Department for Education

EU exit: estimating the impact on UK higher education

Research report

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1 Introduction

London Economics were commissioned by the Department for Education to undertake an analysis of:

1. The price elasticity of international student enrolments with respect to changes in the level of tuition fees charged – separately at undergraduate and postgraduate level, and for EU and non-EU domiciled students.

2. The potential impact on first-year EU student enrolments and associated tuition fee income for UK higher education institutions (HEIs) resulting from:

    a. The removal of tuition fee loan and grant support (where applicable) for EU students;

    b. The harmonisation of tuition fees charged to EU and non-EU students (i.e. the de-coupling of EU and Home fees);

    c. Changes to the post-study work rights for EU students to those of non-EU students (prior to the introduction of the new Graduate Route[1]); and

    d. Changes to the rights to bring dependants for EU students to those of non-EU students.

The first research objective is investigated using an econometric framework, distinguishing between domicile (EU and non-EU) and level (undergraduate and postgraduate). The impact channels identified under the second research objective are then modelled and analysed in Excel, at an aggregate sector level and by university 'clusters' (based on Boliver (2015[2])). For both objectives, multiple sensitivity analyses are performed to determine the stability and robustness of the results.

The results of this analysis were initially submitted to the Department for Education in slides and have been transferred into this report by the Department.

[1] https://homeofficemedia.blog.gov.uk/2019/10/14/fact-sheet-graduate-immigration-route/
[2] Boliver, V. (2015), 'Are there distinctive clusters of higher and lower status universities in the UK?', Oxford Review of Education, Vol, 41 No. 5, pp.608-627, DOI: 10.1080/03054985.2015.1082905

2 Overview of data

2.1 Data variables, sources and issues

2.1.1 Student enrolments

The number of first-year non-UK (i.e. EU and non-EU) students entering UK HE - by year, country of domicile, study level mode - is based on bespoke data provided by the Higher Education Statistics Agency (HESA), and covers the period from 2000/01 to 2016/17[3]. Note that students coming to the UK to undertake pre-higher education (access) studies as well as exchange students (including Erasmus students) are excluded from the analysis (given their absence from the HESA data).

2.1.2 Tuition fees – Average by year (for econometric analysis)

We generate average tuition fee levels per student by year, domicile (Home/EU vs. non-EU) level of study (undergraduate vs. postgraduate) and mode of study (full-time vs. part-time). This is derived using HESA information on the total fee income generated by UK HEIs from each category of students and the corresponding total number of students in each academic year. Note that:

- Given the variation in fees charged by Home Nation, a weighted average UK tuition fee series is constructed (weighted by the number of students studying at providers in each Home Nation).
- The HESA fee income data do not provide a split of non-EU tuition fee income by study level. Hence, we use information on the ratios of undergraduate to postgraduate fees from the Reddin Tuition Fee Survey (see Times Higher Education (2016[4])) to estimate the split between undergraduate and postgraduate fees for non-EU students.
- Since average fees are estimated on the basis of first-year and continuing students, changes in fees for first-year students take several years to impact average fees (until all cohorts are facing the new fee levels). To capture the significant jumps in fees in 2006/07 and 2012/13, we assumed that fees in 2012/13 and 2013/14 are equal to the average fee level in 2014/15, and that fees in 2006/07 and 2007/08 are equal to the average fee level in 2008/09.

[3] Source: HESA Student Record 2000/01 to 2016/17. Copyright Higher Education Statistics Agency Limited.

[4] Times Higher Education (2016). 'International and postgraduate fees survey, 2016'. https://www.timeshighereducation.com/features/international-and-postgraduate-fees-survey-2016

2.1.3 Tuition fees – average by cluster and Home Nation, 2016/17 only (for economic modelling)

To analyse the impact of potential policy changes on EU student enrolments and associated tuition fee income, we generate average tuition fee levels per student in 2016/17 - again by domicile, level of study and mode – but also by university cluster and Home Nation (i.e. location of provider). This is again derived by combining HESA information on total fee income with the corresponding total number of students in 2016/17.

Here, note that:

- It was not possible to generate estimated fees by institution (as well as domicile, level of study and mode), given a large number of gaps, inconsistencies and outliers in the underlying fee income and student data.
- For EU students in England and Wales, the original fee income data for 2016/17 do not provide a breakdown by study level or mode. We thus imputed these breakdowns using the comparable information for the 2015/16 academic year.
- For non-EU students, to estimate average tuition fees per student by study level, again, we make use of the Reddin Tuition Fee Survey to estimate. Further, to estimate fees per non-EU part-time student, we adjusted the calculated fees for the average part-time study intensity[5] (separately for undergraduate and postgraduate students).

[5] Average part-time intensity was based on HESA information for 2015/16 (see HESA, 2017) on the total number of full-time equivalent students by level divided by the number of full-person equivalent (i.e. headcount) figures by level, and assuming a 100% study intensity among full-time students. Note that comparable data for 2016/17 were not available, and that the information includes students of all domiciles (i.e. UK, EU and non-EU) and all years of study (i.e. first-year and continuing).

Table 1 Data sources used to inform other variables

Variable	Source
Number of students travelling outside their home country for tertiary education	*UNESCO Statistics*
Population aged 15-24	*UNESCO Statistics*
Exchange rate (Local currency unit per GBP)	*World Bank: Global Economic Monitor*
GDP per capita	*World Bank: Development Indicators*
Average tuition fee in the United States of America/Australia/Canada/Germany	*Various - National Education Statistics Providers*
Total number of higher education institutions in Top 100 World University Rankings	*The World University Ranking*
Deferred payment dummy variable: Equal to 1 after the switch from upfront fee to loan system in England in 2006, 0 otherwise	*Student Loans Company*
Youth unemployment rate (20-24 year olds)	*Eurostat*
Unemployment rate amongst 25-35 year olds who have attained/completed tertiary education	*OECD*
Total number of higher education institutions in Top 1,000 rankings per capita	*QS World University Rankings 2016; population aged 15-24 used to calculate per capita measure*

The final dataset comprises 235 countries and territories across 17 years (from 2000 to 2016) and is unbalanced (i.e. there are missing observations across countries and/or time).

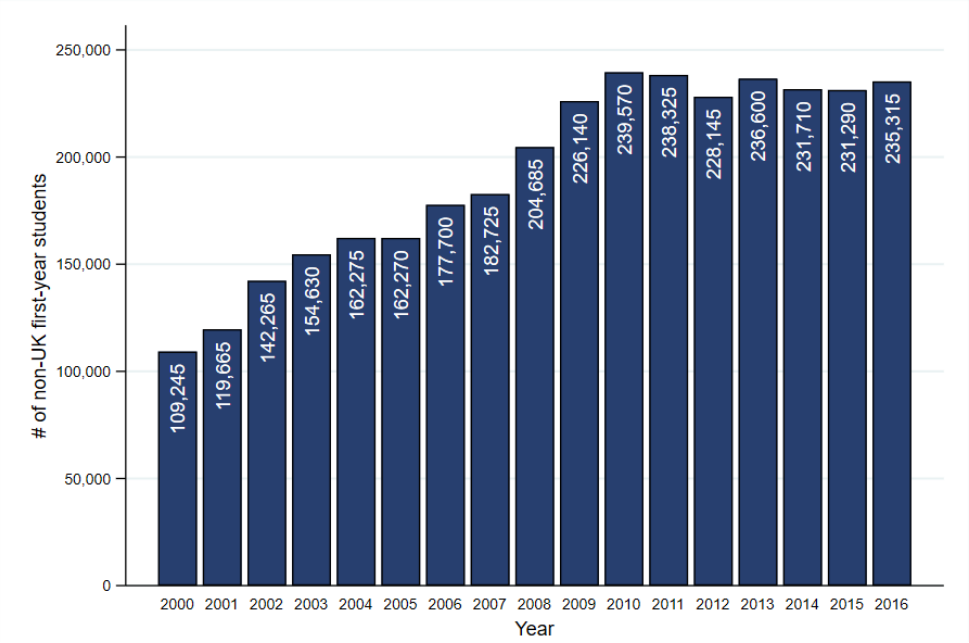
2.1.4 International demand for UK higher education

There has been a significant increase in international student enrolments to UK higher education institutions since 2000/01.

From 2000/01, student enrolments more than doubled by the end of the decade, reaching a peak in 2010/11 of approximately 240,000 first-year enrolments. Since 2010/11, international student enrolments have been fairly stable.

In 2016/17, there were 235,315 first-year international students entering UK higher education.

Figure 1 Number of non-UK first-year students 2000-2016

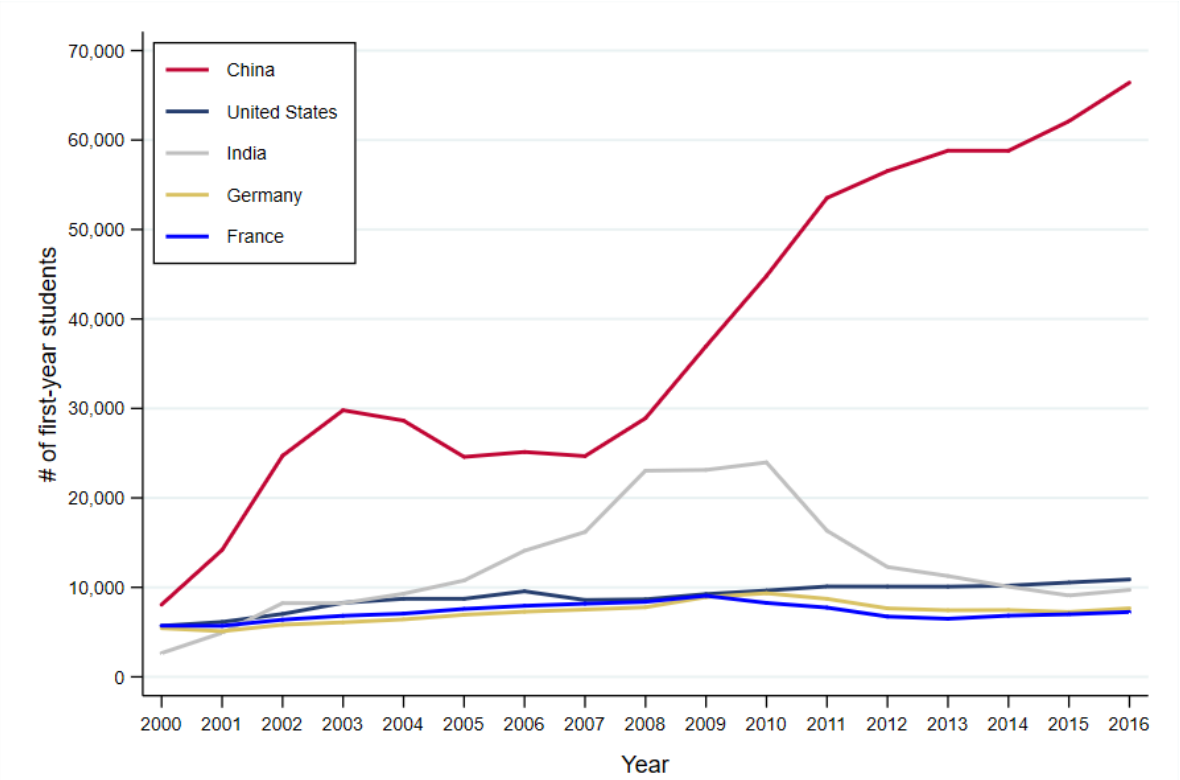


Note: Figures are rounded to the nearest 5. **Source**: London Economics' analysis of HESA data.

China has been one of the main contributors to the growth in student numbers, with more than six-fold growth in the 17-year period. In 2016/17, there were approximately 66,000 students originating from China, which is more than the combined total of the next 4 major contributors (United States, India, Germany and France) – and amounts to 28% of total first-year international enrolments.

The number of students originating from India has tailed off since 2008/09. This is in part driven by the changes to post-study work visa arrangements announced in 2012, and a depreciation in the Indian Rupee.

Figure 2 Number of non-UK first-year students by country of origin 2000-2016



In 2016/17, there were 235,315 first-year international students entering UK HE (equivalent to one in five (20%) of all first-year students).

Approximately 73% (172,280) of international first-year students were domiciled outside the EU, with the remaining 27% (63,035) domiciled within the EU (from Member States outside the UK).

In terms of study mode, the vast majority of these students (92%) were studying full-time, with only 8% of students undertaking qualifications on a part-time basis.

In terms of study level, 37% (86,915) were undertaking undergraduate degrees and a further 6% (15,085) were studying other undergraduate qualifications. In addition, 48% (111,805) of international students were enrolled in postgraduate taught qualifications (i.e. Masters degrees), 6% (14,720) were studying postgraduate research qualifications and 3% were studying other postgraduate qualifications.

Additional descriptive statistics are provided in Annex 1.

Table 2 First-year international students 2016/17 by domicile, mode and study level

	EU	Non-EU	Total
Full-time			
First degree	30,640	55,630	**86,270**
Other undergraduate	1,225	5,200	**6,425**
Postgraduate (research)	4,205	9,620	**13,830**
Postgraduate (taught)	18,825	88,990	**107,815**
Other postgraduate	1,140	1,580	**2,720**
Total	**56,035**	**161,020**	**217,055**
Part-time			
First degree	370	280	**645**
Other undergraduate	2,515	6,150	**8,665**
Postgraduate (research)	425	470	**890**
Postgraduate (taught)	1,945	2,045	**3,990**
Other postgraduate	1,755	2,315	**4,070**
Total	**7,005**	**11,260**	**18,260**
Total			
First degree	31,005	55,905	**86,915**
Other undergraduate	3,740	11,350	**15,085**
Postgraduate (research)	4,630	10,090	**14,720**
Postgraduate (taught)	20,770	91,035	**111,805**
Other postgraduate	2,890	3,900	**6,790**
Total	**63,035**	**172,280**	**235,315**

3 Estimating the price elasticity of international student demand for UK higher education

3.1 Objectives

This section of the research study focuses on quantifying the impact of changes in the level of tuition fees charged to international students on their demand for UK higher education[6]. In economic terms, this is known as the price elasticity of demand; that is, the responsiveness of quantity (in this case, first-year international student numbers) to changes in price (in this case, the level of tuition fees charged by UK HEIs).

An econometric framework is used to estimate the price elasticity of demand using an (unbalanced) annual, longitudinal dataset (described in the previous section) covering 235 countries and territories across 17 years from 2000 to 2016.

The level and evolution of average tuition fees charged by UK HEIs varies by students' level and mode of study. Moreover, other factors (such as labour market outcomes) determining enrolment to UK HE are likely to be affected by the level and/or mode of study. Therefore, we perform separate estimations for undergraduate (first degree only) and postgraduate (taught and research only) students[7], and focus on full-time student enrolments only.

We further undertake separate estimations for students from EU and non-EU countries.

Alongside UK tuition fees, we control for a range of other factors that may explain the movement in student numbers enrolling in UK HE, including:

- Real determinants (e.g. GDP per capita, tuition fees charged in competitor countries);
- Nominal determinants (e.g. exchange rates); and,
- Other factors (e.g. population aged 15-24, total outbound student mobility, deferred fee payments (for EU students)).

[6] The possibility of undertaking an analysis by Home Nation was examined; however, due to little variation and no first-year students entering HE institutions in Wales and Northern Ireland from many countries, a UK-wide analysis was more suitable.

[7] The econometric analysis excludes any students undertaking other undergraduate or other postgraduate qualifications (based on HESA study level classification XLEV601; for more information, please refer to HESA (no date)).

3.2 Overview of approach

To establish robust estimates of the price elasticity of demand, the methodological approach follows four key steps:

1. Data exploration → Visual inspection of key variables across years at an aggregate level and by country.
2. Tests for stationarity and cointegration → Underlying statistical assumptions required for econometric analysis.
3. Model estimation → Use an error correction specification and consider three alternative estimators.
4. Tests for the robustness of the preferred model specification and sensitivity of coefficient estimates by considering:
    a. The inclusion of additional control variables;
    b. Changes in the estimation sample; and,
    c. Changes in the estimation approach.

These steps are performed separately for each specification - distinguishing between EU and non-EU full-time first-year student numbers at undergraduate and postgraduate level.

Before proceeding to the analysis, the following sections provide further details on stationarity, cointegration and error correction specifications.

3.2.1 Stationarity

A series is stationary if its statistical properties are constant over time. In many cases, empirical literature is based on weak (or, covariance) stationarity, which requires the distribution of a series x_t to be defined by the distance between two observations and not by the time *t*. This also implies that the series has finite and constant mean and variance.

This property is useful for estimation purposes as it suggests that the underlying data generating process can be predicted if it is observed for a sufficient period of time. In other words, an estimation model can be fitted to the data.

The following tests are used to test for stationarity in each of the relevant variables in the dataset:

1. For variables that vary across countries (e.g. student enrolments), Im-Pesaran-Shin and Fisher panel unit root tests are used. Using the optimal lag length

(determined by the Akaike Information Criterion), these tests have the null hypothesis that the data series for all the panels (i.e. countries) are non-stationary as they contain a unit root (that is, an unpredictable pattern in the time series). In cases where the null hypothesis cannot be rejected, the data series can be first-differenced and tested for the presence of a unit root.

2. For variables that are the same across countries (e.g. tuition fees charged to EU undergraduates), Dicky Fuller and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests are conducted. The null hypothesis under the Dicky Fuller test is that the variable contains a unit root; whereas, under the KPSS test, it is that the variable is stationary. These tests are used in conjunction to investigate the possibility of a variable being neither stationary nor having a unit root.

Test results suggest that first-year full-time student enrolments and average tuition fees for both undergraduate and postgraduate levels are non-stationary in levels but stationary in first-difference. Full results are provided in Annex 2.

3.2.2 Cointegration and error correction models

If two non-stationary series are related, then they are cointegrated if there exists a linear combination of the two series that is stationary. In other words, a cointegrating relationship is a long-run relationship between a set of variables.

The error correction model (ECM) framework can be applied to estimate the relationship between variables which are non-stationary and cointegrated.

More formally, in the current setting, the model can be specified as:

$$\Delta Y_{it} = \alpha + \beta' \Delta X'_{it} + v(Y_{it-1} - \gamma - \lambda' X'_{it-1}) + \varepsilon_{it}$$

where Y_{it} is the number of student enrolments (in natural logarithm form) for country *i* in year *t*, X_{it} is a set of explanatory factors (including the average tuition fee (in natural logarithm form)) for country *i* in year *t*, ε_{it} captures the error term and α, β, γ and λ are parameter vectors to be estimated.

The ECM framework captures both the short- and long-run relationship between the demand for UK HE and average tuition fees (and other factors). For example, an increase in average tuition fees will have two effects on demand:

- First, there is an immediate (short run) impact on demand due to a change in the level of tuition fees from the previous period. This impact is measured by the corresponding coefficient β.

- Second, an increase in tuition fees disturbs the equilibrium relationship, causing student numbers to be too high. Hence, student numbers will adjust downwards in subsequent periods towards a new long-run steady state. This is measured by the corresponding coefficient in the cointegrating vector λ, and the speed of adjustment is measured by υ.

3.2.3 Error correction model coefficient interpretation

For simplicity, let's assume a bivariate single-equation ECM between the number of student enrolments (Y_t) and the average tuition fee level (X_t)[8].

$$\Delta Y_t = \alpha + \beta \Delta X_t + \upsilon(Y_{t-1} - \gamma - \lambda X_{t-1}) + \varepsilon_t$$

The equation suggests that current changes in Y are a function of current changes in X and the degree to which the two variables are outside their equilibrium in the previous period.

- λ captures the underlying equilibrium relationship between the set of variables over the period of analysis. That is, it measures the causal effect that occurs over future time periods and is referred to as the long-run effect of X on Y.
- β captures the immediate (or contemporaneous) effect of X on Y, referred to as the short-run effect.
- υ determines the rate at which equilibrium between the two variables is achieved.

For example, assume the estimated coefficients are: λ = 1, β = 0.5, υ = -0.5 and γ=0. Then a 1 unit change in X has an immediate effect on Y of 0.5. Given an equilibrium relationship, an increase in X causes Y to be too low; hence, there needs to be an adjustment to reach equilibrium. As a result, in the next period (t+1), Y increases by 0.25 (λ multiplied by the difference between Y_{t-1} and λX_{t-1}). This continues until Y has increased by 1 unit in this example.

When estimating the impact of potential price increases on EU student enrolments (resulting from the removal of tuition fee support for EU students or the harmonization of tuition fees charged to EU and non-EU students (see next section), we

[8] Note: The cross-sectional component *i* is also supressed in the equation for simplicity and the interpretation is unchanged in its presence.

predominantly make use of our resulting estimates of the long-run price elasticity of demand (i.e. the effect in steady state)[9].

3.2.4 Cointegration tests and error correction model estimation

Westerlund panel cointegration tests are used to test for cointegration between the number of student enrolments, tuition fees and other variables[10]. This test implements four panel cointegration tests that are based on testing the significance of the error-correction parameter (for example, υ from the previous section).

The null hypothesis, H_0, under this test is that there is no cointegration, which is equivalent to the error correction term being equal to zero (H_0: υ=0). This can be tested against two alternatives (H_1): (i) there is cointegration for the panel as a whole (H_1: υ<0); or (ii) there is cointegration for at least one unit in the panel (H_1: υ<0 for some subset *h*<N and/or *h*<T, where N and T are the total number of cross-sectional and time observations, respectively. The latter alternative hypothesis is used in this analysis.

Three alternative estimation procedures are considered to estimate the parameters in the error correction model. In particular:

1. A dynamic fixed-effects estimator: This approach restricts all coefficients to be equal across all panels (i.e. all countries), allowing for country-specific intercepts and correcting for serial correlation.

2. The mean-group estimator (Pesaran and Smith): This approach estimates a model for each country separately and a simple arithmetic average of the coefficients is reported. It allows the intercepts, slope coefficients and error variances to differ across countries.

3. The pooled mean-group estimator (Pesaran, Shin and Smith): This is an intermediate estimator which allows the intercept, short-run coefficients and error variances to differ across countries (similar to the mean-group estimator) but constrains the long-run coefficients to be equal across countries (similar to the fixed-effects estimator).

[9] This applies to our analysis of the impact on EU *undergraduate* student enrolments. For EU *postgraduate* students, as outlined below, the econometric analysis suggests that there is long-run relationship between average tuition fees and student enrolments (i.e. the effect of a change in fees does not persist into the future) but that there is an immediate effect only.

[10] The test is performed separately by domicile and study level – i.e. for full-time first-year EU and non-EU undergraduate and postgraduate students (i.e. four model specifications).

The preferred estimation procedure is selected by performing the Hausman specification test, which compares one estimator $(\beta\_1)\hat{}$ (known to be consistent) with another estimator $(\beta\_2)\hat{}$ (efficient under the assumptions being tested). If there is no systematic difference between the two estimators, $(\beta\_2)\hat{}$ is the consistent and efficient estimator of the true parameters (i.e. H_0 cannot be rejected).

The natural logarithm transformation is applied to all variables in the dataset (except binary variables, taking the value of 0 or 1). Hence, given a log-log specification, the short- and long-run price elasticity of demand are reported in the corresponding coefficients in vectors β and λ (respectively). For example, a 1% change in the level of tuition fees will lead to a λ_{fee}% change in international demand for UK HE in the long-run.

The following section provides the results from the EU undergraduate and EU postgraduate econometric analysis covering the period from 2000 to 2016.

For non-EU students, given the substantial differences in the evolution of student numbers and other characteristics across non-EU countries, a homogenous panel data model (across countries) is not suitable to estimate the price sensitivity of demand for HE for non-EU students. As a result, no results for non-EU students are presented here. Further details and recommendations for future analysis on the price sensitivity of demand from non-EU students are provided in the Annex.

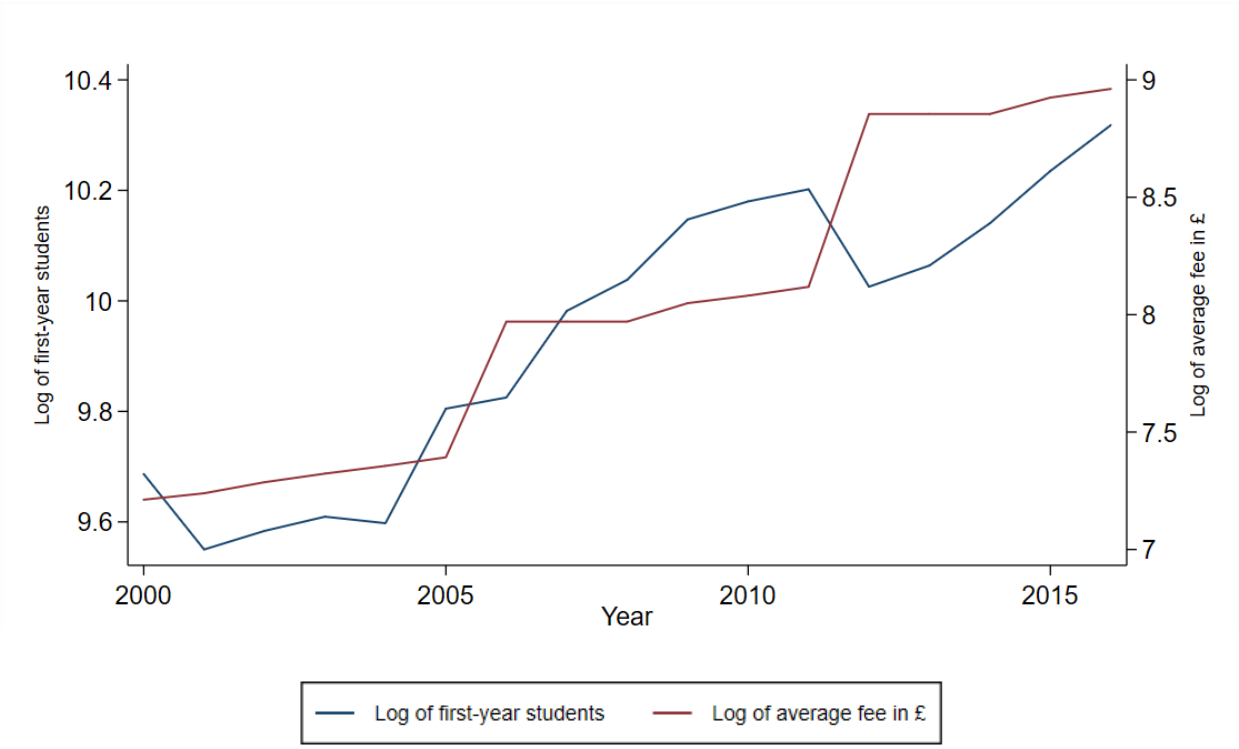
3.3 Econometric analysis of EU full-time first-year undergraduate students

3.3.1 Relationship between tuition fees and UG student numbers

A visual inspection of the evolution in tuition fees[11] and full-time first-year undergraduate (UG) students entering UK HE from the EU suggests that undergraduate students respond to changes in tuition fees. That is, full-time first-year EU undergraduate student numbers are sensitive to price changes. However, the extent of the response differs across countries.

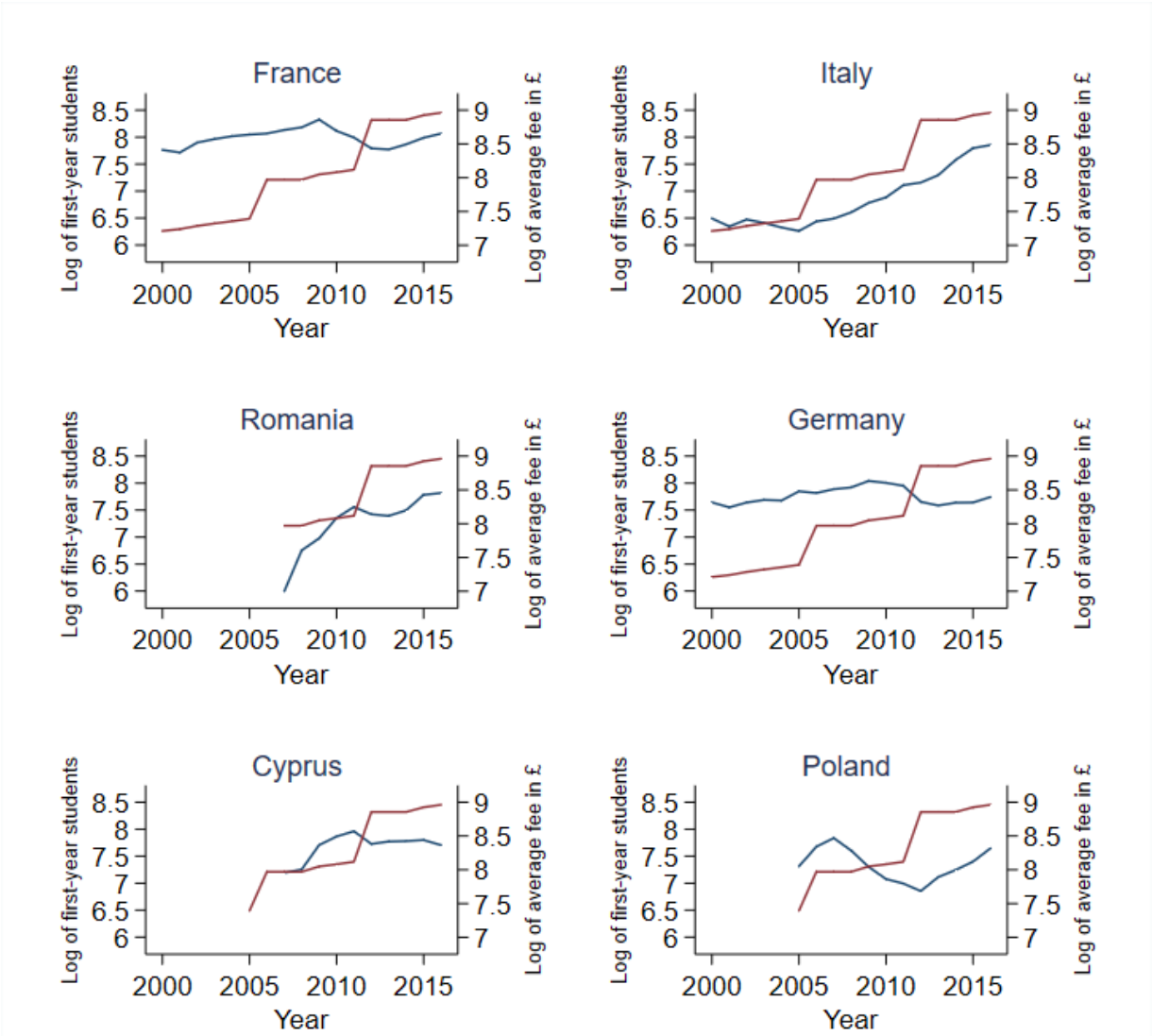
[11] Since average fees are estimated on the basis of all students (rather than first-year students only), changes in fee levels take several years to impact average fees (until all cohorts are facing the new fee levels). To capture the significant jumps in fees in 2006 and 2012, we created a stepwise fee series where the fees in 2012 and 2013 are assumed to be equal to the average fee level in 2014, and the fees in 2006 and 2007 is equal to the average fee level in 2008.

Figure 3 Log value of full-time first-year undergraduate students from the EU against log value of average tuition fees



Source: London Economics' analysis

Figure 4 Undergraduate log values for top 6 EU countries (determined by student numbers in 2016)



3.3.2 EU undergraduate students - Estimation results

The Westerlund panel cointegration test provides strong statistical evidence for a long-run relationship between EU undergraduate student enrolments, average UK tuition fees, exchanges rates (local currency unit per £), total outbound student numbers and a dummy variable which equals 1 from 2006 for the switch from an upfront fee to loan system in England (0 otherwise)[12].

[12] Detailed results are provided in the Annex. 2. The exchange rate variable is dropped from the model as it is statistically insignificant at appropriate levels of significance and its exclusion has little to no impact on the other coefficients. The estimation including the exchange rate and results from the other procedures are provided in the Annex, including more detailed outputs on the preferred estimation.

The inclusion of total outbound student numbers from each country is used to capture both size (in terms of population) and wealth effects, as well as changes in perception and popularity of studying abroad.

The preferred estimation is based on the dynamic fixed effects procedure, in which all parameters are constrained to be equal across countries.[2]

The estimated long-run price elasticity of demand is statistically significant (at the 5% significance level) and suggests that a 10% increase in the level of tuition fees charged to EU full-time first-year undergraduate students is associated with a 3.5% reduction in demand for UK HE.

The switch from an upfront fee to a loan system has no impact in the long-run (as its reported coefficient is statistically insignificant); however, in the short-run, the switch is associated with an increase of 14.5% in full-time first-year undergraduate EU students, which is statistically significant (at the 5% level).

Table 3 Coefficient estimates for first difference in the log value of full-time first-year EU undergraduate students

Dependent variable: First difference in the log value of full-time first-year EU UG students	Coefficient estimate
Long-run (in levels)	
UK tuition fees (Stepwise series, log)	-0.354**
Outbound international students by country (log)	1.847***
Dummy for switch from an upfront fee to a loan system	0.166
Error correction term	0.216***
Short-run (in first-difference)	
UK Fees (Stepwise series, log)	-0.268***
Outbound international students by country (log)	0.150*
Dummy for switch from an upfront fee to a loan system	0.145**
Constant	1.884***
Number of observations	341

*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Note: Excludes Croatia and Cyprus due to an insufficient number of observations

Source: London Economics' analysis

3.3.3 EU undergraduate students - Robustness checks

The robustness of the estimated coefficients in the preferred specification are tested by:

- Including additional explanatory variables in the short-run (e.g. ranking of US universities, youth unemployment, number of top universities in the country of origin per capita);

- Changing the countries in the estimation sample (top 20 countries only, top 15 countries only);
- Changing the period of analysis in the estimation sample (post-2006 period only); and,
- Changing the estimation approach (using a panel fixed effects model to estimate the short-run price elasticity).

Overall, the coefficients remain stable and robust to the inclusion of other variables, changes in the estimation sample and changes to the timeframe:

- Across all estimations, the estimated long-run price elasticity of demand varies from -0.441 to -0.347 and remains statistically significant in all but one case.
- The panel fixed effects model (estimated to test the stability of the estimated short-run coefficient for the average tuition fee) produces a comparable short-run effect to the preferred panel cointegration model (-0.28 compared to -0.27)[13].

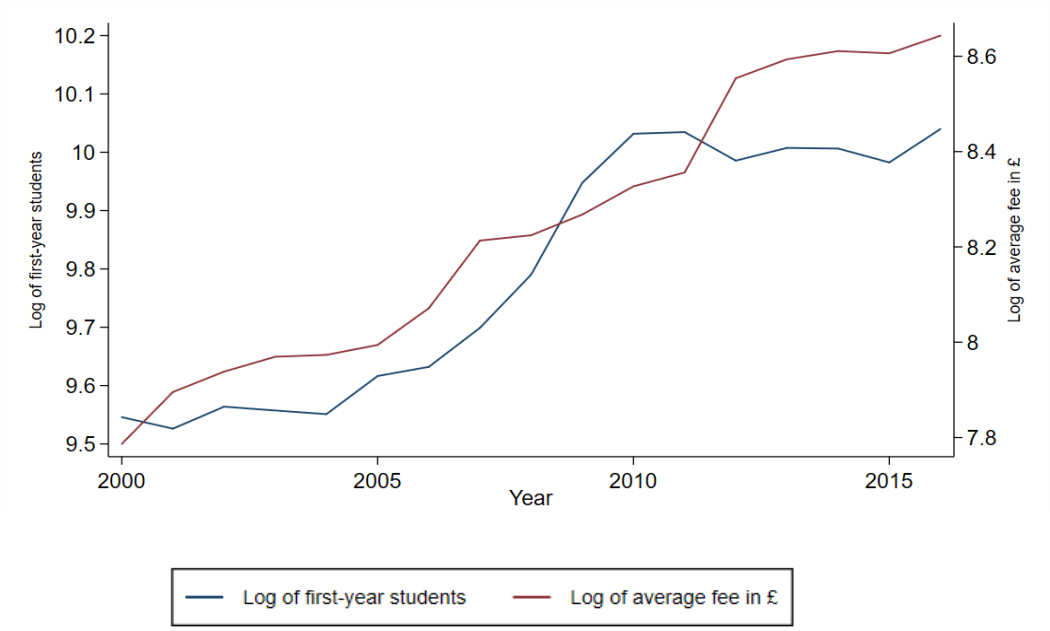
3.4 Econometric analysis of EU full-time first-year postgraduate students

3.4.1 Relationship between tuition fees and PG student numbers

As shown in Chart 5, average tuition fees[14] charged to EU full-time first-year postgraduate (PG) students have trended upwards over the period of analysis, with a steep increase observed in 2012 (in line with the price increase for UG students in that year). At the same time, EU postgraduate students numbers declined and have remained relatively stable since. Similar to undergraduate students, the responsiveness of postgraduate student numbers to changes in tuition fees is markedly different across countries.

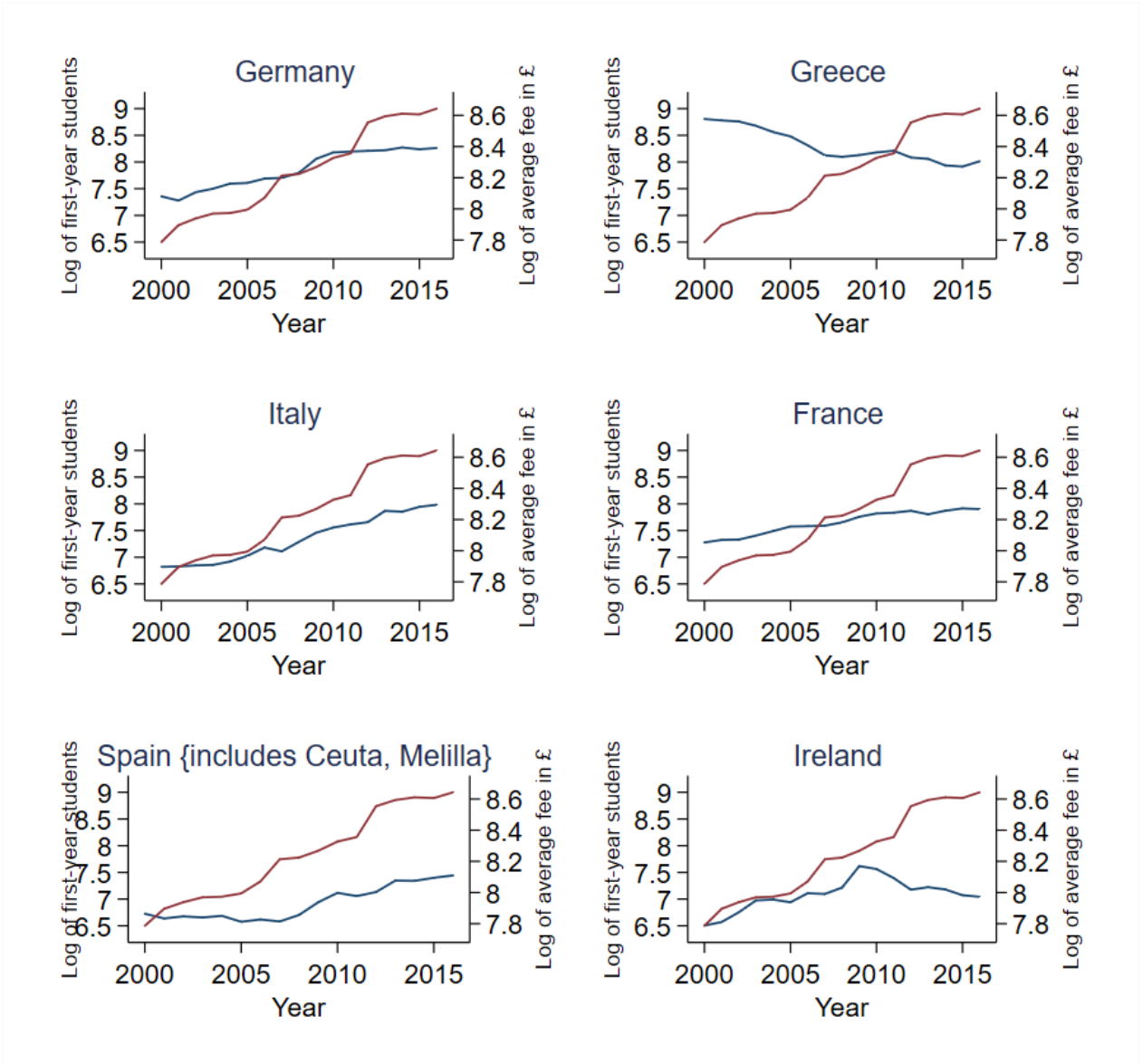
[13] Detailed results are provided in the Annex.
[14] As average fees are estimated on the basis of all students (rather than first-year students only), changes in fee levels take several years to impact average fees (until all cohorts are facing the new fee levels). In contrast to undergraduate students, there is no step-wise adjustment to the tuition fee series for postgraduate students.

Figure 5 Log value of full-time first-year postgraduate students from the EU against log value of average tuition fees



Source: London Economics' analysis

Figure 6 Postgraduate log values for top 6 EU countries (determined by student numbers in 2016)



3.4.2 EU postgraduate students - Estimation results

The preferred specification model for EU postgraduate students includes the unemployment rate amongst individuals aged 25-35 years old who have attained tertiary education, average UK tuition fees, the exchange rate (local currency unit per £) and total outbound student numbers. The Westerlund cointegration test suggests the presence of a long-run relationship between the set of variables[15].

The rationale for the inclusion of the unemployment variable is that, compared to undergraduate students, postgraduate students are likely to be more sensitive to changes in labour market conditions.

Similar to the estimation for undergraduate students, the preferred estimation for postgraduate students is based on the dynamic fixed effects procedure.

The long-run coefficient estimate for tuition fees is statistically insignificant and small in magnitude. However, the statistically significant short-run price elasticity of demand (at the 5% significance level) suggests that a 10% increase in the level of tuition fees charged to EU full-time first-year postgraduate students is associated with a 2.6% reduction in demand for UK HE.

[15] Detailed results are provided in the Annex.

Table 4 Coefficient estimates for first difference in the log value of full-time first-year EU postgraduate students

Dependent variable: First difference in the log value of full-time first-year EU PG students	Coefficient estimate
Long-run (in levels)	
UK tuition fees (Average series, log)	-0.033
Exchange rate (Local unit per £, log)	-0.364
Outbound international students by country (log)	1.255***
Unemployment rate amongst 25-35 year olds who have attained/completed tertiary education (log)	10.52***
Constant	1.811***
Number of observations	296

*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Note: Excludes Croatia due to insufficient number of observations; Excludes Bulgaria, Cyprus, Malta and Romania due to no data on unemployment rates amongst 25-35 year olds who have attained/completed tertiary education.

Source: London Economics' analysis

3.4.3 EU postgraduate students - Robustness checks

Using the same set of robustness checks as applied to the preferred EU undergraduate model, the estimated coefficients in the preferred EU postgraduate specification also remain stable and robust.

Across all estimations:

- The estimated long-run price elasticity of demand remains statistically insignificant (i.e. equivalent to zero); while
- Estimates of the short-run price elasticity of demand range from -0.304 to -0.225 and remain statistically significant in all cases. Using a panel fixed

effects model to estimate the short-run price elasticity of demand also produces a similar estimate of -0.221, which is statistically significant[16].

3.5 Summary of main findings

The econometric analysis suggests that full-time first-year EU undergraduate student numbers are negatively affected by changes in the level of tuition fees charged – both in the short- and long-run:

A change in tuition fees has an immediate short-run impact (a 1% change in the level of tuition fees charged to EU undergraduates is associated with a decrease of 0.27% in student numbers in the short-run) that disturbs the equilibrium relationship, causing student numbers to be too high. As a result, the increase in tuition fees lowers student numbers in subsequent periods (such that equilibrium is again achieved).

In other words, the immediate effect of changes in the fee is persistent over time, captured by the long-run estimate (a 1% change in the level of tuition fees charged to EU undergraduates is associated with a decrease of 0.35% in student numbers in the long-run).

In contrast, the estimation results for full-time first-year EU postgraduate students suggest that:

Tuition fees are *not* the main long-run determinant of EU postgraduate student enrolments (that is, there is no statistical evidence of a long-run impact of changes in tuition fees on the number of EU postgraduate students).

However, in the short-run, a change in tuition fees charged results in lower demand (a 1% change in the level tuition fees charged to EU postgraduates is associated with a decrease of 0.26% in student numbers in the short-run). This immediate effect is not persistent over time.

The following section estimates the potential impact of policy changes on EU student enrolments and associated tuition fee income for UK HEIs, using the above results to model the impact on EU student enrolments and associated tuition fee income of removing fee loan and grant support for EU students, and harmonising tuition fees charged to EU and non-EU students.

[16] Detailed results are provided in the Annex.

4 Estimating the potential impact of policy changes on international student demand for UK higher education

4.1 Objectives

We analyse the potential impact on EU student enrolments and associated tuition fee income for UK HEIs resulting from:

1. The removal of tuition fee loan and grant support (where applicable) for EU students;
2. The harmonisation of tuition fees charged to EU and non-EU students (i.e. the de-coupling of EU and Home fees, so that EU students would pay the same fees as non-EU students);
3. Changes to the post-study work rights for EU students to those of non-EU students; and,
4. Changes to the rights to bring dependants for EU students to those of non-EU students.

The analysis is based on 2016/17 HESA data on first-year EU student enrolments and fee income, including students:

- At both undergraduate and postgraduate levels, where we apply the same assumptions to 'other UG' ('other PG') students as to first degree (postgraduate taught/research) students; and
- On both a full-time and part-time basis, where we apply the same assumptions for both part-time as to full-time study.

The impacts of the policy changes are modelled in the sequence presented above[17]. Given the multiplicative nature of the modelling, the aggregate impact of all policy changes on EU student enrolments and associated fee income remains unaffected by the sequencing of events; however, the impact of a given policy change may differ with its ordering.

The impact of each policy is presented in aggregate across all UK HEIs as well as by each of 4 clusters of UK HEIs (developed by Boliver (2015)). Moreover, the sensitivity of the results is assessed by modifying the clustering of UK HEIs in three scenarios:

1. Scenario 1: Move five HEIs down from assigned baseline cluster
2. Scenario 2: Move five HEIs up from assigned baseline cluster

[17] The impact of each policy change was also modelled independently (i.e. separately, without any sequencing). These results are presented in the Annex.

3. Scenario 3: Allocate HEIs such that 25% of total EU enrolments are in each cluster

4.2 University clusters

Boliver (2015) classifies UK HEIs into four distinct clusters, based on differences in research activity; teaching quality; economic resources; academic selectivity; and socio-economic student mix.

Among the pre-1992 universities, Oxford and Cambridge 'emerge as an elite tier' (Cluster 1), 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). A detailed table of the classification is provided in Annex 4.

The analysis by Boliver provides a cluster classification for a total of 126 UK higher education institutions (out of a total of 170 institutions). We ranked these HEIs by cluster (with Cluster 1 at the top) and mean entry tariff points, and assigned clusters (and ranking positions) to an additional 37 institutions[18] based on their mean tariff points (or, if not available, based on the mean tariff points of similar institutions). We thus arrived at a clustering for 164 institutions (and again ranked all of these by cluster and mean entry tariff points).

For the sensitivity analysis, we moved the 5 HEIs at the bottom of each cluster down to the next lowest cluster as part of Scenario 1 (e.g. the 5 HEIs at the bottom of Cluster 2 were re-assigned to Cluster 3) and moved the 5 HEIs at the top of each cluster up to the next highest cluster for Scenario 2 (e.g. the 5 HEIs at the top of Cluster 2 were re-assigned to Cluster 1).

[18] 6 HEIs are not assigned to a cluster and are excluded from the analysis. However, these 6 institutions only accounted for approximately 10 EU student enrolments in 2016/17 (out of a total of 62,805, i.e. 0.016%) and hence, the analysis is largely unaffected by their exclusion.

Table 5 University clusters for sensitivity analysis

(Number of HEIs)	Core analysis	Sensitivity analysis		
		Scenario 1	Scenario 2	Scenario 3
Cluster 1	2	2	7	16
Cluster 2	56	51	56	33
Cluster 3	85	85	85	49
Cluster 4	21	26	16	66
Total	**164**	**164**	**164**	**164**

Source: London Economics' analysis, Department for Education, Boliver (2015)

4.3 Baseline EU student enrolments and tuition fee income

In 2016/17, there were 34,635 first-year undergraduate student enrolments from the EU, corresponding to £244 million in tuition fee income.

Moving from Cluster 1 to Cluster 4, the average number of undergraduate EU student enrolments per HEI declines from 320 to 150.

On average, each institution receives approximately £1.5 million in associated tuition fee income.

Table 6 Undergraduate EU student enrolments, by university cluster

Undergraduates	Total	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Number of institutions	**164**	2	56	85	21
Total					
Student enrolments	**34,635**	635	14,615	16,260	3,125
Tuition fee income	**£244.06m**	£5.29m	£105.31m	£114.31m	£19.14m
Average per institution					
Student enrolments	**210**	320	260	190	150
Tuition fee income	**£1.49m**	£2.65m	£1.88m	£1.34m	£0.91m

Note: Number of enrolments are rounded to the nearest 5.

HEIs in Cluster 2 represent approximately 60% (16,890 out of 28,160) of first-year postgraduate student enrolments in 2016/17.

There is a substantially larger average number of postgraduate student enrolments per HEI in Cluster 1 compared to Clusters 2, 3 and 4. This corresponds to significantly higher tuition fee income for HEIs in Cluster 1 - £8.0 million compared to £2.2 million, £0.6 million and £0.1 million in Clusters 2, 3 and 4 (respectively).

Table 7 Postgraduate EU student enrolments, by university cluster

Postgraduates	Total	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Number of institutions	**164**	2	56	85	21
Total					
Student enrolments	**28,160**	1,735	16,890	8,855	680
Tuition fee income	**£191.96m**	£16.05m	£124.23m	£48.65m	£3.03m
Average per institution					
Student enrolments	**170**	870	300	105	30
Tuition fee income	**£1.17m**	£8.03m	£2.22m	£0.57m	£0.14m

Note: Number of enrolments are rounded to the nearest 5.

4.4 Impact of removing tuition fee support

4.4.1 Assumptions

The removal of tuition fee support for EU undergraduate students corresponds to the elimination of tuition fee loans for EU students in England, Wales and Northern Ireland, and tuition fee grants for EU students in Wales[19] and Scotland:

1. Switch from loan system to up-front payment (England, Wales and Northern Ireland): The econometric analysis indicates that, holding all other factors constant, a switch *from* an upfront fee system *to* a loan system is associated with an increase of 14.5% in full-time first-year undergraduate students from the EU, which is statistically significant (at the 5% level). It is assumed that the reciprocal effect is identical; that is, the *removal* of tuition fee support reduces EU demand for UK

[19] Based on student support arrangements in 2016/17 (i.e. before the implementation of the Diamond Review of Higher Education in Wales' recommendations).

undergraduate studies by 14.5%. This is adjusted by the proportion of EU students who take out a loan using information published by the Student Loans Company (where available (see below))[20].

2. Increase in the *effective* fee: The econometric analysis further indicates that a 1% change in the level of tuition fees charged to EU undergraduates is associated with a decrease of 0.35% in student numbers (long-run price elasticity). We then apply this estimate to the *effective* price change following the removal of fee loans and/or grants. This is calculated based on the amount of fee loan that would not be repaid (i.e. the RAB charge) and the average fee grant relative to the current average *effective* tuition fee charged (net of this fee support; by location of study, study mode and cluster). Where available, the average fee loan was adjusted for loan take-up rates (whereas we assume 100% take-up for any tuition fee grants available to EU students – see below).

We assume that demand from part-time undergraduate students responds in the same way as full-time undergraduate students. Moreover, following the removal of loan support, it is assumed that there is no impact on demand for UK HE from postgraduates originating from the EU.

The below table summarises the assumptions made on the loan take-up rate, RAB charge and average funding by location and mode of study (all for EU undergraduate students).

[20] We thus assume that those students who currently take out loans from the Student Loans Company would otherwise not have access to other finance with sufficiently generous terms, and thus choose not to study in the UK.

Table 8 Assumptions made on the loan take-up rate, RAB charge and average funding by location and mode of study (for EU undergraduate students).

Location of study	Type of support	Full-time students			Part-time students		
		Take up rate[21]	RAB charge[22]	Average Loan/grant per student (adjusted for take-up and RAB)	Take up rate[1]	RAB charge[2]	Average Loan/grant per student (adjusted for take-up and RAB)
England	**Fee loan**	73%	45%	**£2,710**	73%	47%	**£1,390**
	Fee grant	-	-	-	-	-	-
Wales	**Fee loan**	83%	10%	**£310**	83%	10%	**£130**
	Fee grant	100%	-	**£4,510**	-	-	-
Scotland	**Fee loan**	-	-	-	-	-	-
	Fee grant	100%	-	**£1,700**	100%	-	**£800**
Northern Ireland	**Fee loan**	100%	10%	**£350**	-	-	-
	Fee grant	-	-	-	100%	-	**£780**

Note: All average funding values have been rounded to the nearest £10.

[21] Tuition fee loan take-up rates for full-time EU students in England and Wales are taken from Student Loans Company data, and we assume the same take-up rates for part-time students as for full-time students. Tuition fee loan take-up rates for students in Northern Ireland were not available, so we have assumed take-up rates of 100%. Tuition fee grant take-up rates are assumed to be 100% in all cases

[22] The Resource Accounting and Budgeting Charge (RAB charge, or interest rate subsidy) captures the proportion of the loan that is not repaid. We have assumed a RAB charge of 45% (47%) associated with tuition fee loans for full-time (part-time) EU-domiciled students studying in England (see London Economics, 2018a). In addition, we have assumed a RAB charge of 10% for EU students studying in Wales, based on estimates as part of the Diamond Review of Higher Education in Wales (Welsh Government, 2016). We assume that the RAB charge in Northern Ireland is the same as in Wales (given a similar average tuition fee loan level)

To capture variation in student behaviour across clusters, the 95% confidence interval for the estimated coefficient is split into four equal segments, and each university cluster is assigned the mid-point from a different segment. It is assumed that, in general, EU undergraduate students in Cluster 1 are least sensitive and students in Cluster 4 are most sensitive to the removal of tuition fee support.

Figure 7 Point estimates for switch from loan system to up-front payment, by university cluster

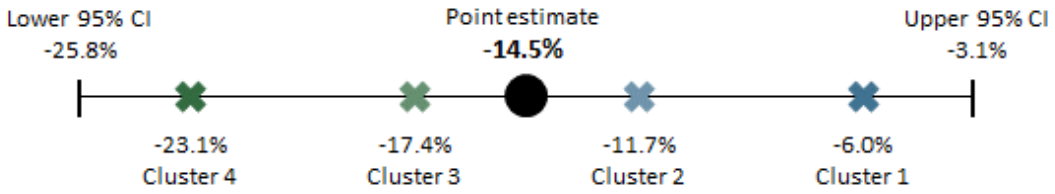
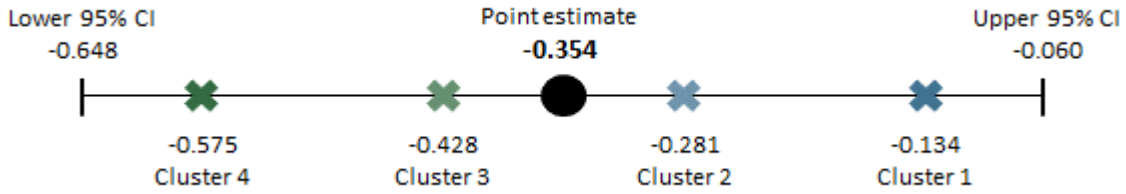


Figure 8 Point estimates for increase in the effective fee paid, by university cluster



While we assume variation by *cluster*, when estimating the impact of increases in the effective fee paid, we assume that the price elasticity of EU student demand is constant with respect to the *size* of the price increase[23]. In other words, we apply the same price elasticity of demand irrespective of the percentage change in price.

In reality, it is likely that students' price elasticity increases (i.e. demand becomes more elastic) with the relative (percentage) size of the price change. Hence, this is a simplifying assumption and a key limitation of the analysis, necessitated by the fact that it was not possible to estimate specific price elasticities at different points of the demand curve (due to relatively limited fee variation in the panel data underlying our econometric analysis).

4.4.2 Average impacts per HEI

The analysis suggests that the removal of tuition fee support would reduce EU-domiciled undergraduate (first-year) enrolments by approximately 38%, with 80 fewer enrolments

[23] Note that this assumption of a constant price elasticity of demand also applies to the analysis of the impact of the harmonisation of tuition fees charged to EU and non-EU students (see next sub-section).

per institution on average, corresponding to a loss of approximately £0.49 million in tuition fee income per institution.

In Cluster 1, the effect of removing tuition fee support would result in 35 (11%[24]) fewer EU students per institution and a loss of £0.27 million per institution.

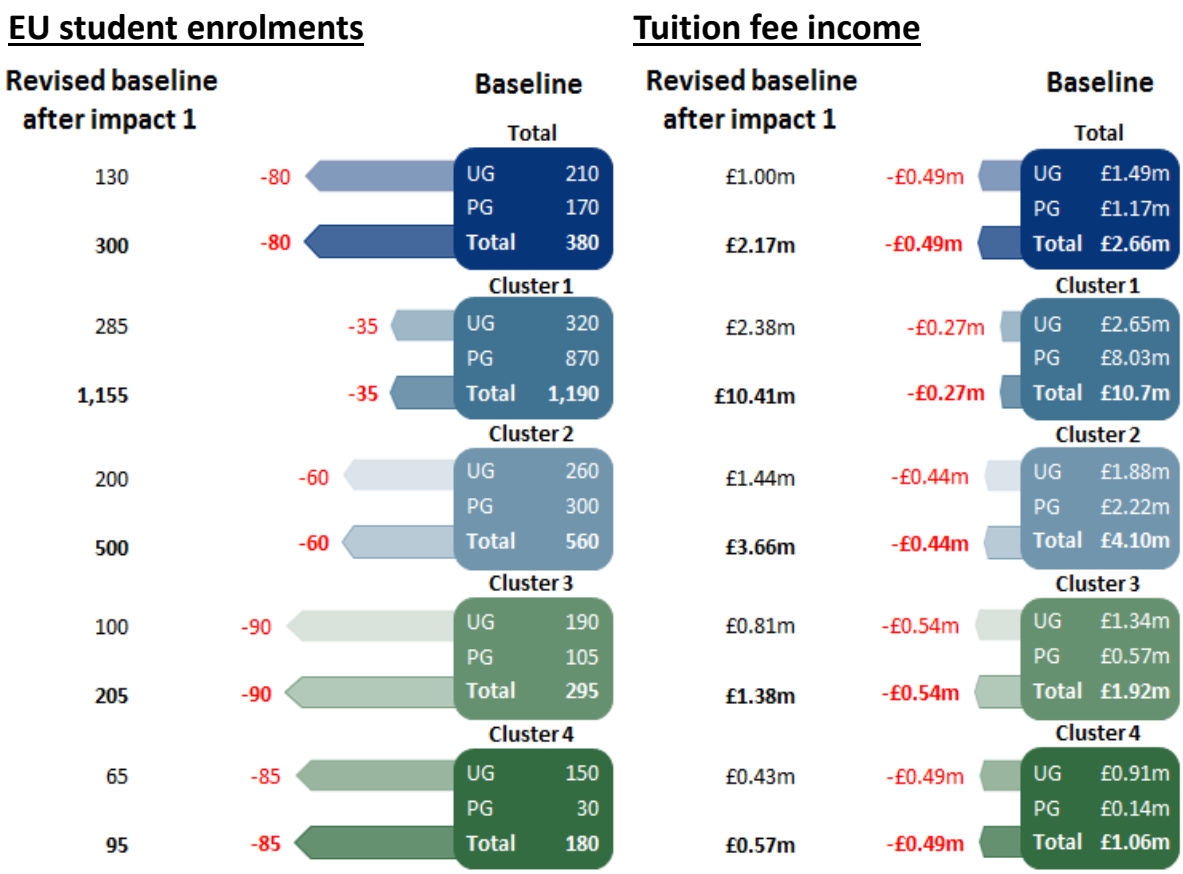
In Cluster 2, the lack of tuition fee support would potentially decrease the number of EU students by 60 (23%) per institution on average, with each institution losing approximately £0.44 million.

On average, institutions in Cluster 3 experience a decrease in (first-year) EU-domiciled undergraduate enrolments of 90 (47%), equating to an average loss of £0.54 million in tuition fee income for each institution.

With the smallest number of EU undergraduate students per institution, institutions in Cluster 4 would lose the largest proportion of EU students, with 85 (57%) fewer EU undergraduate students per institution on average. This corresponds to an institutional level impact of approximately £0.49 million.

[24] All percentages are as a proportion of EU undergraduate student enrolments (or associated tuition fee income).

Figure 9 Average impact of removing tuition-fee support, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding.

4.4.3 Aggregate impacts

In aggregate, across all institutions, the analysis indicates that the removal of tuition fee support for EU-domiciled undergraduate students would potentially result in a decrease in demand for UK higher education by approximately 13,090 students (38% of EU undergraduate enrolments).

The total impact in financial terms across all institutions would be a loss of approximately £80.7 million (33% of total tuition fee income generated from EU undergraduate enrolments).

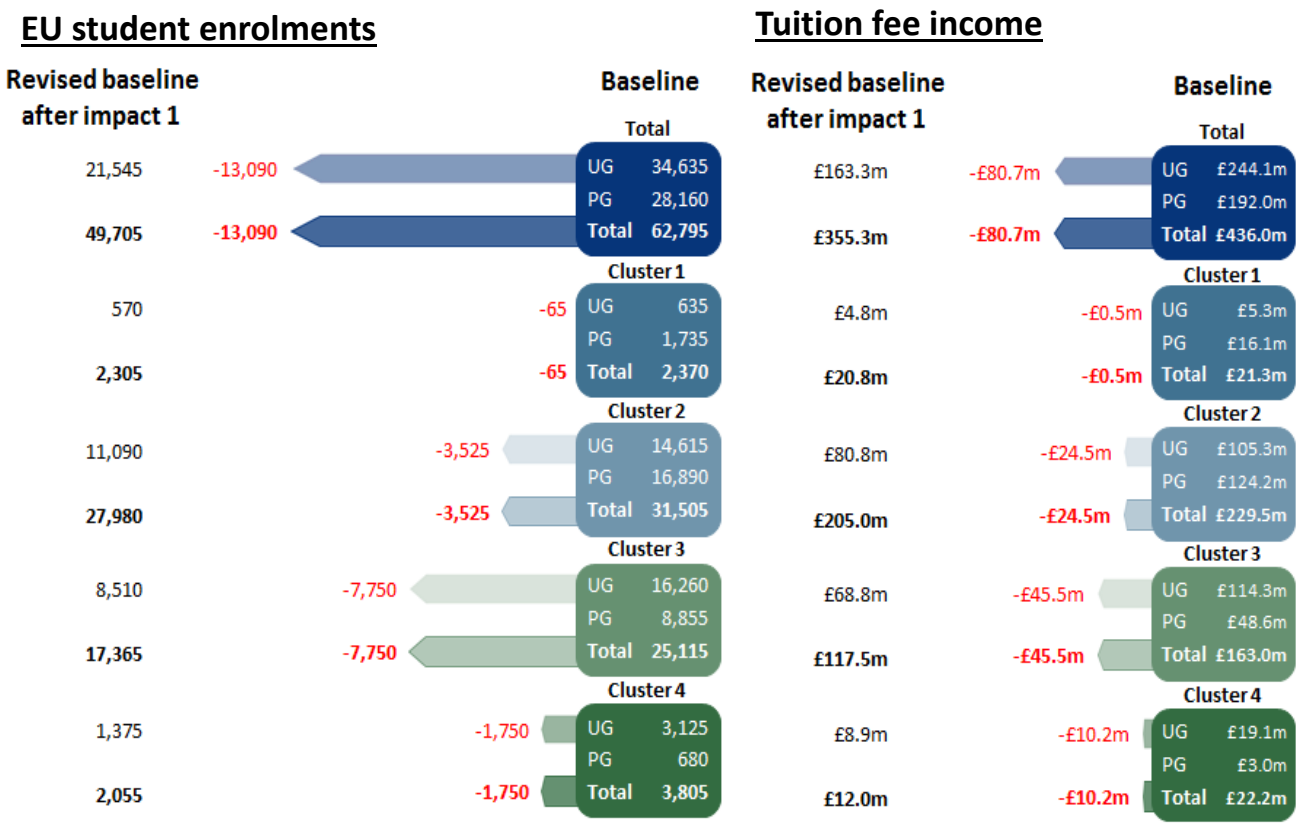
In Cluster 1, the analysis indicates a relatively small impact of the removal of EU undergraduate student support, with a potential reduction in enrolments amongst EU students by 65 (10%), equating to a loss of approximately £0.5 million in aggregate.

In Cluster 2, the removal of tuition fee support would reduce the number of EU students by 3,525 (24%), lowering fee income by £24.5 million in aggregate.

Approximately 59% (7,750 out of 13,090) of the reduction in demand corresponds to EU-domiciled undergraduate students in Cluster 3, with a total financial impact of roughly £45.5 million.

Across all HEIs in Cluster 4, the policy changes would reduce income by £10.2 million corresponding to 1,750 (56%) fewer student enrolments.

Figure 10 Aggregate impact of removing tuition fee support, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding.

4.5 Impact of removing Home fee status

4.5.1 Assumptions

Following the removal of student support arrangements for EU undergraduate students, the model considers the subsequent impact on UK HEIs if the current requirement to charge EU-domiciled students the same fees as Home-domiciled students is removed.

That is, tuition fees charged to EU-domiciled students are increased to non-EU students fee levels.

To quantify the impact on student enrolments, the resulting percentage increase in tuition fees charged to EU-domiciled students is multiplied by the relevant estimated price elasticity of demand from the econometric analysis (distinguishing between UG and PG students). The estimated long-run price elasticity of demand is used for EU undergraduate students, and the short-run price elasticity of demand is used for EU postgraduate students[25]. Both effects are statistically significant, with the impact of changes in the tuition fees charged to EU undergraduate students having a persistent effect over time.

As above, we again split the 95% confidence interval around both point estimates into four equal segments, and assign the mid-point to each cluster, so that institutions in Cluster 1 are least negatively affected by price increases, and institutions in Cluster 4 are most negatively affected.

Again, the model assumes the same price elasticity for part-time students as for full-time students.

Figure 11 Point estimates for removing home fee status for EU undergraduates

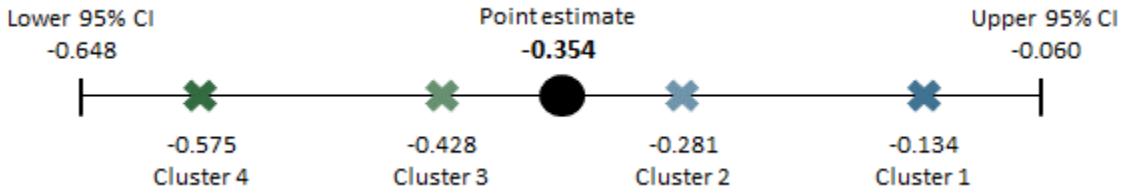
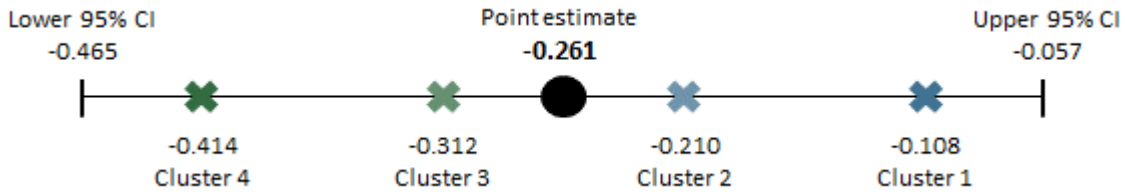


Figure 12 Point estimates for removing home fee status for EU postgraduates



***Source**: London Economics' analysis*

[25] The estimated long-run price elasticity reflects the equilibrium effect of a change in the average tuition fee on student enrolments. It is the causal effect that occurs over future periods and is often referred to as the long-run effect. The estimated short-run price elasticity captures the immediate effect (that is, in the same period) of a change in the average tuition fee on student enrolments. For EU postgraduate students, the econometric analysis suggests that there is no long-run relationship between average tuition fees and student enrolments (i.e. the effect of a change in fees does not persist into the future) but there is an immediate effect only.

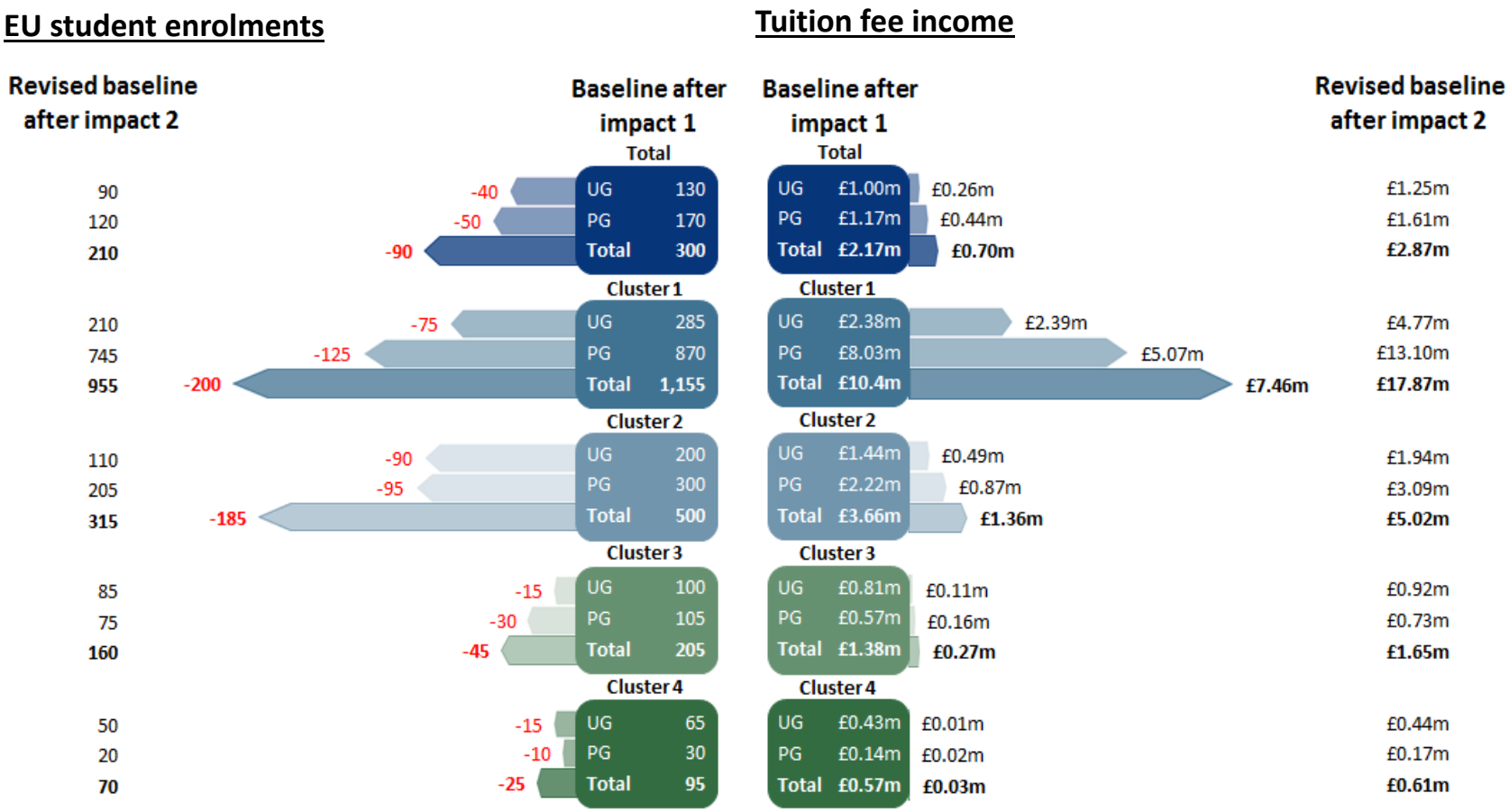
4.5.2 Average Impact per HEI

At institutional level, the harmonisation of fees between EU and non-EU students (following the removal of tuition fee support for EU students) is estimated to *further* reduce EU student numbers by 90 (30%) on average per institution. However, the loss in fee income associated with the reduction in student numbers is more than offset by the increase in tuition fee income generated from higher fees charged to EU-domiciled, which results in an average increase of £0.70 million in fee income per institution. However, these figures mask significant differences between Clusters.

Despite assuming the lowest responsiveness to changes in price, the relatively large increase in fees per student implies that institutions in Clusters 1 and 2 would lose approximately 200 and 185 EU students on average (respectively) following the harmonisation of fees and removal of student support, compared to only 45 and 25 students per institution in Clusters 3 and 4, respectively.

However, the reduction in student numbers is outweighed by the increase in fee income generated from a higher fee charged per EU-domiciled student. Institutions in Clusters 1 and 2 gain an additional £7.46 million and £1.36 million in fee income on average per institution, respectively.

Figure 13 Average impact of removing home fee status, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding.

4.5.3 Aggregate impacts

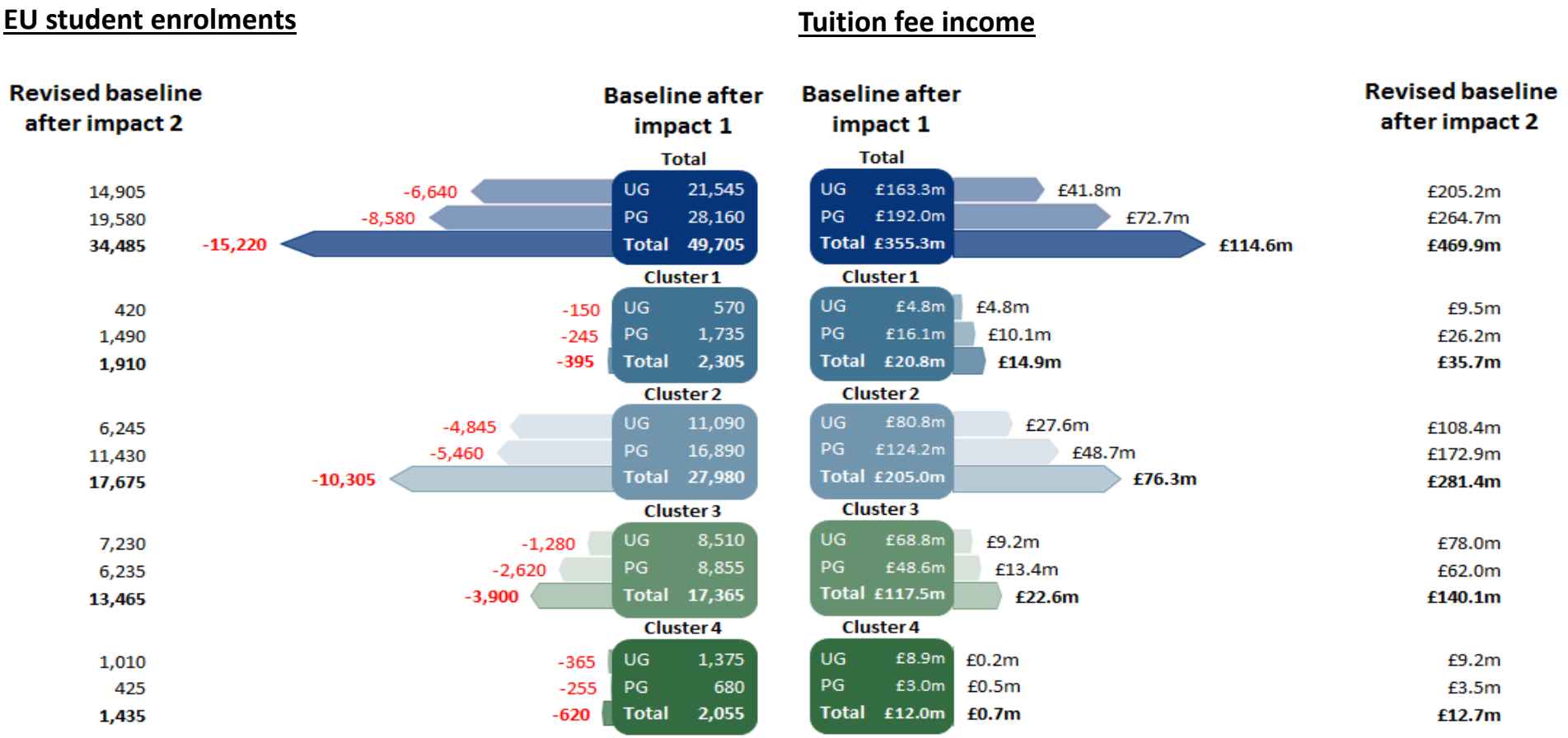
In aggregate, across all institutions, the removal of the Home fee status for EU-domiciled students would result in a decline in EU demand for UK higher education by approximately 15,220 (31%) students. However, the income generated from the new fee status would increase fee revenue by £114.6 million across all UK HEIs.

Across Cluster 1, tuition fee income would be expected to increase by approximately £14.9 million for EU-domiciled students in their first year of intended study.

The harmonisation of fees between EU and non-EU students would reduce the number of EU students in Cluster 2 institutions by 10,305 (37%) but provide additional fee income of £76.3 million in total.

Similar effects would occur for institutions in Clusters 3 and 4. EU student numbers would decrease by 3,900 (22%) across institutions in Cluster 3, but there is a total financial gain of £22.6 million. In Cluster 4, the fee harmonisation would reduce enrolments by 620 (30%), with total tuition fee income increasing by £0.7 million.

Figure 14 Aggregate impact of removing home fee status, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding.

4.6 Impact of restricting the right to work in the UK post-study

4.6.1 Assumptions

To model the impact of changing the post-study work rights of EU-domiciled students to those of non-EU students, we made use of Longitudinal Educational Outcomes (LEO) data on the % of graduates in sustained employment (excluding further study) in the UK one-year post-graduation (for 2015/16) – separately by study level. In each instance, we assume that the % of EU graduates in sustained employment in the UK one year after graduation would converge (decrease) to the corresponding % of non-EU students.

As displayed in the table below, it is thus assumed that, following the restriction of post-study work rights, demand from EU students for UK HE would fall by 19.2% for undergraduate students and 18.4% for postgraduate students.

There is no existing evidence on the proportion of students that would *still* come to study at a UK higher education institution, despite restrictions to their post-study work rights. Therefore, it is assumed that all (100%) of these students would no longer choose to study in the UK.

There are a number of caveats to be considered – so that the estimates should be treated as an upper bound:

- We do not distinguish between clusters – i.e. we make the same assumptions for all HEIs.
- EU and non-EU students are likely to have different characteristics that would influence their decision to pursue work in the UK post-graduation. For example, given the geographical proximity of the EU Member States, EU students may continue to come to the UK for higher education but go back to their home country for work.
- It is possible that, as a result of the restrictions to post-study work rights, EU undergraduate students may subsequently become more likely pursue further studies in the UK rather than to enter employment in the UK.

Table 9 Proportion of graduates in sustained employment one-year post-graduation, by domicile and level of study

% in sustained employment one year post-graduation	Undergraduate	Postgraduate
EU	27.7%	27.5%
Non-EU	8.5%	9.1%
Difference (in percentage points)	**-19.2**	**-18.4**

Note: The information for UG (PG) students is based on individuals who graduated with a Bachelor's degree qualification (Master's or Doctorate (taught or research) degree) from higher education institutions in England only. Hence, the information excludes any other undergraduate (postgraduate) qualifications, as well as international students who studied in Wales, Scotland or Northern Ireland. **Source**: Department for Education (2018). 'Graduate outcomes (LEO): 2015 to 2016'.

4.6.2 Average impacts per HEI

The analysis suggests that, on average, each institution would face approximately 40 (19%) fewer first-year EU-domiciled student enrolments after the restriction of the post-graduation work rights. This equates to a loss of approximately £0.54 million per institution on average in terms of tuition fee income.

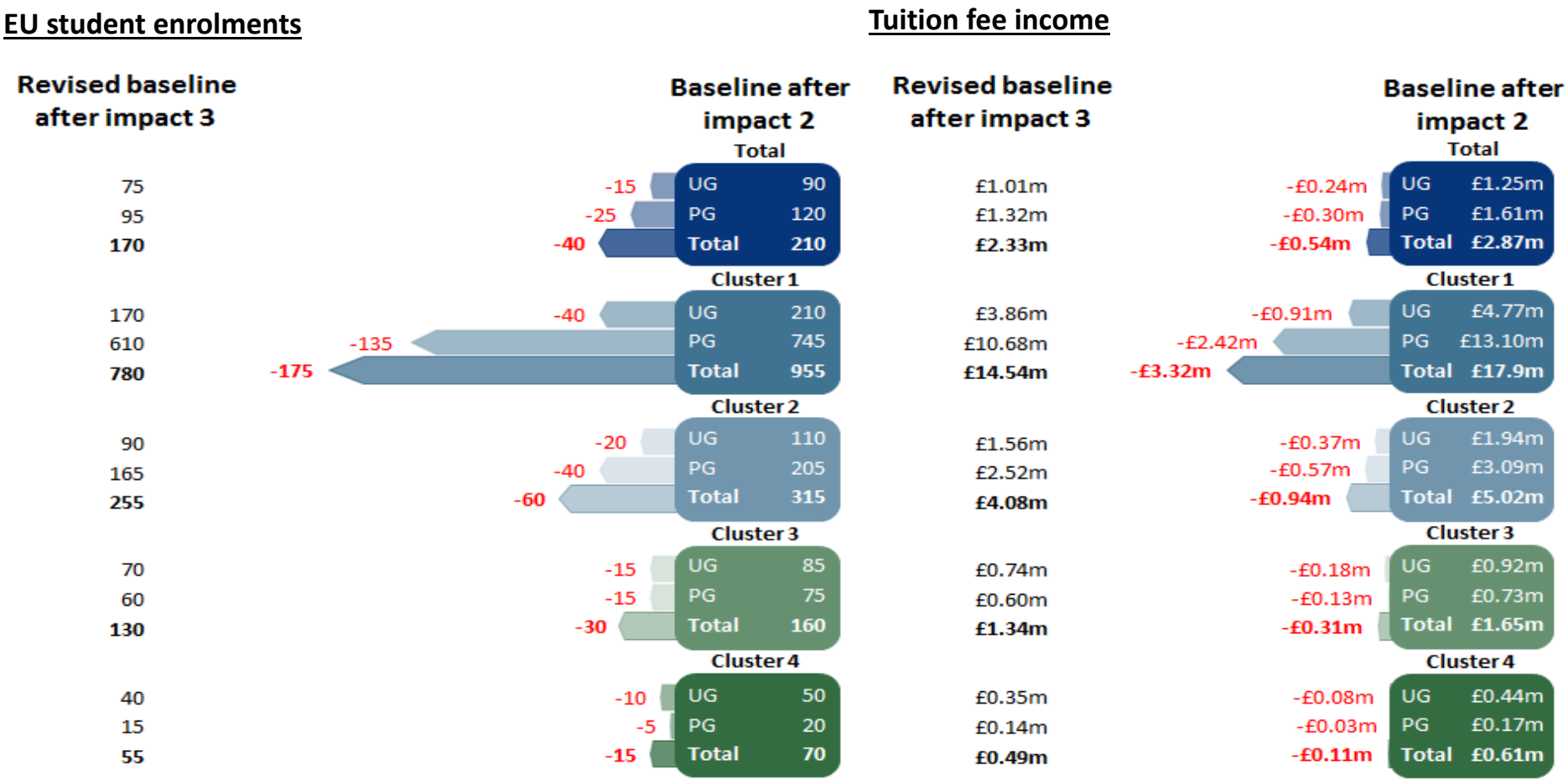
Again, there is significant variation across clusters. Facing the largest impact per institution, in Cluster 1, the restrictions would reduce the number of EU students by 175 (18%) per institution, with each institution experiencing a potential financial loss of £3.32 million. This is mainly driven by a reduction in postgraduate enrolments.

In contrast, institutions in Cluster 4 would see student enrolments decline by only 15 (21%) per institution, corresponding to a loss of approximately £0.11 million per institution. This is largely associated with a drop in undergraduate student enrolments.

In Cluster 2, the restriction of the right to work post-graduation would lower fee revenue by approximately £0.94 million per institution on average, which equates to a decrease in student numbers by 60 (19%) per institution.

Institutions in Cluster 3 would experience a financial loss of £0.31 million on average, with 30 (19%) fewer enrolments per institution.

Figure 15 Average impacts of restricting right to work in UK, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding.

4.6.3 Aggregate impacts

Across all institutions, restricting the right of EU students to work in the UK post-graduation would lower the demand for UK higher education by approximately 6,640 (19%) first-year students. Of this number, approximately 2,870 are undergraduate students, with the remaining 3,770 being postgraduate students.

This decline in student numbers would reduce total tuition fee income generated by UK higher education institutions by £88.0 million.

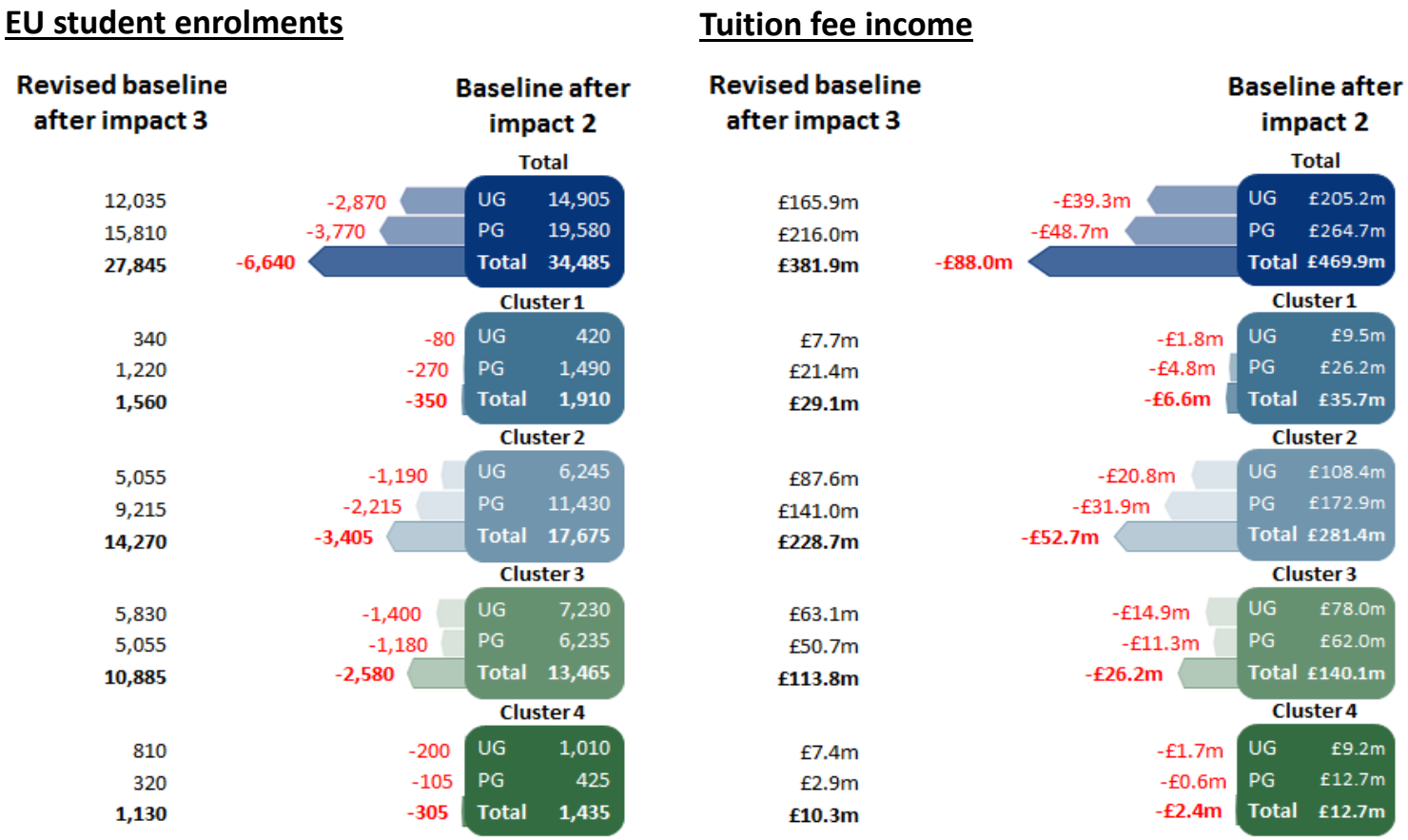
In Cluster 1, the changes in the right to work in the UK post-study would reduce the number of EU-domiciled students by 350 (18%), with a total financial loss of £6.6 million.

In Cluster 2, the number of EU students would decline by 3,405 (19%), corresponding to a loss in fee income of approximately £52.7 million.

The restriction of the right to work post-graduation would reduce the number of EU students by 2,580 (19%) across all institutions in Cluster 3. The total impact in financial terms across the cluster would be approximately £26.2 million.

In Cluster 4, there would be approximately 305 (21%) fewer EU students, equating to a potential reduction in fee income of £2.4 million.

Figure 16 Aggregate impacts of restricting right to work in UK, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding.

4.7 Impact of restricting the right to bring dependants to the UK

4.7.1 Assumptions

The impact on student enrolments and associated tuition fee income due to changes in the right to bring dependants to the UK is based on data from the 'Survey of Graduating International Students' (SoGIS) in 2017[26]. Specifically, we assume that:

- 2.5% of EU-domiciled undergraduate students would be affected by the restriction – this is equal to the current % of international undergraduate students who have *any children*; and
- 6.3% of EU-domiciled postgraduate students would be affected by the restriction – this is equal to the current % of international postgraduate students who have *two or more children*.

The difference is based on the assumption that EU undergraduate students would not be able bring any children to the UK (which is in line with the existing rules of the Tier 4 visa), and EU postgraduate students would be less likely to bring more than one child[27]. With no existing evidence on the impact of such a policy change, it is assumed that 50% of students in these categories would no longer enrol in UK HE[28].

There are a number of limitations associated with these assumptions:

- We do not distinguish between clusters – i.e. we make the same assumptions for all HEIs.
- The SoGIS data are based on a small, self-selected sample and do not distinguish between the mode of study (full-time/part-time); further, the results by study level cannot be broken down by domicile (EU or non-EU).
- The question in the survey only asks about how many children students have, and *not* whether the children live with the student.
- The data are based on child dependants only, and do not consider other dependants such as spouses/civil partners.

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[26] https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/datasets/surveyofgraduatinginternationalstudentsuk

[27] This assumption is based on the fact that current Tier 4 postgraduate dependant visas are subject to a monthly maintenance requirement.

[28] For example, we assume that the remaining 50% of EU undergraduate students might be able to bring in dependants on their partner's visa, while we assume that 50% of EU postgraduate students with more than one child would not be able to fulfil the Tier 4 maintenance requirement for their dependants' visas, and would thus choose not to study in the UK.

4.7.2 Average impacts per HEI

In addition to the removal of student support, harmonisation of fees and restriction on the right to work post-graduation, the effect of changes in the right to bring dependants are relatively limited – and would see enrolments in the UK decrease by less than 5 per institution on average.

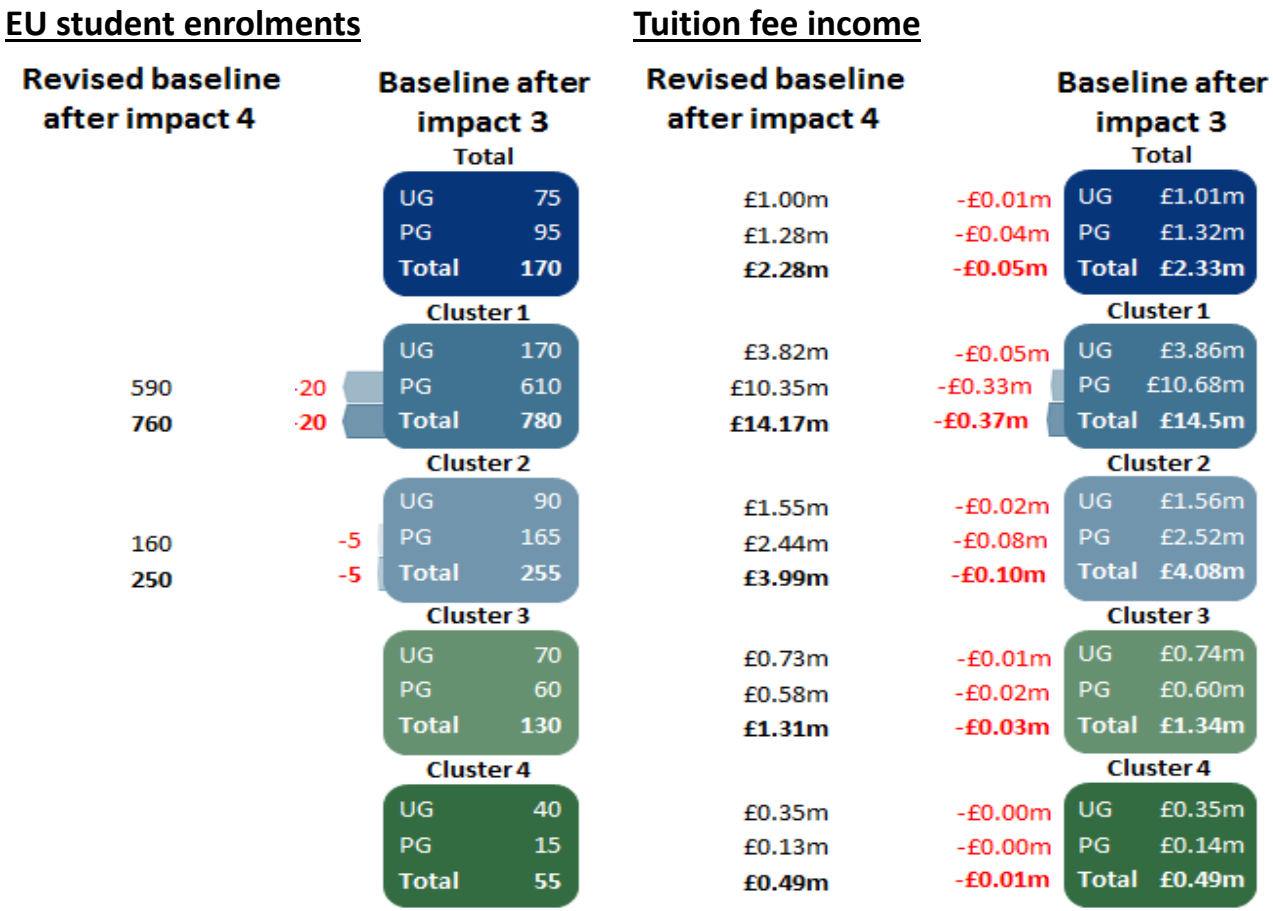
The financial loss in terms of fee income associated with this change stands at approximately £0.05 million per institution across all clusters.

In Cluster 1, again facing the largest effect per institution, restricting the right to bring dependants would reduce the number of EU postgraduate students by 20 (3%) per institution on average. This corresponds to a total reduction in average tuition fee income per institution of £0.37 million.

For institutions in Cluster 2, restricting the right to bring dependants would reduce the number of EU student enrolments by 5 (2%), which equates to an institutional level impact of approximately £0.10 million less in tuition fee income.

The impact of changes to the right to bring dependants on student enrolments (and hence, tuition fee income) is relatively small for higher education institutions in Clusters 3 and 4.

Figure 17 Average impacts of restricting right to bring dependants to UK, university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding.

4.7.3 Aggregate impacts

In aggregate, the impact of restricting the right to bring dependants for EU-domiciled students would further decrease tuition fee income by approximately £8.4 million across all institutions. In terms of student numbers, this equates to 590 (2%) fewer EU student enrolments at UK higher education institutions.

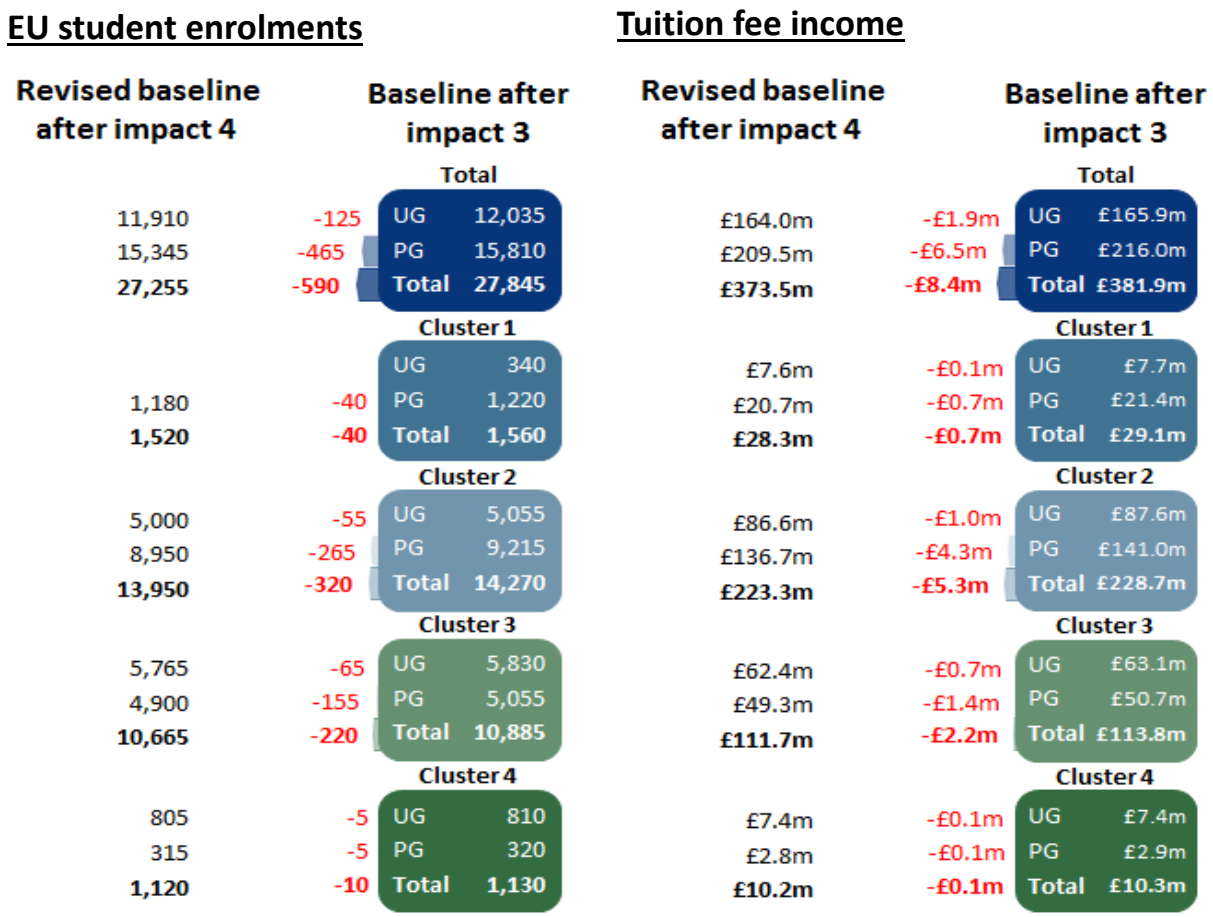
In Cluster 1, the analysis suggests that student enrolments would decrease by 40 (3%) across institutions, with an associated total financial impact of £0.7 million in lost tuition fee income.

The changes to the rules to bring dependants would see 320 (2%) fewer enrolments across all institutions in Cluster 2, which corresponds to a total loss in fee income of £5.3 million.

Across all HEIs in Cluster 3, there would be approximately 220 (2%) fewer EU first-year students, equating to a potential reduction in fee income of £2.2 million.

For HEIs in Cluster 4, restricting the right to bring dependants would reduce enrolments amongst EU-domiciled students by 10 (1%), which lowers tuition fee income by approximately £0.1 million.

Figure 18 Aggregate impacts of restricting right to bring dependants to UK, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding.

4.8 Combined impact of all policy changes

4.8.1 Average impacts per HEI

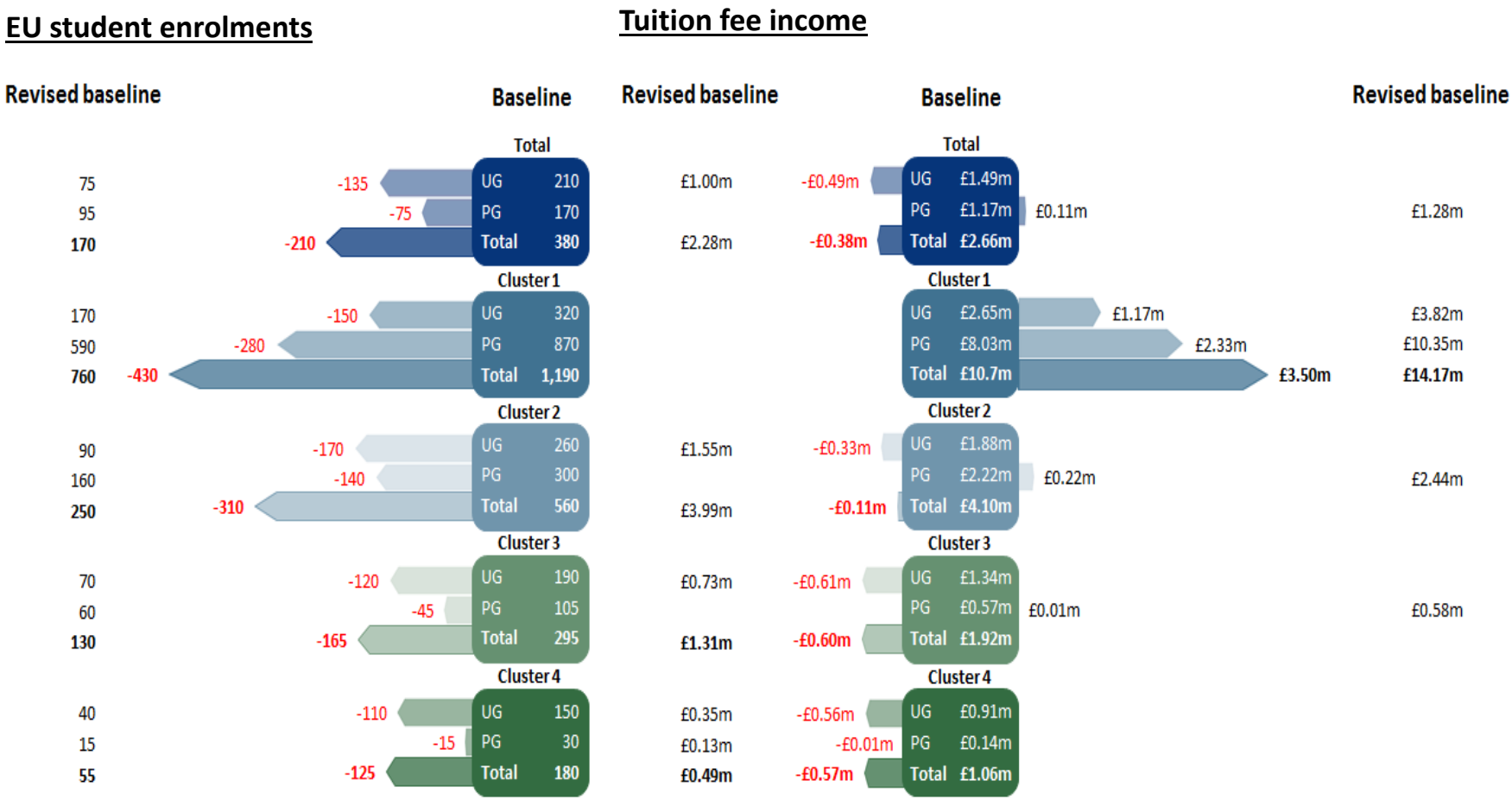
Taken together, the combined impact of all four policy changes would reduce the number of first-year EU students by 210 (55%) per institution (on average). The total financial impact is estimated to be a loss of £0.38 million in tuition fee income; however, this masks variation by the level of study. Overall, each institution's fee income generated from undergraduate students is estimated to *decrease* by approximately £0.49 million; while fee income associated with postgraduate students is estimated to *increase* by approximately £0.11 million on average.

The analysis suggests that all clusters would experience a net average reduction in EU student enrolments, ranging from 430 (36%) for HEIs in Cluster 1 to 125 (69%) for HEIs in Cluster 4.

However, at the institutional level, the average financial impact in terms of fee revenue ranges from an increase of £3.50 million for institutions in Cluster 1 to a decrease of £0.60 million for institutions in Cluster 3.

Overall, in financial terms, institutions in Cluster 1 are expected to benefit from the combined impact of all policy changes; whereas institutions in Cluster 2, 3 and 4 would be financially worse-off (on average).

Figure 19 Average impact of all policy changes, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding. ***Source****: London Economics' analysis*

4.8.2 Aggregate impacts

In total, the combined effect of all four policy changes would be to reduce first-year EU student enrolments in UK higher education institutions by approximately 35,540 (57%)[29]. This corresponds to a reduction in fee income from EU sources of approximately £80.1 million for undergraduate students, which is partially offset by an increase in fee income generated from postgraduate students of approximately £17.6 million - resulting in a net reduction of £62.5 million.

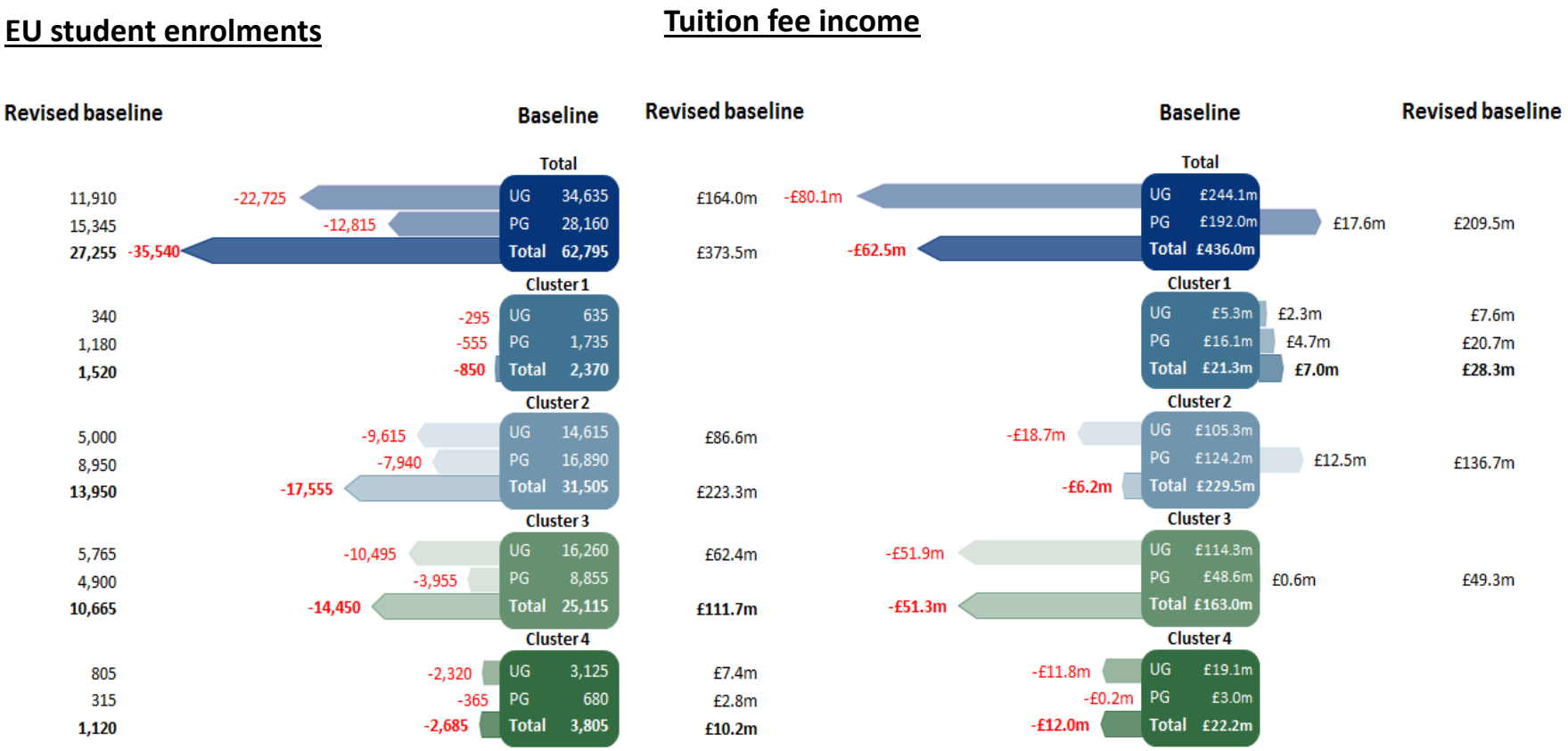
The analysis suggests that, despite a reduction in demand from EU students, the increase in fees charged per EU student (based on the removal of the Home fee status) implies that institutions in Cluster 1 are approximately £7.0 million better off in aggregate as a result of the policy changes.

In aggregate, institutions in Cluster 2 would be worse off by £6.2 million; however, this masks variation by level of study.

Overall, the reductions in tuition fee income generated from EU undergraduate students would see institutions in Clusters 3 and 4 losing £51.3 million and £12.0 million in total EU tuition fee income, respectively.

[29] This is equal to 15% of total international student enrolments in 2016/17.

Figure 20 Aggregate impact of all policy changes, by university cluster



Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding. **Source**: London Economics'

4.9 Sensitivity analysis for cluster scenarios

We test sensitivity of the above core results by modifying the clustering of UK HEIs in three different scenarios:

1. Strong impact – Based on the ranking by mean tariff point score, we move the five lowest ranked HEIs in Clusters 2 and 3 down to Clusters 3 and 4, respectively. This scenario thus captures a stronger impact as compared to the core results, as students in Clusters 3 and 4 are assumed to be *more* sensitive to changes in fees and the removal of tuition fee support than students in Clusters 1 and 2.
2. Weak impact – Based on the same ranking, we move the five highest ranked HEIs in Clusters 2, 3 and 4 up to Clusters 1, 2 and 3, respectively. In this case, the scenario models a weaker impact as compared to the core analysis, as students in the moved institutions are moved into clusters that are assumed to be relatively *less* sensitive than the originally allocated cluster.
3. Equal distribution – In this scenario, clusters are re-assigned so that EU students are equally distributed across the four clusters (again using the ranking of HEIs by cluster and mean tariff points).

Table 10 provides an overview of the number of higher education institutions in each cluster under each scenario, in comparison to the core classification.

Table 11 summarises the aggregate impact across all institutions of each proposed policy change, alongside the combined impact, under each scenario.

Table 10 Cluster scenarios for sensitivity analysis

(Number of HEIs)	Core analysis	Sensitivity analysis		
		Scenario 1	Scenario 2	Scenario 3
Cluster 1	2	2	7	16
Cluster 2	56	51	56	33
Cluster 3	85	85	85	49
Cluster 4	21	26	16	66
Total	**164**	**164**	**164**	**164**

6 HEIs are not assigned to a cluster and are excluded from the analysis. However, these 6 institutions only accounted for approximately 10 EU student enrolments in 2016/17 (out of a total of 62,805, i.e. 0.016%) and hence, the analysis is largely unaffected by their exclusion.

Source: London Economics' analysis, Department for Education, Boliver (2015)

Table 11 Sensitivity analysis results

	Baseline		'Strong impact'		'Weak impact'		Equal distribution	
Policy change	**# Students**	**Fee in-come**	**# Students**	**Fee in-come**	**# Students**	**Fee in-come**	**# Students**	**Fee in-come**
Average impact per institution								
Removal of fee support	-80	-£0.49m	-80	-£0.50m	-80	-£0.48m	-85	-£0.52m
Fee harmonisation	-90	+£0.70m	-90	+£0.67m	-80	+£0.84m	-75	+£0.88m
Removal of right to work post-study	-40	-£0.54m	-40	-£0.53m	-45	-£0.56m	-45	-£0.56m
Removal of right to bring dependants	0	-£0.05m	-5	-£0.5m	-5	-£0.05m	-5	-£0.05m
Total	**-210**	**-£0.38m**	**-215**	**-£0.41m**	**-210**	**-£0.26m**	**-210**	**-£0.26m**
Aggregate impact								
Removal of fee support	-13,090	-£80.72m	-13,255	-£82.13m	-12,985	-£78.86m	-14,175	-£85.27m
Fee harmonisation	-15,220	£114.58m	-15,260	+£110.67m	-14,125	+£137.47m	-13,150	£143.66m
Removal of right to work post-study	-6,640	-£87.96m	-6,665	-£86.85m	-6,790	-£92.34m	-6,870	-£92.44m
Removal of right to bring dependants	-590	-£8.37m	-570	-£8.20m	-655	-£8.74m	-635	-£8.79m
Total	**-35,540**	**-£62.47m**	**-35,750**	**-£66.51m**	**-34,555**	**-£42.48m**	**-34,830**	**-£42.84m**

Note: Enrolments are rounded to the nearest 5. Differences in totals are due to rounding. **Source**: London Economics'

In aggregate, across all institutions and policy changes, the impact on EU student numbers is relatively unchanged across the different scenarios, ranging from a reduction of 34,555 ('Weak impact' Scenario 2) to 35,750 ('Strong impact' Scenario 1).

The estimated foregone tuition fee income varies from £42.5 million ('Weak impact' Scenario 1) to £66.5 million ('Strong impact' Scenario 1). The variation in the impact on tuition fee income is mainly driven by differences in the impact of harmonising the tuition fees charged to EU students in line with non-EU students across the different cluster scenarios.

4.10 Total impact for the 2016/17 cohort

4.10.1 Assumptions

All of the above estimates focused on the impact of the different policy changes on first-year EU student enrolments, and the associated tuition fee income accrued from these students during their first year of study.

In addition to these first-year impacts, in the following, we assess the impact of all policy changes (combined) over the 2016/17 cohort's entire study duration. That is, we quantify the aggregate impact on the tuition fee income accrued from the 2016/17 cohort by modelling the expected duration of study, accounting for completion rates (by study level and mode), and discounting to net present values.

We assume an average duration of study of between 1 and 3 years for full-time students. Part-time durations have been derived using an assumed study intensity of 40%[30], with assumed average durations thus ranging between 3 and 8 years[31].

Tuition fee income generated in each year is discounted by an annual nominal discount rate of 5.6%, derived using an inflation rate of 2.0% and the HMT Green Book real discount rate of 3.5%[32].

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[30] . Given that HESA does not publish official statistics on part-time study intensity, we instead use previous estimates outlined in Higher Education Policy Institute (2013), including information on the number of undergraduate part-time students in English institutions broken down into different study intensity bands. Based on this information, we estimate that part-time students study at an intensity equivalent to approximately 40% that of full-time students (assuming the same study intensity across students at either undergraduate or postgraduate level).

[31] These assumptions are aligned with the assumed study durations underlying London Economics' recent analysis of the cost and benefits of international students studying in the UK, undertaken on behalf of the Higher Education Policy Institute and Kaplan (see London Economics, 2018b).

[32] The inflation rate is based on the Bank of England's annual inflation target (see Bank of England, 2018). The real discount rate is based on HM Treasury's recommendations in The Green Book (see HM Treasury, 2018). Note that we assume that students pay the same level of tuition fee per year (i.e. we assume no growth in the level of fee paid per student in subsequent years of study).

Table 12 Assumptions for duration of study, by level and mode of study

	Duration of study (in years)		Duration of study (in years)
Full-time		**Part-time**	
First degree	3	First degree	8
Other undergraduate	1	Other undergraduate	3
Postgraduate (research)	3	Postgraduate (research)	8
Postgraduate (taught)	1	Postgraduate (taught)	3
Other postgraduate	1	Other postgraduate	3

Our estimates are further adjusted for expected continuation/completion rates (again by level and mode of study, and by year of study). For this, we make use of HESA data on non-continuation one year or two years after entry, for UK-domiciled full-time and part-time first undergraduate students, respectively (on average, and broken down by young and mature entrants)[33].

Combining the yearly continuation/completion rates with the assumed duration of study, the table below provides the completion rates in each year relative to the number of starts in 2016/17. It is assumed that HEIs provide no re-imbursement to students who leave their course during the first year of study. This is equivalent to assuming that there is 100% completion in the first year of study.

[33] For more information, see HESA (2018).
The non-continuation rates are based on the proportion of students no longer enrolled in HE one or two years after study, respectively. Hence, they implicitly take account of students who 'switch' between qualifications or transfer to a different institution as 'continuing' students.
Non-continuation rates for part-time students are for students not continuing after 2 years, therefore they have been divided by two (assuming that equal proportions of students drop out in each year).
Note that, as the HESA data provide no comparable information for non-UK domiciled students, we have assumed that their completion rates are identical to those estimated for UK domiciled students.
No data is available for completion rates for part-time other undergraduate qualifications, this is assumed to be the same as part-time first-degree qualifications. Further note that the HESA information provides separate non-continuation rates for first degree and other undergraduate students, but excludes students at postgraduate level. To achieve assumptions for postgraduate students, we assume that students undertaking higher research or taught degrees post the same non-continuation rates as mature first-degree students.

Table 13 Continuation/completion rates by level and mode of study

Year	Full-time					Part-time				
	First degree	Other UG	Higher degree (taught)	Higher degree (taught)	Other PG	First degree	Other UG	Higher degree (taught)	Higher degree (research)	Other PG
1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2	93%			88%		83%	83%	84%	84%	84%
3	86%			78%		69%	69%	70%	70%	70%
4						58%			59%	
5						48%			49%	
6						40%			41%	
7						33%			34%	
8						28%			29%	

4.10.2 Average impacts per HEI

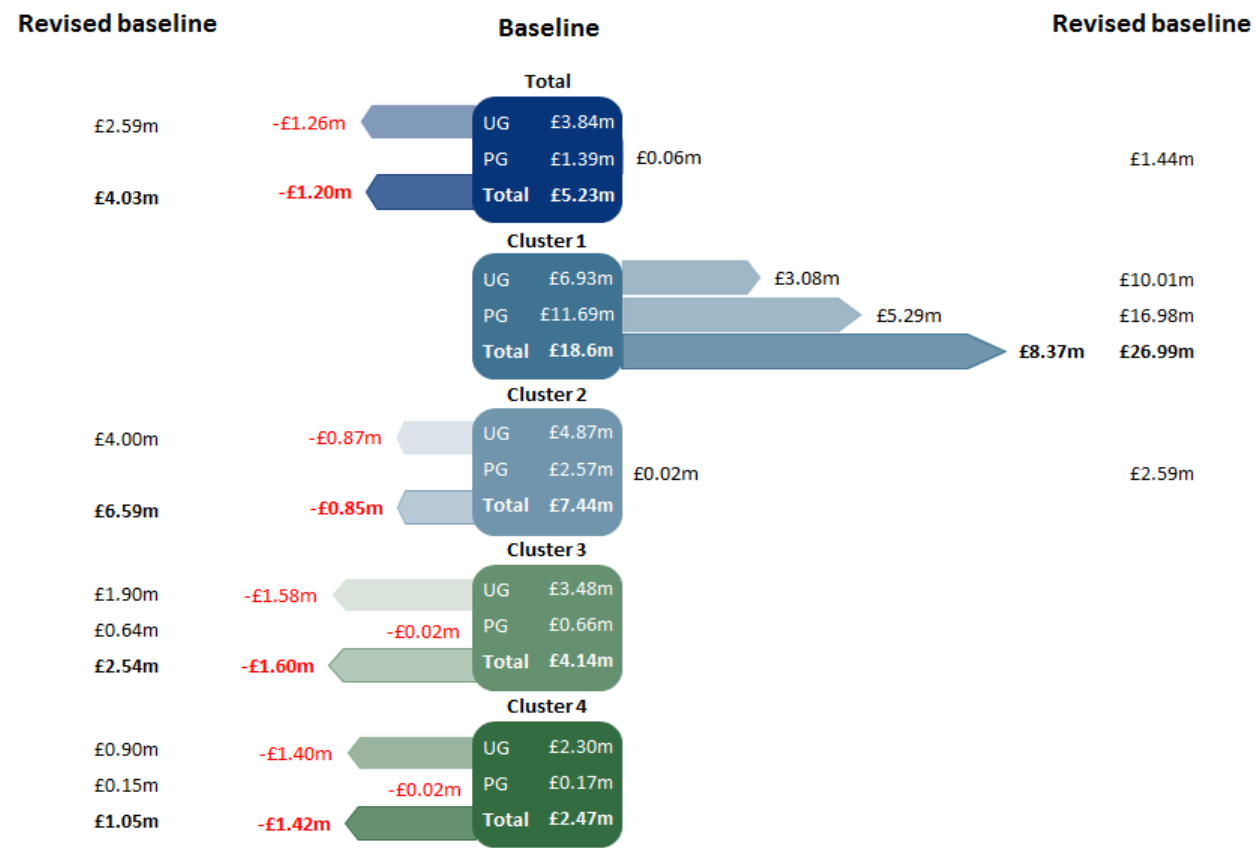
On average, the combined impact of all four policy changes associated with the 2016/17 cohort of EU students – over their entire study duration - is estimated to reduce tuition fee income by £1.20 million per institution. This loss is mainly driven by the loss in fee income generated from EU undergraduate students, which is approximately £1.26 million lower per institution (on average) than the baseline (i.e. before the implementation of the policy changes).

As with the impact on fee income in the first year (only), the cohort analysis shows significant differences across university clusters.

The analysis suggests that HEIs in Cluster 1 would be better-off by £8.37 million on average in terms of tuition fee income generated from the 2016/17 cohort. This increase in income is generated from both EU undergraduate students (£3.08 million per institution) and EU postgraduate students (£5.29 million per institution).

In contrast, institutions in Cluster 2, 3 and 4 would be financially worse-off, with losses of £0.85 million, £1.60 million and £1.42 million per institution (on average, respectively). These losses are primarily driven by reductions in the number of EU undergraduate students.

Figure 21 Average of total impact, by university cluster



Note: Differences in totals are due to rounding.
Source: London Economics' analysis

4.10.3 Aggregate impacts

In aggregate across all institutions, for the 2016/17 EU student cohort, the combined effect of all four policy changes corresponds to a total loss in tuition fee income of £196.8 million. Broken down by study level, the loss in tuition fee income of approximately £206.2 million generated from EU undergraduate students is partially offset by additional fee income from EU postgraduate students of approximately £9.3 million.

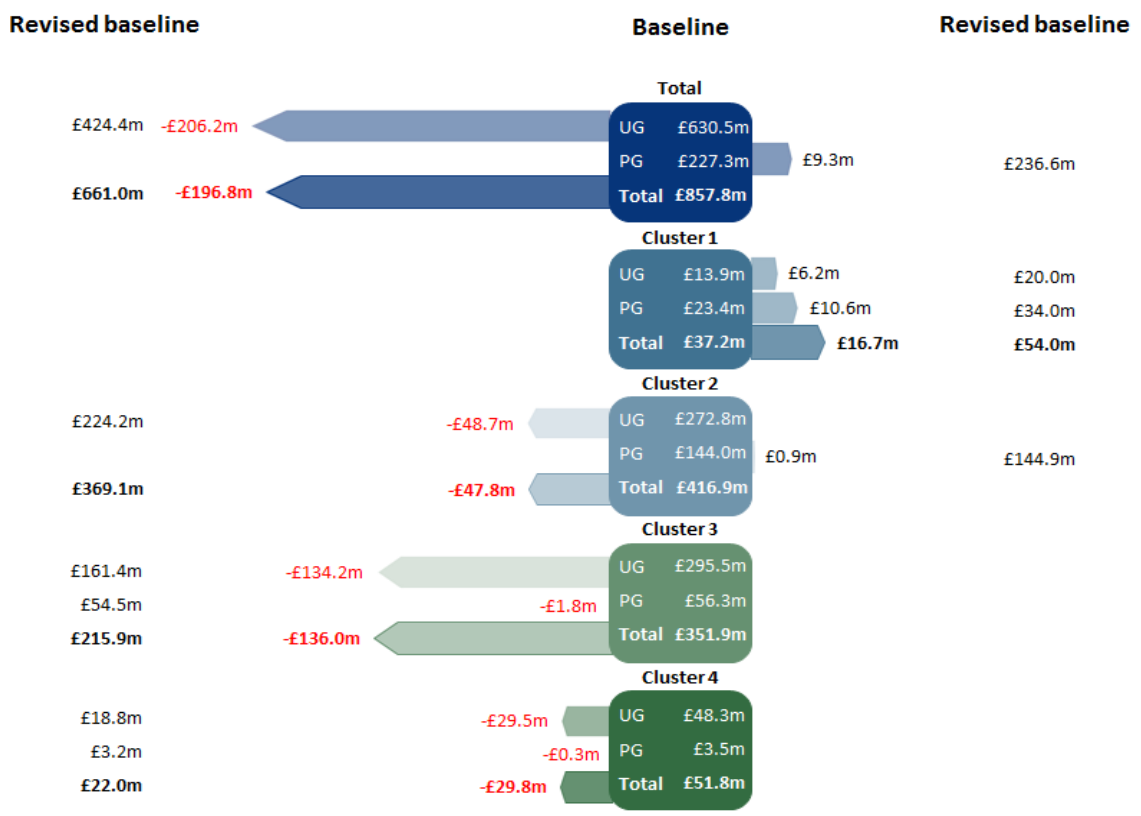
In Cluster 1, the total financial impact would be a gain of approximately £16.7 million in tuition fee income from EU students in the 2016/17 cohort.

Across all HEIs in Cluster 2, there is an estimated loss in tuition fee income of £47.8 million associated with the cohort.

The policy changes would reduce aggregate tuition fee income generated from the cohort by approximately £136.0 million for HEIs in Cluster 3.

For HEIs in Cluster 4, tuition fee income would decline by approximately £29.8 million in total.

Figure 22 Aggregate of total impact, by university cluster



Note: Differences in totals are due to rounding.
Source: London Economics' analysis

5 Conclusions

Across all higher education institutions, the analysis suggests that:

Removing the tuition fee support for EU-domiciled undergraduate students would reduce demand for UK higher education by approximately 13,090 (21%[34] of all EU student enrolments) first-year students per year, equating to a loss of £80.7 million in tuition fee income.

Removing the Home fee status for EU-domiciled (undergraduate and postgraduate) students would generate additional fee revenue of approximately £114.6 million. That is, the increase in fees charged to EU-domiciled students would more than offset the loss in fee income due to falling demand amongst EU students (15,220 students, 24% of EU-domiciled student enrolments in 2016/17).

Restricting the right to work in the UK post-graduation for EU-domiciled students would potentially result in 6,640 (11% of EU-domiciled student enrolments) fewer EU student enrolments, corresponding to a reduction in fee revenue generated by UK HEIs of £88.0 million.

Restricting the right to bring dependants for EU-domiciled students would further reduce tuition fee income by approximately £8.4 million, with 590 (1% of EU-domiciled student enrolments) fewer enrolments.

Taken together, the estimated combined impact of all of these policy changes would be to reduce tuition fee income from EU sources by approximately £62.5 million, with 35,540 (57%) fewer first-year EU enrolments. However, the aggregate impact on fee income masks significant variation by university cluster (and level of study). In particular, HEIs in Clusters 1 would benefit in aggregate; whereas institutions in Clusters 2, 3 and 4 would be worse-off.

The results on student enrolments are insensitive to changes in classification of HEIs by clusters, with the reduction in demand varying from 34,555 (55%) to 35,750 (57%). The total financial loss ranges from £42.5 million to £66.5 million.

[34] Note: All percentages on this page are as a proportion of the baseline EU student enrolments (62,795) or associated tuition fee income (£436.0 million) in 2016/17.

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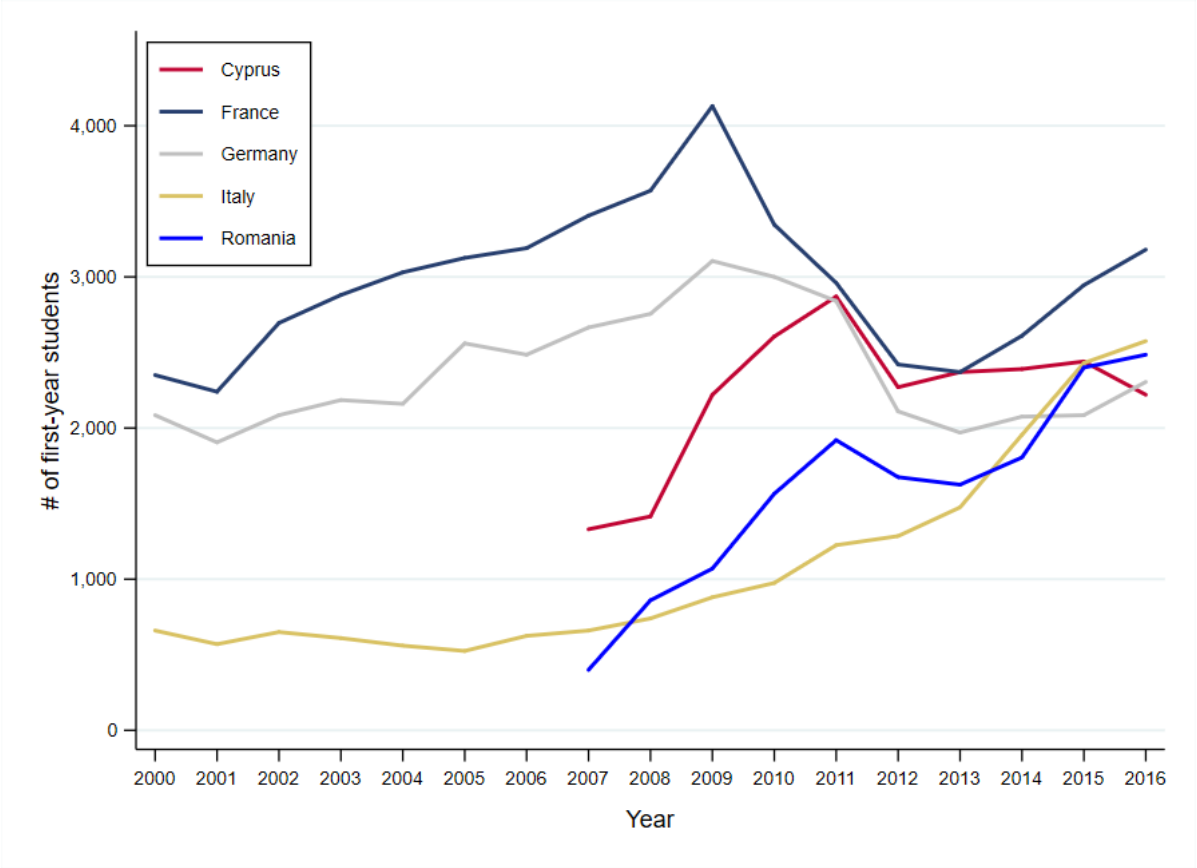
Annex 1 Additional descriptive statistics

Figure 23 Number of full-time first-year undergraduate first-degree students from the top 5 EU countries, by year[35]



[35] Top 5 countries selected according to 2016 enrolments. HESA student numbers are rounded to the nearest five. EEA countries have been included in non-EU totals. Students with 'Leeward island', 'Commonwealth of Independent States', 'West Indies'. 'Winward Islands', 'British Antarctic Territory', 'British Indian Ocean Territory' could not be identified consistently over time and are excluded from the analysis. Data for Cyprus (EU) is only available from 2007 onwards.

Figure 24 Number of full-time first-year undergraduate first-degree students from the top 5 non-EU countries, by year

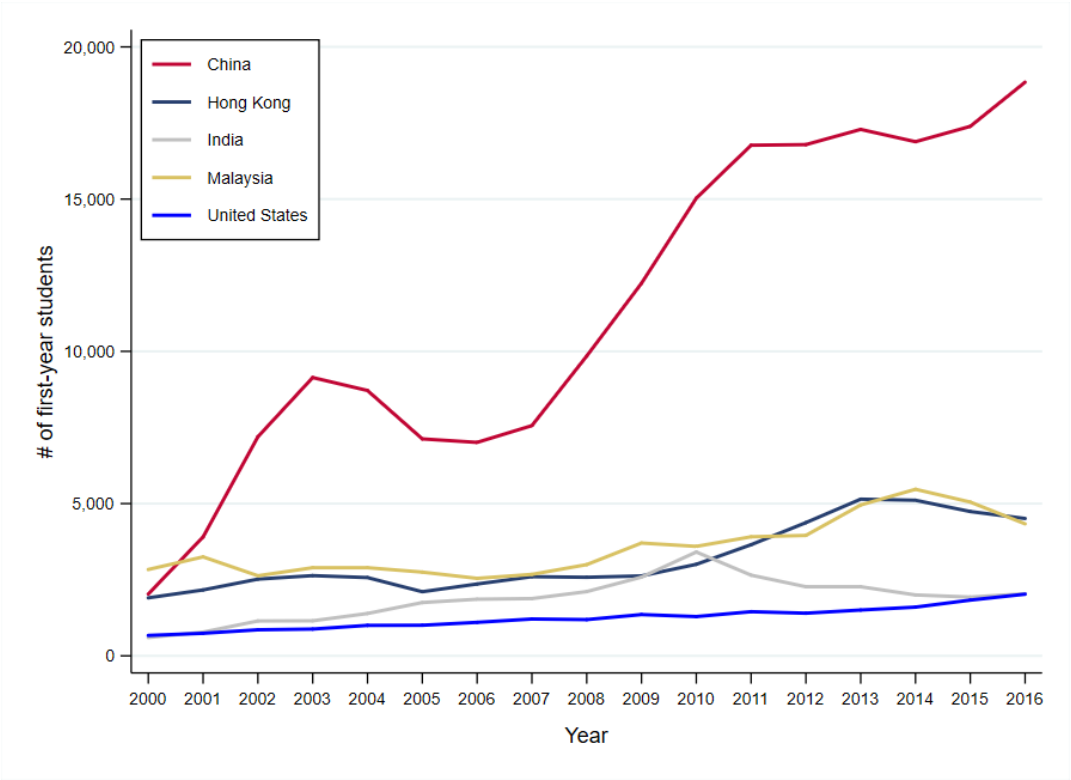


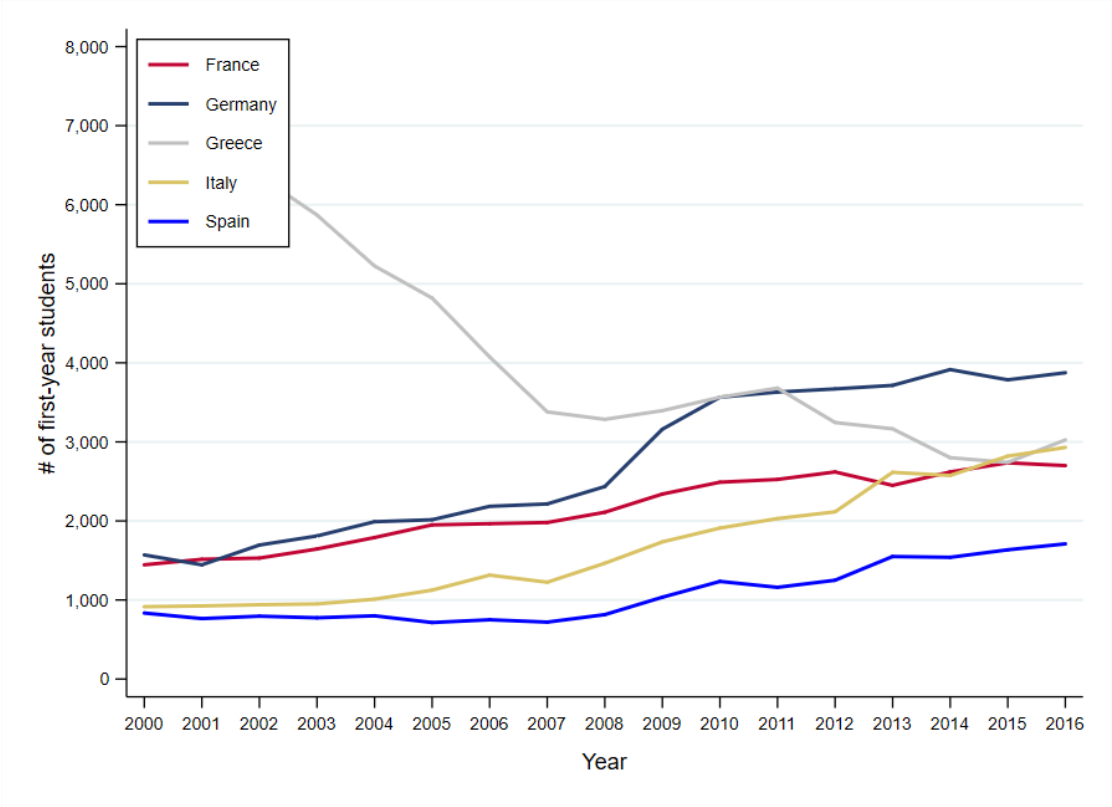
Table 14 Number and % of EU full-time first-year undergraduate students in 2016, by Home Nation (location of study)

	England	Scotland	Wales	N. Ireland	**Total**
Number	24,010	4,305	1,690	275	**30,280**
%	79%	14%	6%	1%	**100%**

Table 15 Number and % of non-EU full-time first-year undergraduate students in 2016, by Home Nation (location of study)

	England	Scotland	Wales	N. Ireland	**Total**
Number	47,150	3,650	2,490	460	**53,745**
%	88%	7%	5%	1%	**100%**

Figure 25 Number of full-time first-year postgraduate students from the top 5 EU countries, by year[36]



[36] Note: Top 5 countries selected according to 2016 enrolments. HESA student numbers are rounded to the nearest five. EEA countries have been included in non-EU totals. Students with 'Leeward island', 'Commonwealth of Independent States', 'West Indies'. 'Winward Islands', 'British Antarctic Territory', 'British Indian Ocean Territory' could not be identified consistently over time and are excluded from the analysis. Data for Cyprus (EU) is only available from 2007 onwards.

Figure 26 Number of full-time first-year postgraduate students from the top 5 non-EU countries, by year

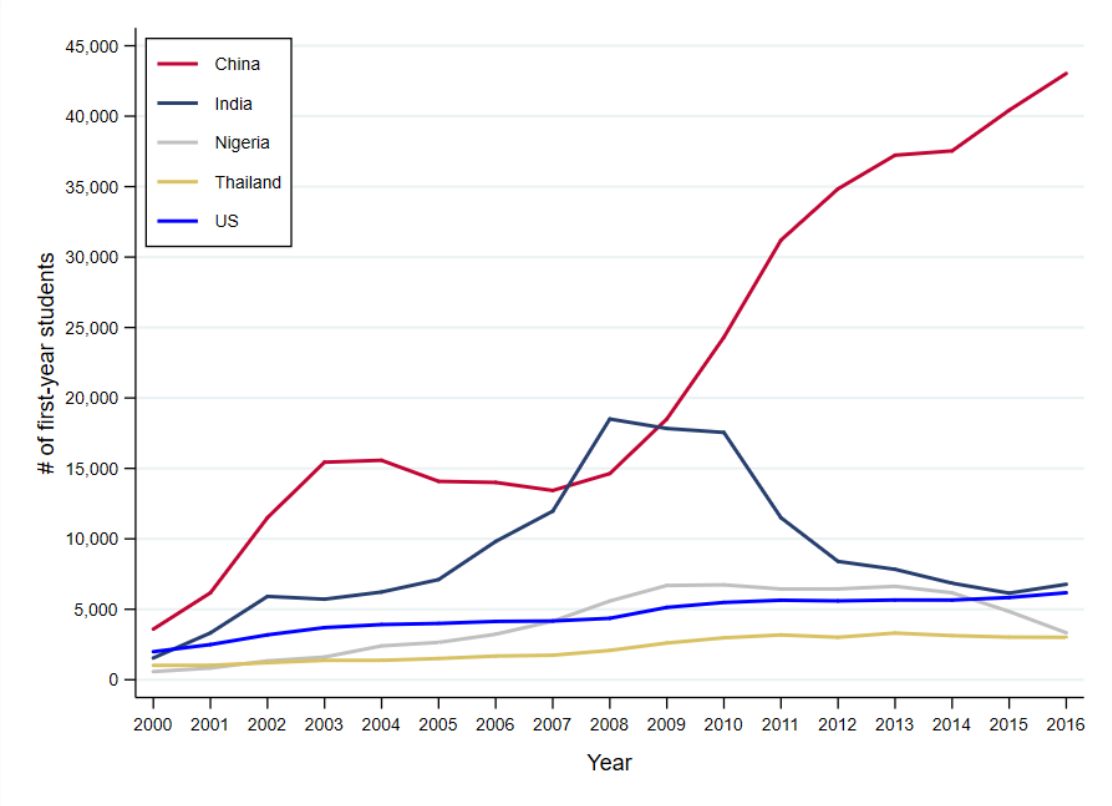


Table 16 Number and % of EU full-time first-year postgraduate students in 2016, by Home Nation (location of study)

	England	Scotland	Wales	N. Ireland	**Total**
Number	18,510	3,560	610	245	**22,925**
%	81%	16%	2%	1%	**100%**

Table 17 Number and % of non-EU full-time first-year postgraduate students in 2016, by Home Nation (location of study)

	England	Scotland	Wales	N. Ireland	**Total**
Number	81,670	10,905	3,920	700	**97,190**
%	84%	11%	4%	1%	**100%**

Annex 2 Detailed econometric results for EU students

Stationarity tests

Table 18 Im-Pesaran-Shin (IPS)/Fisher-type panel unit root tests *(Based on EU countries only)*

Variable	Form	Im-Pesaran-Shin panel unit root test		Fisher-type panel unit root test	
		Demean	Demean and time trend	Demean	Demean and time trend
Number of full-time first-year undergraduate students (log)	Level	-1.673** (0.047)	-1.748** (0.040)	66.519* (0.085)	38.404 (0.920)
	First-difference	-9.013*** (0.000)	-8.614*** (0.000)	106.082*** (0.000)	122.954*** (0.000)
Number of full-time first-year postgraduate students (log)	Level	-2.811*** (0.002)	-0.603 (0.273)	71.396** (0.038)	34.437 (0.971)
	First-difference	-12.975*** (0.000)	-8.952*** (0.000)	115.751*** (0.000)	79.718*** (0.008)
Number of outbound international students by country (log)	Level	-2.638*** (0.004)	-0.337 (0.368)	58.512 (0.249)	50.137 (0.547)
	First-difference	-8.485*** (0.000)	-6.538*** (0.000)	144.873*** (0.000)	135.175*** (0.000)
Exchange rate (Local currency unit per GBP, log)	Level	-3.556*** (0.000)	-0.384 (0.350)	117.267*** (0.000)	106.441*** (0.000)
	First-difference	-13.073* (0.000)	-9.547*** (0.000)	365.304*** (0.000)	266.002*** (0.000)

H_0: All panels contain a unit root. IPS test displays $\hat{w}_t$ statistic and Fisher-type test displays inverse chi-squared statistic. *** p-value<0.01, ** p-value<0.05, * p-value<0.1. Values in parentheses are p-values. **Note**: Demean subtracts cross-sectional means.

Source: London Economics' analysis

Table 19 Dicky Fuller unit root tests/KPSS Stationarity tests

(Based on EU countries only)

Variable	Form	Dickey Fuller unit root test H0: Series has a unit root		KPSS Stationarity test H0: Series is trend stationary	
		No drift	With drift	Lag order: Test-statistic	Critical values
Average UK tuition fee charged to EU undergraduate students (log)	Level	0.422 (0.982)	0.422 (0.659)	0: 0.255*** 1: 0.158** 2: 0.135*	10%: 0.119 5%: 0.146 1%: 0.216
	First-difference	-2.657* (0.082)	-2.657** (0.011)	0: 0.096 1: 0.074 2: 0.135	10%: 0.119 5%: 0.146 1%: 0.216
Average UK tuition fees charged to EU postgraduate students (log)	Level	-0.215 (0.937)	-2.904** (0.045)	0: 0.115 1: 0.083 2: 0.083	10%: 0.119 5%: 0.146 1%: 0.216
	First-difference	-0.215 (0.417)	-2.904*** (0.007)	0: 0.065 1: 0.068 2: 0.079	10%: 0.119 5%: 0.146 1%: 0.216

*** p-value<0.01, ** p-value<0.05, * p-value<0.1. Values in parentheses are p-values.

Source: London Economics' analysis

Cointegrations tests

EU undergraduates

Westerlund's panel cointegration test on EU undergraduate student enrolments, average UK tuition fees, exchanges rates (local currency unit per £), total outbound student numbers and a dummy variable which equals 1 from 2006 for the switch from an upfront fee to loan system in England (zero otherwise).

Table 20 Cointegration tests for EU undergraduates

H_0 : No cointegration

H_a : Some panels are cointegrated

Cointegrating vector : Panel specific

Panel means: Included

Time trend: Not included

AR parameter: Panel specific

Number of panels: 25

Average number of periods: 14.6

Number of observations: 366

	Statistic	P-value
Variance ratio	-2.389	0.008

EU postgraduates

Westerlund's panel cointegration test on EU postgraduate student enrolments, average UK tuition fees, exchanges rates (local currency unit per £), total outbound student numbers and unemployment rate amongst individuals aged 25-35 years old who have attained tertiary education.

Table 21 Cointegration tests for EU postgraduates

H_0 : No cointegration

H_a : Some panels are cointegrated

Cointegrating vector : Panel specific

Number of panels: 22

Panel means: Included

Average number of periods: 14.6

Time trend: Not included

Number of observations: 321

AR parameter: Panel specific

	Statistic	P-value
Variance ratio	-2.972	0.001

Table 22 EU undergraduate students – Regression results

Dependent variable: First difference in the log value of full-time first-year undergraduate students		Preferred model (Dynamic fixed effects)	Pooled mean group	Mean group	Dynamic fixed effects	Top 15 Member States	Top 20 Member States	US ranking	US tuition fee	Youth employment	Top universities per capita	Post 2006
Long-run (in levels)	UK tuition fees (Stepwise series, log)	-0.354** (0.150)	-0.369*** (0.031)	-1.606 (1.253)	-0.370** (0.150)	-0.445 (0.319)	-0.430** (0.188)	-0.349** (0.154)	-0.354** (0.150)	-0.396*** (0.151)	-0.363** (0.146)	-0.347** (0.172)
	Outbound international students by country (log)	1.847*** (0.433)	0.995*** (0.084)	3.876* (2.213)	1.852*** (0.441)	2.148** (0.887)	1.977*** (0.576)	1.843*** (0.436)	1.847*** (0.434)	1.824*** (0.428)	1.804*** (0.453)	1.903*** (0.586)
	Dummy for switch from an upfront fee to loan system	0.166 (0.203)	0.207*** (0.040)	0.379** (0.157)	0.202 (0.226)	0.099 (0.425)	0.205 (0.254)	0.158 (0.216)	0.162 (0.195)	0.205 (0.206)	0.174 (0.199)	-
	Exchange rate (Local currency unit per GBP, log)	-	-0.237*** (0.088)	-0.780 (0.919)	0.094 (0.657)	-	-	-	-	-	-	-
Error correction term		0.216*** (0.049)	0.223** (0.094)	0.544*** (0.085)	0.215*** (0.050)	0.157** (0.070)	0.190*** (0.058)	0.216*** (0.049)	0.216*** (0.051)	0.216*** (0.050)	0.215*** (0.050)	0.224*** (0.061)
Short-run (in first-difference)	UK tuition fees (Stepwise series, log)	-0.268*** (0.044)	-0.267*** (0.045)	-0.148** (0.060)	-0.264*** (0.048)	-0.255*** (0.057)	-0.261*** (0.055)	-0.269** (0.049)	-0.268*** (0.044)	-0.281*** (0.042)	-0.268*** (0.044)	-0.263*** (0.044)
	Outbound international students by country (log)	0.150* (0.091)	-0.208 (0.181)	-0.549* (0.323)	0.150 (0.093)	0.050 (0.156)	0.136 (0.114)	0.150* (0.091)	0.153 (0.096)	0.142 (0.089)	0.142 (0.093)	0.028 (0.142)
	Dummy for switch from an upfront fee to loan system	0.145** (0.058)	0.122* (0.064)	0.130** (0.053)	0.148** (0.066)	0.125* (0.064)	0.133** (0.053)	0.145** (0.057)	0.144** (0.058)	0.166*** (0.062)	0.144* (0.058)	0.134** (0.062)

Dependent variable: First difference in the log value of full-time first-year undergraduate students		Preferred model (Dynamic fixed effects)	Pooled mean group	Mean group	Dynamic fixed effects	Top 15 Member States	Top 20 Member States	US ranking	US tuition fee	Youth employment	Top universities per capita	Post 2006
Short-run (in first-difference)	Exchange rate (Local currency unit per GBP, log)	-	-0.071 (0.079)	-0.230* (0.127)	-0.044 (0.146)	-	-	-	-	-	-	-
	Number of US institutions in top 100 world university rankings (log)	-	-	-	-	-	-	-0.008 (0.044)	-	-	-	-
	Average US tuition fees (log)	-	-	-	-	-	-	-	-0.025 (0.127)	-	-	-
	Youth unemployment (20-24 year olds (log)	-	-	-	-	-	-	-	-	0.067* (0.034)	-	-
	Number of universities in top 1000 per capita (log)	-	-	-	-	-	-	-	-	-	-0.583 (1.466)	-
	Constant	1.884*** (0.725)	0.057 (0.062)	1.873 (2.596)	1.885** (0.817)	1.799* (1.009)	1.885** (0.833)	1.885*** (0.723)	1.888*** (0.729)	1.773** (0.722)	1.784** (0.786)	2.042** (0.977)
Number of observations		341	341	341	341	195	260	341	341	341	341	271

*** p-value<0.01, ** p-value<0.05, * p-value<0.1. Values in parentheses are standard errors. **Note**: Excludes Croatia and Cyprus due to insufficient number of observations. ***Source**: London Economics' analysis*

Table 23 EU postgraduate students – Regression results

Dependent variable: First difference in the log value of full-time first-year postgraduate students		Preferred model (Dynamic fixed effects)	Pooled mean group	Mean group	Top 15 Member States	Top 20 Member States	US ranking	US tuition fee	Top universities per capita	Post 2006
Long-run (in levels)	UK tuition fees (Average series, log)	-0.033 (0.210)	-0.284*** (0.064)	0.408 (0.403)	0.405 (0.408)	1.07 (0.257)	-0.126 (0.235)	-0.021 (0.209)	-0.034 (0.213)	-0.067 (0.210)
	Outbound international students by country (log)	-0.364 (0.357)	-0.027 (0.109)	-0.292 (0.337)	0.369 (1.225)	-0.284 (0.591)	-0.559 (0.388)	-0.370 (0.361)	-0.354 (0.349)	-0.402 (0.362)
	Exchange rate (Local currency unit per GBP, log)	1.255*** (0.235)	1.608*** (0.092)	1.299*** (0.465)	1.309*** (0.333)	1.371*** (0.299)	1.258*** (0.235)	1.254*** (0.235)	1.228*** (0.210)	1.113*** (0.241)
	Unemployment rate amongst 25-35 year olds who have attained/completed tertiary education (log)	0.333*** (0.122)	0.143*** (0.039)	0.122 (0.243)	0.206 (0.282)	0.265 (0.212)	0.342*** (0.128)	0.327** (0.128)	0.334*** (0.120)	0.295** (0.126)
Error correction term		0.297*** (0.085)	0.411*** (0.088)	0.931*** (0.158)	0.164* (0.086)	0.207*** (0.072)	0.285*** (0.084)	0.297*** (0.085)	0.296*** (0.086)	0.417*** (0.111)
Short-run (in first-difference)	UK tuition fees (Average series, log)	-0.261** (0.104)	-0.261*** (0.100)	0.143 (0.193)	-0.317** (0.111)	-0.195** (0.103)	-0.282** (0.110)	-0.255** (0.108)	-0.265** (0.105)	-0.225** (0.112)
	Outbound international students by country (log)	0.108 (0.110)	0.125 (0.165)	0.162 (0.332)	0.039 (0.122)	0.099 (0.096)	0.103 (0.111)	0.102 (0.111)	0.100 (0.102)	0.268 (0.197)
	Exchange rate (Local currency unit per GBP, log)	-0.425*** (0.108)	-0.297*** (0.098)	-0.085 (0.238)	-0.276 (0.168)	-0.400*** (0.118)	-0.454*** (0.109)	-0.406*** (0.123)	-0.419*** (0.105)	-0.443*** (0.116)

Dependent variable: First difference in the log value of full-time first-year postgraduate students		Preferred model (Dynamic fixed effects)	Pooled mean group	Mean group	Top 15 Member States	Top 20 Member States	US ranking	US tuition fee	Top universities per capita	Post 2006
Short-run (in first-difference)	Unemployment rate amongst 25-35 year olds who have attained/completed tertiary education (log)	0.152*** (0.053)	0.179*** (0.041)	0.188** (0.084)	0.100 (0.078)	0.134** (0.066)	0.162*** (0.053)	0.149*** (0.053)	0.152*** (0.052)	0.142** (0.062)
	Number of US institutions in top 100 world university rankings (log)	-	-	-	-	-	0.002** (0.001)	-	-	-
	Average US tuition fees (log)	-	-	-	-	-	-	0.044 (0.102)	-	-
	Number of universities in top 1000 per capita (log)	-	-	-	-	-	-	-	-0.419 (1.029)	-
Error correction term		Constant	1.811*** (0.535)	3.234*** (0.700)	7.275 (5.663)	1.739*** (0.570)	1.720*** (0.498)	1.485** (0.605)	1.829*** (0.536)	1.732*** (0.593)

*** p-value<0.01, ** p-value<0.05, * p-value<0.1. Values in parentheses are standard errors. Note: : Excludes Croatia due to insufficient number of observations; Excludes Bulgaria, Cyprus, Malta and Romania due to no data on unemployment rates amongst 25-35 year olds who have attained/completed tertiary education. *Source: London Economics' analysis*

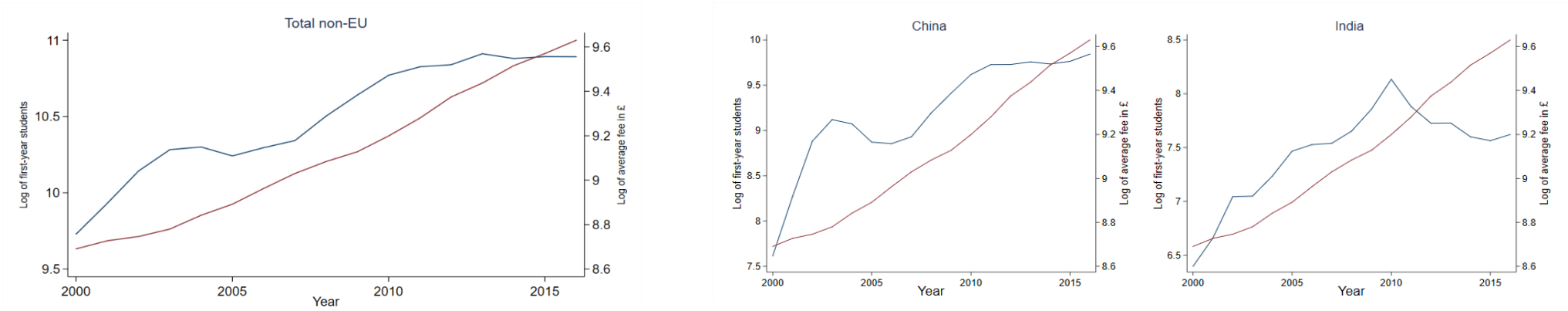
Annex 3 Detailed econometric results for non-EU students

A visual inspection of full-time first-year student enrolments from non-EU countries and average tuition fees over time suggests that, in general, student numbers have continued to increase despite an upward trend in fees, i.e. demand has been largely unresponsive to price increases. This is the case for both undergraduate and postgraduate enrolments.

Moreover, the underlying factors determining demand for HE from each non-EU country are vastly different.

For example, student numbers from China have steadily increased despite the removal of the post-study work visa scheme, whereas student numbers from India decreased in the same time period (and were also affected by a depreciation in the Indian Rupee).

Figure 27 Log value of first-year undergraduate students against log value of average fees in all non-EU countries, China and India (from left to right respectively), by year



Source: London Economics' analysis

Given the substantial differences across non-EU countries, a homogenous panel data model (across countries) is not suitable to estimate the price sensitivity of demand for HE.

We have undertaken extensive model testing using a wide range of panel data estimation techniques, such as (i) Fixed effects, (ii) Error correction and (iii) System GMM.

Model estimates for the price elasticity for undergraduate students are not stable and range from 0% to -6% - i.e. following a 10% increase in price, the decline in quantity demanded ranges between 0% and 60%. Typically, you would expect the price elasticity to lie between 0% and -1%.

Given an insufficient number of observations at a country level, a proposed alternative approach would be to conduct the non-EU analysis for the top 10 exporting countries[37] separately at HE institution level. That is, the dataset would contain students numbers from a given non-EU country enrolled at each HE institution over time. This would also capture price variation at the institution level.

[37] The top 10 exporting non-EU countries selected according to 2016 enrolments account for 71.1% of first-year students in 2016

Annex 4 Modelling the separate impacts of policy changes

The table below summarises the individual impact of each policy change on the average number of EU student enrolments and associated fee income per institution (by level and university cluster).

Table 24 Individual impact of each policy change – Average per HEI

Average EU student enrolments per institution	Total	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Baseline					
Undergraduate	210	320	260	190	150
Postgraduate	170	870	300	105	30
Total	**380**	**1,190**	**560**	**295**	**180**
Change in baseline after:					
Removal of fee support					
Undergraduate	-80	-35	-60	-90	-85
Postgraduate	0	0	0	0	0
Total	**-80**	**-35**	**-60**	**-90**	**-85**
Fee harmonisation					
Undergraduate	-70	-85	-115	-45	-40
Postgraduate	-50	-125	-95	-30	-10
Total	**-120**	**-210**	**-210**	**-75**	**-50**
Removal of right to work post-study					
Undergraduate	-40	-65	-50	-35	-30
Postgraduate	-30	-165	-55	-20	-5
Total	**-70**	**-230**	**-105**	**-55**	**-35**
Removal of right to bring dependants					
Undergraduate	0	-5	0	0	-5
Postgraduate	-5	-30	-5	-5	0
Total	**-5**	**-35**	**-5**	**-5**	**-5**

The table below summarises the individual impact of each policy change on the total number of EU student enrolments and associated fee income (by level and university cluster).

Table 25 Individual impact of each policy change – Aggregate

Average tuition fee income per institution	Total	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Baseline					
Undergraduate	£1.49m	£2.56m	£1.88m	£1.34m	£0.91m
Postgraduate	£1.17m	£8.03m	£2.22m	£0.57m	£0.14m
Total	**£2.66m**	**£10.67m**	**£4.10m**	**£1.92m**	**£1.06m**
Change in baseline after:					
Removal of fee support					
Undergraduate	-£0.49m	-£0.27m	-£0.44m	-£0.54m	-£0.49m
Postgraduate	£0.00m	£0.00m	£0.00m	£0.00m	£0.00m
Total	**-£0.49m**	**-£0.27m**	**-£0.44m**	**-£0.54m**	**-£0.49m**
Fee harmonisation					
Undergraduate	£0.31m	£2.66m	£0.60m	£0.13m	£0.02m
Postgraduate	£0.44m	£5.07m	£0.87m	£0.16m	£0.02m
Total	**£0.75m**	**£7.73m**	**£1.47m**	**£0.29m**	**£0.05m**
Removal of right to work post-study					
Undergraduate	-£0.29m	-£0.51m	-£0.36m	-£0.26m	-£0.18m
Postgraduate	-£0.21m	-£1.48m	-£0.41m	-£0.11m	-£0.03m
Total	**-£0.50m**	**-£1.98m**	**-£0.77m**	**-£0.36m**	**-£0.20m**
Removal of right to bring dependants					
Undergraduate	-£0.02m	-£0.03m	-£0.02m	-£0.02m	-£0.01m
Postgraduate	-£0.04m	-£0.26m	-£0.07m	-£0.02m	-£0.0m
Total	**-£0.05m**	**-£0.29m**	**-£0.09m**	**-£0.03m**	**-£0.01m**

Annex 5 University Clusters

Table 26 List of UK HEIs and the cluster to which they are assigned

Rank	Higher education institution	Baseline	'Strong impact' scenario	'Weak impact' scenario	Equal distribution scenario
1	The University of Cambridge	Cluster 1	Cluster 1	Cluster 1	Cluster 1
2	The University of Oxford	Cluster 1	Cluster 1	Cluster 1	Cluster 1
3	Imperial College of Science, Technology and Medicine	Cluster 2	Cluster 2	Cluster 1	Cluster 1
4	London School of Economics and Political Science	Cluster 2	Cluster 2	Cluster 1	Cluster 1
5	University of Durham	Cluster 2	Cluster 2	Cluster 1	Cluster 1
6	University College London	Cluster 2	Cluster 2	Cluster 1	Cluster 1
7	The University of St Andrews	Cluster 2	Cluster 2	Cluster 1	Cluster 1

8	The University of Bristol	Cluster 2	Cluster 2	Cluster 2	Cluster 1
9	The University of Bath	Cluster 2	Cluster 2	Cluster 2	Cluster 1
10	The University of Warwick	Cluster 2	Cluster 2	Cluster 2	Cluster 1
11	The University of Edinburgh	Cluster 2	Cluster 2	Cluster 2	Cluster 1
12	Courtauld Institute of Art	Cluster 2	Cluster 2	Cluster 2	Cluster 1
13	King's College London	Cluster 2	Cluster 2	Cluster 2	Cluster 1
14	The University of Exeter	Cluster 2	Cluster 2	Cluster 2	Cluster 1
15	The University of Sheffield	Cluster 2	Cluster 2	Cluster 2	Cluster 1
16	University of Nottingham	Cluster 2	Cluster 2	Cluster 2	Cluster 1
17	The University of Birmingham	Cluster 2	Cluster 2	Cluster 2	Cluster 2
18	The University of York	Cluster 2	Cluster 2	Cluster 2	Cluster 2
19	Glasgow School of Art	Cluster 2	Cluster 2	Cluster 2	Cluster 2

20	The University of Leeds	Cluster 2	Cluster 2	Cluster 2	Cluster 2
21	The University of Lancaster	Cluster 2	Cluster 2	Cluster 2	Cluster 2
22	The University of Manchester	Cluster 2	Cluster 2	Cluster 2	Cluster 2
23	The Royal Veterinary College	Cluster 2	Cluster 2	Cluster 2	Cluster 2
24	The University of Southampton	Cluster 2	Cluster 2	Cluster 2	Cluster 2
25	University of Newcastle-upon-Tyne	Cluster 2	Cluster 2	Cluster 2	Cluster 2
26	St George's, University of London	Cluster 2	Cluster 2	Cluster 2	Cluster 2
27	The University College of Osteopathy	Cluster 2	Cluster 2	Cluster 2	Cluster 2

28	The Institute of Cancer Research	Cluster 2	Cluster 2	Cluster 2	Cluster 2
29	Cranfield University	Cluster 2	Cluster 2	Cluster 2	Cluster 2
30	Liverpool School of Tropical Medicine	Cluster 2	Cluster 2	Cluster 2	Cluster 2
31	London School of Hygiene and Tropical Medicine	Cluster 2	Cluster 2	Cluster 2	Cluster 2
32	Royal College of Art	Cluster 2	Cluster 2	Cluster 2	Cluster 2
33	SRUC	Cluster 2	Cluster 2	Cluster 2	Cluster 2
34	The University of Glasgow	Cluster 2	Cluster 2	Cluster 2	Cluster 2
35	Queen Mary University of London	Cluster 2	Cluster 2	Cluster 2	Cluster 2

36	Cardiff University	Cluster 2	Cluster 2	Cluster 2	Cluster 2
37	The School of Oriental and African Studies	Cluster 2	Cluster 2	Cluster 2	Cluster 2
38	The University of Liverpool	Cluster 2	Cluster 2	Cluster 2	Cluster 2
39	The University of Surrey	Cluster 2	Cluster 2	Cluster 2	Cluster 2
40	The Queen's University of Belfast	Cluster 2	Cluster 2	Cluster 2	Cluster 2
41	Loughborough University	Cluster 2	Cluster 2	Cluster 2	Cluster 2
42	The University of Sussex	Cluster 2	Cluster 2	Cluster 2	Cluster 2
43	The University of East Anglia	Cluster 2	Cluster 2	Cluster 2	Cluster 2
44	Royal Holloway and Bedford New College	Cluster 2	Cluster 2	Cluster 2	Cluster 2
45	The University of Leicester	Cluster 2	Cluster 2	Cluster 2	Cluster 2

46	The University of Reading	Cluster 2	Cluster 2	Cluster 2	Cluster 2
47	Royal Conservatoire of Scotland	Cluster 2	Cluster 2	Cluster 2	Cluster 2
48	The University of Strathclyde	Cluster 2	Cluster 2	Cluster 2	Cluster 2
49	The University of Aberdeen	Cluster 2	Cluster 2	Cluster 2	Cluster 2
50	Royal Academy of Music	Cluster 2	Cluster 2	Cluster 2	Cluster 3
51	Heriot-Watt University	Cluster 2	Cluster 2	Cluster 2	Cluster 3
52	Royal College of Music	Cluster 2	Cluster 2	Cluster 2	Cluster 3
53	Guildhall School of Music and Drama	Cluster 2	Cluster 2	Cluster 2	Cluster 3
54	Goldsmiths College	Cluster 2	Cluster 3	Cluster 2	Cluster 3
55	The Royal Central School of Speech and Drama	Cluster 2	Cluster 3	Cluster 2	Cluster 3
56	The University of Kent	Cluster 2	Cluster 3	Cluster 2	Cluster 3

57	The University of Dundee	Cluster 2	Cluster 3	Cluster 2	Cluster 3
58	The University of Buckingham	Cluster 2	Cluster 3	Cluster 2	Cluster 3
59	The City University	Cluster 3	Cluster 3	Cluster 2	Cluster 3
60	Aston University	Cluster 3	Cluster 3	Cluster 2	Cluster 3
61	Royal Northern College of Music	Cluster 3	Cluster 3	Cluster 2	Cluster 3
62	The Robert Gordon University	Cluster 3	Cluster 3	Cluster 2	Cluster 3
63	The University of Keele	Cluster 3	Cluster 3	Cluster 2	Cluster 3
64	Trinity Laban Conservatoire of Music and Dance	Cluster 3	Cluster 3	Cluster 3	Cluster 3
65	Brunel University London	Cluster 3	Cluster 3	Cluster 3	Cluster 3
66	Conservatoire for Dance and Drama	Cluster 3	Cluster 3	Cluster 3	Cluster 3
67	University of the Arts, London	Cluster 3	Cluster 3	Cluster 3	Cluster 3

68	Oxford Brookes University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
69	Leeds Arts University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
70	University of Abertay Dundee	Cluster 3	Cluster 3	Cluster 3	Cluster 3
71	The University of Stirling	Cluster 3	Cluster 3	Cluster 3	Cluster 3
72	Rose Bruford College of Theatre and Performance	Cluster 3	Cluster 3	Cluster 3	Cluster 3
73	Swansea University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
74	The Arts University Bournemouth	Cluster 3	Cluster 3	Cluster 3	Cluster 3
75	Falmouth University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
76	Heythrop College	Cluster 3	Cluster 3	Cluster 3	Cluster 3
77	Norwich University of the Arts	Cluster 3	Cluster 3	Cluster 3	Cluster 3
78	University of Ulster	Cluster 3	Cluster 3	Cluster 3	Cluster 3

79	The University of Brighton	Cluster 3	Cluster 3	Cluster 3	Cluster 3
80	The University of Essex	Cluster 3	Cluster 3	Cluster 3	Cluster 3
81	Edinburgh Napier University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
82	The University of Hull	Cluster 3	Cluster 3	Cluster 3	Cluster 3
83	The Liverpool Institute for Performing Arts	Cluster 3	Cluster 3	Cluster 3	Cluster 3
84	Bournemouth University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
85	University of Northumbria at Newcastle	Cluster 3	Cluster 3	Cluster 3	Cluster 3
86	The University of Lincoln	Cluster 3	Cluster 3	Cluster 3	Cluster 3
87	Aberystwyth University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
88	Bath Spa University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
89	The Nottingham Trent University	Cluster 3	Cluster 3	Cluster 3	Cluster 3

90	Royal Agricultural University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
91	Glasgow Caledonian University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
92	Harper Adams University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
93	University of Plymouth	Cluster 3	Cluster 3	Cluster 3	Cluster 3
94	The University of Westminster	Cluster 3	Cluster 3	Cluster 3	Cluster 3
95	The Manchester Metropolitan University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
96	Bangor University	Cluster 3	Cluster 3	Cluster 3	Cluster 3
97	Ravensbourne	Cluster 3	Cluster 3	Cluster 3	Cluster 3
98	The University of Portsmouth	Cluster 3	Cluster 3	Cluster 3	Cluster 3
99	The National Film and Television School	Cluster 3	Cluster 3	Cluster 3	Cluster 4
100	London Business School	Cluster 3	Cluster 3	Cluster 3	Cluster 4

101	University of London (Institutes and activities)	Cluster 3	Cluster 3	Cluster 3	Cluster 4
102	University of the West of England, Bristol	Cluster 3	Cluster 3	Cluster 3	Cluster 4
103	The University of Winchester	Cluster 3	Cluster 3	Cluster 3	Cluster 4
104	Sheffield Hallam University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
105	The University of Salford	Cluster 3	Cluster 3	Cluster 3	Cluster 4
106	University of Chester	Cluster 3	Cluster 3	Cluster 3	Cluster 4
107	University of South Wales	Cluster 3	Cluster 3	Cluster 3	Cluster 4
108	Queen Margaret University, Edinburgh	Cluster 3	Cluster 3	Cluster 3	Cluster 4
109	The University of Bradford	Cluster 3	Cluster 3	Cluster 3	Cluster 4
110	Liverpool John Moores University	Cluster 3	Cluster 3	Cluster 3	Cluster 4

111	University of Gloucestershire	Cluster 3	Cluster 3	Cluster 3	Cluster 4
112	The University of Huddersfield	Cluster 3	Cluster 3	Cluster 3	Cluster 4
113	The University of Central Lancashire	Cluster 3	Cluster 3	Cluster 3	Cluster 4
114	University of Hertfordshire	Cluster 3	Cluster 3	Cluster 3	Cluster 4
115	The University of the West of Scotland	Cluster 3	Cluster 3	Cluster 3	Cluster 4
116	The University of Greenwich	Cluster 3	Cluster 3	Cluster 3	Cluster 4
117	Kingston University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
118	University of Worcester	Cluster 3	Cluster 3	Cluster 3	Cluster 4
119	University for the Creative Arts	Cluster 3	Cluster 3	Cluster 3	Cluster 4
120	Roehampton University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
121	The Open University	Cluster 3	Cluster 3	Cluster 3	Cluster 4

122	De Montfort University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
123	Coventry University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
124	The University of Chichester	Cluster 3	Cluster 3	Cluster 3	Cluster 4
125	The University of Sunderland	Cluster 3	Cluster 3	Cluster 3	Cluster 4
126	Newman University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
127	Birmingham City University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
128	Cardiff Metropolitan University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
129	Canterbury Christ Church University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
130	Leeds Beckett University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
131	Birkbeck College	Cluster 3	Cluster 3	Cluster 3	Cluster 4
132	University of Derby	Cluster 3	Cluster 3	Cluster 3	Cluster 4
133	The University of Northampton	Cluster 3	Cluster 3	Cluster 3	Cluster 4

134	Middlesex University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
135	Teesside University	Cluster 3	Cluster 3	Cluster 3	Cluster 4
136	Staffordshire University	Cluster 3	Cluster 4	Cluster 3	Cluster 4
137	The University of West London	Cluster 3	Cluster 4	Cluster 3	Cluster 4
138	London South Bank University	Cluster 3	Cluster 4	Cluster 3	Cluster 4
139	University of the Highlands and Islands	Cluster 3	Cluster 4	Cluster 3	Cluster 4
140	University of Bedfordshire	Cluster 3	Cluster 4	Cluster 3	Cluster 4
141	St Mary's University, Twickenham	Cluster 4	Cluster 4	Cluster 3	Cluster 4
142	Edge Hill University	Cluster 4	Cluster 4	Cluster 3	Cluster 4
143	York St John University	Cluster 4	Cluster 4	Cluster 3	Cluster 4
144	Bishop Grosseteste University	Cluster 4	Cluster 4	Cluster 3	Cluster 4

145	Liverpool Hope University	Cluster 4	Cluster 4	Cluster 3	Cluster 4
146	Leeds Trinity University	Cluster 4	Cluster 4	Cluster 4	Cluster 4
147	University of Suffolk	Cluster 4	Cluster 4	Cluster 4	Cluster 4
148	Writtle University College	Cluster 4	Cluster 4	Cluster 4	Cluster 4
149	University of Wales Trinity Saint David	Cluster 4	Cluster 4	Cluster 4	Cluster 4
150	Anglia Ruskin University	Cluster 4	Cluster 4	Cluster 4	Cluster 4
151	Plymouth College of Art	Cluster 4	Cluster 4	Cluster 4	Cluster 4
152	University of Cumbria	Cluster 4	Cluster 4	Cluster 4	Cluster 4
153	Southampton Solent University	Cluster 4	Cluster 4	Cluster 4	Cluster 4
154	Buckinghamshire New University	Cluster 4	Cluster 4	Cluster 4	Cluster 4

155	University of St Mark and St John	Cluster 4	Cluster 4	Cluster 4	Cluster 4
156	Glyndŵr University	Cluster 4	Cluster 4	Cluster 4	Cluster 4
157	The University of East London	Cluster 4	Cluster 4	Cluster 4	Cluster 4
158	The University of Bolton	Cluster 4	Cluster 4	Cluster 4	Cluster 4
159	London Metropolitan University	Cluster 4	Cluster 4	Cluster 4	Cluster 4
160	The University of Wolverhampton	Cluster 4	Cluster 4	Cluster 4	Cluster 4
161	University College Birmingham	Cluster 4	Cluster 4	Cluster 4	Cluster 4
	St Mary's University College	Unassigned	Unassigned	Unassigned	Unassigned
	Stranmillis University College	Unassigned	Unassigned	Unassigned	Unassigned
	Gower College Swansea	Unassigned	Unassigned	Unassigned	Unassigned
	Grŵp Llandrillo Menai	Unassigned	Unassigned	Unassigned	Unassigned

	Grŵp NPTC Group	Unassigned	Unassigned	Unassigned	Unassigned
	The University of Wales (central functions)	Unassigned	Unassigned	Unassigned	Unassigned

Note: Out of a total of 170 HEIs active in 2016/17 (based on HESA data), 6 (at the bottom of the list) are not assigned to a cluster and are excluded from the analysis. However, these 6 institutions only accounted for approximately 10 EU student enrolments in 2016/17 (out of a total of 62,805, i.e. 0.016%) and hence, the analysis is largely unaffected by their exclusion.

Source: London Economics' analysis, Department for Education, Boliver (2015)

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