

The analysis demonstrates that, although some factors have a relatively immediate effect on the demand for UK higher education, a number of factors (such as the value of the currency and UK fee levels) have both an immediate effect and a longer term (lagged) impact. The econometric analysis is more robust in identifying the relationship between these macroeconomic characteristics and undergraduate enrolment compared to postgraduate enrolment. This is driven by the nature of the postgraduate market[33], as well as the lack of consistent information on higher education fees for postgraduate students charged by competitor countries.

To illustrate the impact of some of these macroeconomic factors on demand for UK higher education, a range of scenarios were modelled.

- We found that modelling a **depreciation** of Sterling, holding all other factors constant, would result in a large and significant positive impact on the finances of UK higher education institutions (by about **£226.4 million** in relation to students first year of study).
- The **removal of student support** from undergraduate EU-domiciled students would have a negative effect on demand for higher education, as EU students would see the cost of higher education increase substantially. This reduction in institutional income was estimated to be a minimum of **£24.0 million**.
- **Harmonising the fees** charged to EU and international students would have an ambiguous effect on institutions. Amongst those institutions considered to be the highest-calibre institutions, the harmonisation of fees would see a potential **increase** in aggregate revenues despite the very significant reduction in student enrolments. However, there were less than 10 institutions positively affected. For the remaining higher education institutions, fee harmonisation had a **negative** effect on institutional finances. The impact of fee harmonisation reduced institutional income by **£15.5 million**.

In aggregate, the combined effect of the currency depreciation (+£226.4 million), the removal of EU undergraduate fee support (-£24.0 million) and fee harmonisation (-£15.5 million) was potentially positive – amounting to £186.9 million – though there was significant variation across higher education institutions.

In an economic sense, the analysis is based on the key assumption that all other factors in the model remain constant. However, while necessary due to the current political

[33] In particular, one of the key determinants of university choice at postgraduate level (which is not captured due to lack of available data) relates to the availability of tuition fee funding (at national level as well as at institutional level), as well as the availability of other information relating to student support or bursary opportunities at institutional level (e.g. in relation to accommodation subsidies or graduate teaching opportunities). The decision to enrol in an overseas higher education provider at undergraduate and postgraduate level might be a joint decision, and as such, a number of factors at undergraduate level might be influential in determining later postgraduate enrolment. As a result, a number of variables – although intuitively expected to have a similar effect at postgraduate level as at the undergraduate level analysis – are likely to have limited statistical significance.

uncertainty regarding future immigration caps as well as measurement issues, this is a bold assumption that does not take account of a range of potential factors negatively affecting the international demand for education in the United Kingdom.

First, the analysis is based on historic information – and does not take into account the change in sentiment that might be felt toward the United Kingdom since the recent decision to leave the European Union (or any knock-on consequences from events such as the recent US presidential election).

Second, the general attractiveness of the sector – especially for postgraduate students – might be adversely affected by the fact that UK higher education institutions would undoubtedly find it increasingly challenging to retain high-calibre research staff and related research funding in a less benign environment.

Most importantly, the analysis presented here assumes that there are no immigration caps, nor any differential treatment of higher education institutions in relation to the ability to secure student visas (and post study work visas). As such, the positive impact of the depreciation of Sterling assumes that an additional **19,750** students will be allowed to study in the United Kingdom[34]. However, given the current political environment, if it is decided that institutions cannot benefit from this increased demand because of an international student number cap or as a result of tougher rules facing some institutions, then the **£226.4 million** potential gain that might be achieved by UK higher education institutions may not be realised or only realised in part – thus representing a potential loss.

What does this mean for the UK economy?

The **£226.4 million** per annum potential loss identified only captures the tuition fee income in students' first year of study. This increases to **£463 million** per annum if we consider the fee income accrued over the total duration of study[35]. If we further include the economic output associated with students' non-tuition fee expenditure over the course of their studies (**£604 million**), the total potential loss to the UK economy stands at **£1.067 billion** per annum[36].

Universities have extensive supply chains. Known as the indirect and induced effects, UK higher education institutions (and their staff and students) support these supply chains through their purchases. If we also consider these indirect and induced effects on the wider UK economy associated with this source of export income, the estimate of potential loss increases to approximately **£1.995 billion** per annum[37].

[34] This is the estimated additional student inflow associated with a 10% depreciation of Sterling.
[35] For full-time students, we assume, an average study duration of 3 years for first degrees and higher degrees (research); and 1 year for taught postgraduate degrees and other undergraduate and postgraduate qualifications. Using these assumptions, we thus calculated the tuition fee income over the total duration of study (discounted to reflect present values, using Green Book discount rates (here)).
[36] To analyse the level of non-tuition fee income, we used estimates from the 2011-12 Student Income and Expenditure Survey (here). The survey provides estimates of the average expenditure by *English* domiciled students on living costs, housing costs, participation costs (including tuition fees) and spending on children for both full-time and part-time students. From these estimates, we excluded any estimates of tuition fee expenditure to avoid double-counting. Since the survey does not cover non-UK domiciled students, our analysis implicitly assumes that non-tuition fee expenditure levels do not vary significantly between UK and overseas students. We do however adjust the estimates for the longer average stay durations in the UK of international students compared to EU students, based on the approach outlined in London Economics (2011) Estimating the value to the UK of educational exports, BIS research Report 46 (here). Finally, we adjusted the resulting estimates for inflation.
[37] The estimates of the indirect and induced effects associated with tuition fee income and non-tuition fee income are based on estimates provided by Kelly, U., McNicoll, I., & White, J. (2014), 'The impact of universities on the UK economy' (here).

Index of Tables, Figures and Boxes

Tables

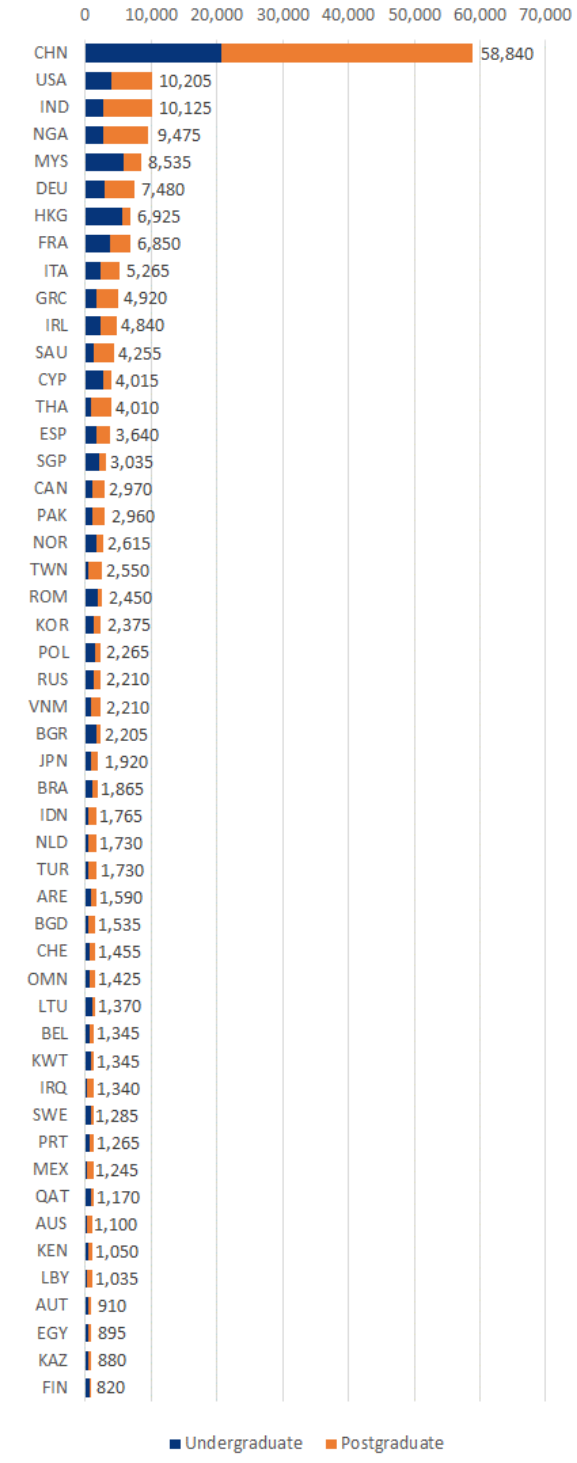
Figures

ANNEXES

Annex 1 Supplementary data analysis

A1.1 Additional enrolment information

Figure 12 UK higher education enrolments 2014-15 (Top 50 originating countries)



London Economics' analysis of HESA data

A1.2 University clustering

Table 7 Presentation of university clusters (Boliver (2015))

Cluster 1 (2 cases)	Cluster 3 (67 cases)	Cluster 3 continued
University of Cambridge[a]	Abertay Dundee University[d]	The University of Northampton[d]
University of Oxford[a]	Aberystwyth University[c]	Nottingham Trent University[f]
	Arts University Bournemouth[e]	Northumbria University[f]
Cluster 2 (39 cases)	University of the Arts London[g]	Oxford Brookes University[f]
University of Aberdeen[c]	Aston University[c]	Plymouth University[f]
University of Bath[b]	Bangor University[c]	University of Portsmouth[f]
University of Birmingham[a]	Bath Spa University[d]	Queen Margaret University[g]
University of Bristol[a]	University of Bedfordshire[d]	Robert Gordon University[g]
Cardiff University[a]	Birmingham City University[d]	University of Roehampton[g]
University of Dundee[c]	Bournemouth University[f]	University of Salford[f]
Durham University[ab]	University of Bradford[f]	Sheffield Hallam University[f]
University of East Anglia[b]	University of Brighton[g]	Staffordshire University[d]
The University of Edinburgh[a]	Brunel University London[c]	University of Stirling[c]
University of Exeter[ab]	Canterbury Christ Church University[d]	University of Sunderland[d]
University of Glasgow[a]	Cardiff Metropolitan University[f]	Swansea University[c]
Goldsmiths, University of London[b]	University of Central Lancashire[d]	Teesside University[f]
Heriot-Watt University[c]	University of Chester[g]	Ulster University[c]
Imperial College London[a]	University of Chichester[e]	University of the West of England[f]
University of Kent[c]	City University[c]	University of West London[d]
King's College London[a]	Coventry University[f]	University of the West of Scotland[d]
Lancaster University[b]	University for the Creative Arts[e]	University of Westminster[g]
University of Leeds[a]	De Montfort University[g]	The University of Winchester[e]
University of Leicester[b]	University of Derby[g]	University of Worcester[e]
University of Liverpool[a]	Edinburgh Napier University[d]	
University College London[a]	University of Essex[b]	**Cluster 4 (19 cases)**
The London School of Economics and Political Science[ab]	Falmouth University[e]	Anglia Ruskin University[d]
	University of Glamorgan[f]	Bishop Grosseteste University[e]
Loughborough University[b]	Glasgow Caledonian University[f]	University College Birmingham[e]
The University of Manchester[a]	University of Gloucestershire[g]	University of Bolton[d]
Newcastle University[a]	University of Greenwich[f]	Buckinghamshire New University[e]
The University of Nottingham[a]	Harper Adams University[e]	University of Cumbria[d]
Queen Mary University of London[ab]	University of Hertfordshire[f]	University of East London[d]
Queen's University Belfast[a]	Univ. of the Highlands & Islands[g]	Edge Hill University[g]
University of Reading[b]	University of Huddersfield[f]	Glyndwr University[e]
Royal Holloway, University of London[b]	The University of Hull[c]	Leeds Trinity University[e]
University of St Andrews[b]	Keele University[c]	Liverpool Hope University[g]
SOAS, University of London[b]	Kingston University[f]	London Metropolitan University[d]
The University of Sheffield[a]	Leeds Beckett University[d]	University of Wales, Newport[f]
University of Southampton[a]	University of Lincoln[f]	University of St Mark and St John[g]
University of Strathclyde[c]	Liverpool John Moores University[f]	Southampton Solent University[e]
University of Surrey[b]	London South Bank University[g]	University Campus Suffolk[g]
University of Sussex[b]	Manchester Metropolitan University[f]	University of Wales Trinity Saint David[c]
The University of Warwick[ab]	Middlesex University[d]	University of Wolverhampton[d]
The University of York[ab]	Newman University, Birmingham[e]	York St John University[e]

a. Russell Group;
b. 1994 Group;
c. Unaffiliated Old (pre-1992) universities;
d. Million+;
e. GuildHE;
f. University Alliance;
g. Unaffiliated New (post-1992) universities.

Source: Boliver (2015) "Are there distinctive clusters of higher and lower status universities in the UK?", Oxford Review of Education, 41:5, 608-627, DOI: 10.1080/03054985.2015.1082905

A1.3 Further statistical tests

To test the stability and sensitivity of preferred estimation results provided in Table 1, further estimations are carried out with changes made to the model specification. In particular, the following changes are considered:

1) **Regional dummies** – Undergraduate fees in Germany, France, and Australia are combined with regional measures to control for potential location effects on the demand for UK higher education. For example, students domiciled in Asia may be more likely to view Australia as a substitute destination country to the UK to pursue higher education. To test for such regional effects, dummy variables for Europe, Africa (predominantly, the French-speaking countries) and Asia are combined with undergraduate fees in Germany, France and Australia, respectively.
2) **OECD data on UK fees** – To test the consistency of the preferred results, the estimation is re-run using UK tuition fee data from the OECD's *Education at a Glance* reports. Competitor country tuition fee data is also taken from the OECD reports.
3) **Top 100 countries** – The cross-sectional dimension of the dataset is limited to the top 100 originating countries in terms of undergraduate student numbers (using 2014-15 HESA figures to define the top 100).
4) **Pre-2012** – The time dimension of the data is restricted from 2003 to 2011 (i.e. before the removal of the post-study work visa).

Table 8 below shows the results from each of these estimations, alongside the preferred estimation from Table 1. Overall, the results are robust to changes in the specification and the underlying data. More specifically:

- Controlling for regional effects on overseas demand for UK higher education, a 1% increase in tuition fees charged in Australia is associated with a 0.82% increase in UK undergraduate enrolments from Asia. This effect is statistically significant at the 5% level. Other regional interactions are statistically insignificant. Compared to the preferred estimation, the magnitude of estimated coefficients for the exchange rate in the contemporaneous period, and the estimated impact of US tuition fees, are larger. Other estimates remain largely unchanged.
- There is no significant change in the estimated coefficients when using OECD data on UK tuition fees at the undergraduate level. The impact of UK tuition fees on enrolments remains negative with statistical significance at the 5% level.
- Considering the top 100 originating countries only, the analysis suggests that the exchange rate only has an impact on undergraduate enrolments in the contemporaneous period. The impact of the removal of the post study work visa remains statistically significant but declines in magnitude (14% compared to 20% in the preferred estimation). This suggests that countries with lower UK higher education enrolments were more affected by the removal of the post study work visa.
- Considering the analysis from 2003 to 2011 only, the results suggest that there is no statistical evidence of a relationship between the exchange rate and UK higher education enrolments at the undergraduate level. However, the estimated coefficients remain economically important.

Figure 13 compares the estimated coefficients for the key variables of interest and their 95% confidence from all estimations. The red dashed-line highlights the 95% confidence interval for the estimated coefficients in the preferred estimation (Table 1).

In all but one case, the estimated point coefficients from these additional estimations lie within the 95% confidence interval of the estimated point coefficients from the preferred estimation. This suggests that the estimated coefficients in the preferred specification are robust and we are 95% confident that the true value of the variables of interest lie within the given ranges.

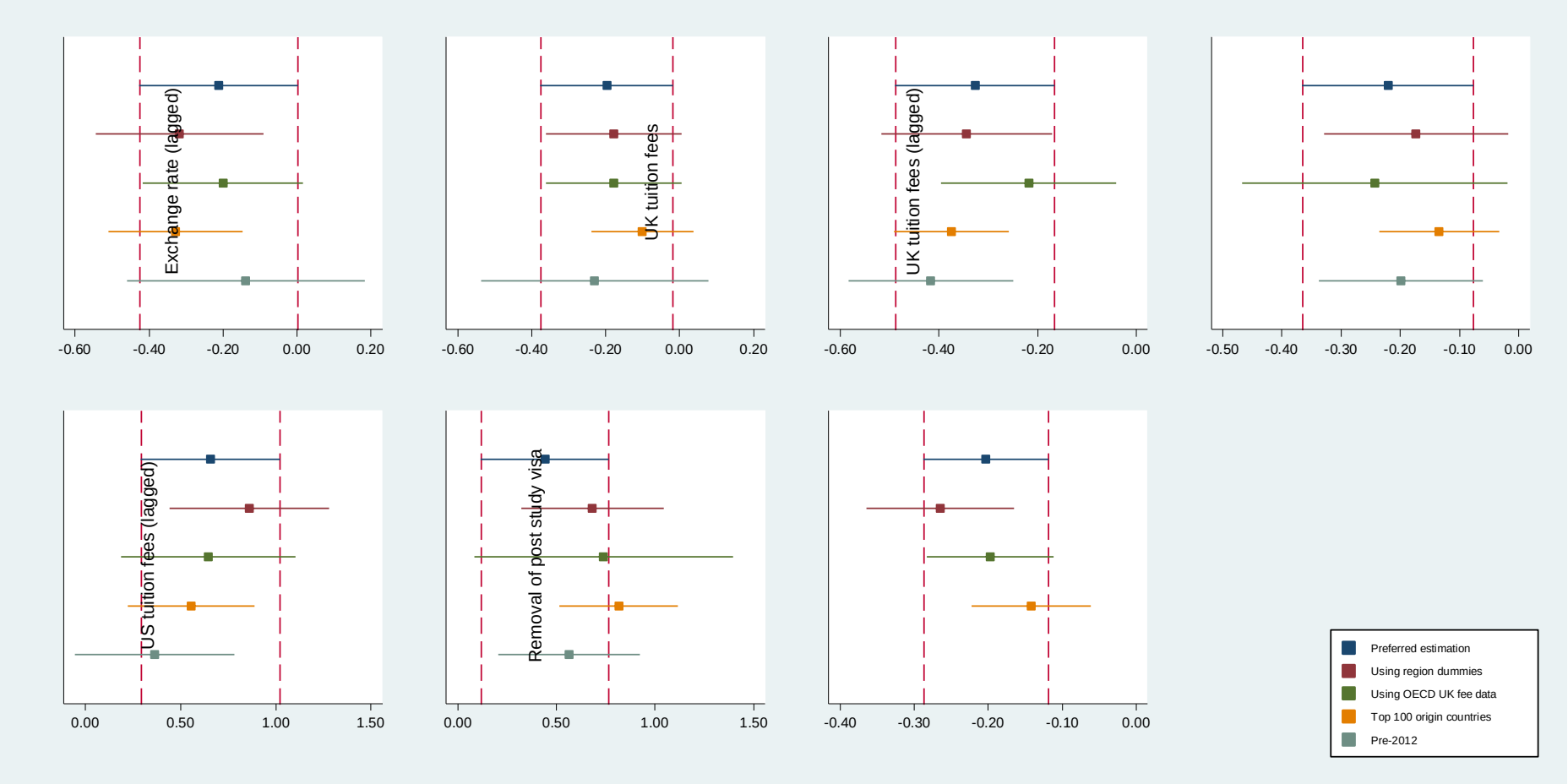
Table 8 Further estimation results (undergraduate level)

Independent variables	Preferred	Including regional dummies	Using OECD data on UK fees	Top 100 originating countries only	Pre-2012
Index Exchange Rate (*period t*)	-0.2118*	-0.3181***	-0.2008*	-0.3286***	-0.1384
Index Exchange Rate (*period t-1*)	-0.1963**	-0.1780*	-0.1776*	-0.1009	-0.2299
Energy Index (*non-oil producer*)	-0.1138*	0.1956	0.0767	0.0373	0.0228
Energy Index (*oil producer*)	0.3749***	0.5035***	0.5224***	0.2243**	0.3947***
GDP per capita (USD) (country *i*)	0.4847***	0.4205***	0.5882***	0.4369***	0.4083***
UK Undergraduate fees (in GBP) (*period t*)	-0.3268***	-0.3438***		-0.3744***	-0.4161***
UK Undergraduate fees (in GBP) (*period t-1*)	-0.2210***	-0.1733**		-0.1346***	-0.1992***
US Undergraduate fees (in GBP) (*period t*)	0.6578***	0.8619***	0.6451***	0.5549***	0.3655*
US Undergraduate fees (in GBP) (*period t-1*)	0.4421***	0.6834***	0.7394**	0.8165***	0.5650***
Population (*country i*)	-0.2417	0.0006	-0.3177	0.3260**	-0.4744*
Post study visa (*dummy*)	-0.2029***	-0.2645***	-0.1972***	-0.1417***	
AUS Undergraduate fees (in GBP) (*period t, non-Asia*)		-0.4886			
AUS Undergraduate fees (in GBP) (*period t, Asia*)		0.8219**			
DE Undergraduate fees (in GBP) (*period t, non-Europe*)		-0.0010			
DE Undergraduate fees (in GBP) (*period t, Europe*)		0.0028			
FR Undergraduate fees (in GBP) (*period t, non-Africa*)		-0.1208			
FR Undergraduate fees (in GBP) (*period t, Africa*)		-0.1951			
OECD UK Undergraduate fees (in GBP) (*period t*)			-0.2177**		
OECD UK Undergraduate fees (in GBP) (*period t-1*)			-0.2434**		
Constant	1.2351	-3.404	-3.315	-9.3431***	6.6750*
Number of observations	1,959	1,959	1,959	1,023	1,433

Note:
1. All variables are in log, unless a dummy variable
2. All undergraduate fees are denominated in Sterling
3. * p < 0.10, ** p < 0.05, *** p < 0.01
4. A number of the variables have been transformed using a logarithmic function. This has been done to allow for a more simple interpretation. Specifically, a β coefficient on a relevant variable can be interpreted as a β% percentage change in the number of undergraduate enrolments in the United Kingdom following a 1% change in the relevant variable. Taking an example, the coefficient of 0.4847 on (log) of per capita Gross Domestic Product suggests that an average increase of 1% in overseas per capita Gross Domestic Product will have a 0.4847% increase in the number of undergraduate enrolments in UK higher education institutions.

Source: London Economics' analysis

Figure 13 Coefficient point estimates and 95% confidence intervals



Note: The post study visa dummy is omitted from the pre-2012 estimation as it is equal to zero from 2003 to 2012.

Source: London Economics' analysis

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