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Ronald B. Davies, Lena S. Specht

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Brexit and Foreign Students in Gravity

Abstract

This paper examines the impact of Brexit on international student migration. In a structural gravity model, we estimate student migration between 69 countries for counterfactual scenarios in which the United Kingdom leaves the European Union one year before the referendum. This exercise reveals a decrease in exchange students studying in the UK of around 3.8% to 4.9%. While the number of non-EU students to the UK rises, a drop in EU student numbers drives this result. Similarly, 30% to 38% fewer UK students choose to study abroad. The estimated changes in international student stocks show that most other member countries lose international students and non-EU countries host more than without Brexit. Our findings provide evidence that there may be hidden costs to Brexit affecting global student exchanges that we have yet to see.

JEL-Codes: F220, I280, J110.

Keywords: international migration, international students, gravity model, Brexit.

Ronald B. Davies
University College Dublin / Ireland
ronald.davies@ucd.ie

Lena S. Specht
University College Dublin / Ireland
lenasspecht@gmail.com

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1 Introduction

Since the Brexit referendum in 2016, European international students and migrants have faced uncertainties about their ability to stay in the United Kingdom. On 31st January 2020, the UK officially left the European Union. With the end of the transition period on 1st January 2021, incoming students now have to apply for a study visa if they intend to stay for longer than six months. EU students without settled or pre-settled status have to pay the same amount of tuition fees as other international students. Additionally, when staying longer than six months, EU students are required to pay the Immigration Health Surcharge of €500 or more depending on their visa type.[1] Naturally, this presents an additional burden for EU students looking to study in the UK, one which likely reduced student exchanges. The goal of this paper is to estimate the impact of Brexit on student exchanges in a structural gravity general equilibrium framework.

The need to do so in a general equilibrium framework is clear since, if EU students choose study abroad options other than the UK, this can crowd out exchanges to these alternative locations. Likewise, if UK classroom places are vacated by EU students, this creates opportunities for others to take their place. Further, using a structural gravity approach is useful because of anticipatory effects. Even before formal Brexit, EU students began to avoid the UK due to anticipated future barriers and a rise in uncertainty (Amuedo-Dorantes and Romiti, 2021). These anticipatory changes make structural modelling and its use of counterfactual estimates a useful methodology for estimating the impact of actual Brexit. Further, as this uses data prior to the COVID-19 pandemic – which largely coincided with formal Brexit and nearly shut down student exchanges (Di Pietro, 2023) – it provides a better estimation of the impact on student flows during "normal" times.

Generally, freedom of movement agreements are found to stimulate migration within the union (e.g. Abbott and Silles (2016); Beine et al. (2019)). Specifically, there are studies that focus on the impact of Brexit on immigration. Examining the

[1] Information on this can be found here: `https://www.gov.uk/healthcare-immigration-application/how-much-pay`.

determinants of migration to the UK, Forte and Portes (2017b) argue that Brexit will decrease immigration from European Economic Area (EEA) members. This stems from their finding that freedom of movement is associated with an increase in immigration by around 500%. In line with this result, Portes and Springford (2023) find a reduction in immigration to the UK compared with counterfactual pre-Brexit or pre-pandemic trends. However, non-EU immigration is estimated to rise, a result similar to this paper's findings for international student migration. Forte and Portes (2017a) further forecast long-run GDP and GDP per capita outcomes imposing different reductions in immigration and estimates on its impact on GDP. They project that by 2030, GDP per capita is likely to fall by up to 5%. Thus, to the extent that (largely temporary) student migration via exchanges follow overall immigration patterns, one might expect a decline in EU students studying in the UK.

Focussing specifically on the work considering the impact of Brexit on international student migration, most use a difference-in-differences approach. Falkingham et al. (2021) leverage the triggering of Article 50 and the UK's subsequent legal action towards withdrawal as a natural experiment. Among the main findings is that EU students' intention to stay in the UK after their studies are less likely than non-EU students'. Falkingham et al. (2021) state several reasons that could lead to this result including increased entry barriers and a general uncertainty about their future in the country. Similarly, exploiting the Brexit referendum as a quasi-experiment, Amuedo-Dorantes and Romiti (2021) find that EU applications plummeted with the exit decision. In line with Falkingham et al. (2021), this is likely due to the uncertainty in the possibility of staying in the country long-term. Relative to these studies, our approach has two advantages. First, whereas they rely on changes during the transition period to formal Brexit, the counterfactual structural approach allows us to estimate the impact of "complete" Brexit. Second, our general equilibrium approach also permits us to estimate the impact on non-EU student migration to the UK, British students studying outside the UK, and how all of these changes affect student flows not directly involving the UK. Thus, our approach yields a more

nuanced understanding of the long-run impacts of Brexit.

Our estimates point to significant effects from Brexit. The extent of this depends on whether, in addition to losing freedom of movement with the European Economic Area (EEA) due to Brexit, the UK also ends its (currently standing) Common Travel Area (CTA) Agreement with Ireland.[2] Overall, we predict a drop in total students travelling to the UK of 3.8% to 4.9% with the higher number occurring when the CTA is also abandoned. This net drop is driven by a concurrent decrease in EU students in the UK of between 20% and 40% and an offsetting increase in non-EU students travelling to the UK. The net drop in outbound British students, however, is far more severe with an estimated decline of 30% to 38%. This is because of the importance of the EU as a nearby destination for outbound UK students.

Understanding these changes in student numbers is likely to have significant economic effects. In particular, there is a literature demonstrating a significant positive link between trade and student exchanges (e.g. Specht (2022) and Murat, 2014, 2018). While it may appear somewhat surprising that students can exert such influence, the work of Egger et al. (2014) suggests that the trade impacts of migration can reach their peak at fairly low numbers (4,000 immigrants by their estimates). Thus, despite their small numbers, students who study abroad and establish international networks may well have sizable effects on trade. Further, Egger et al. (2020) suggests that these networks are separate for skilled and unskilled workers. Therefore, one might expect that student exchanges promote trade in high-skill intensive goods. Beyond trade, student migration has been demonstrated to impact innovation (Chellaraj et al., 2008). Therefore, understanding the impact of Brexit on student exchanges is far more than an academic exercise.

This paper is related to several strands of the international trade and migration literature. More specifically, it borrows from Anderson's (2011) migration gravity model and applies methods commonly used in the international trade literature to student exchanges. We describe these theoretical underpinnings and econometric

[2]We include Switzerland as an EEA member because Switzerland and EU members signed the so-called "Agreement on the Free Movement of Person" that allows movement. For more details see `https://www.sem.admin.ch/sem/en/home/themen/fza_schweiz-eu-efta.html`.

methodology in more detail in the third section. To our knowledge, there are only few papers that apply this methodology to migration. Exceptions are Sirries (2016) and Campos and Timini (2019) (discussed below) who follow an approach comparable to ours. Nevertheless, due to its sound theoretical foundations and appropriateness to the issues, several studies in the international trade literature investigate the effects of Brexit on trade using structural estimation.

Dhingra et al. (2017) provides an extensive simulation of the impacts of Brexit and different counterfactual scenarios from the UK staying in the European Economic Area (EEA) to leaving it completely. Welfare losses due to the change in tariffs, non-tariff barriers and future EU disintegration for the UK range from 1.3% to 2.7%. Taking into account the indirect influence of foreign direct investment and immigration leads to even greater losses. Brakman et al. (2018) and Brakman et al. (2023) also find negative aggregate general equilibrium trade effects employing a structural gravity model that captures Brexit as a bilateral trade cost change. Indeed, most studies predict repercussions on the UK's trade (Baldwin, 2016).

More closely related to our topic is the Brexit-focused literature which includes immigration in their models. Jafari and Britz (2020) employ computable general equilibrium modeling to examine the impact of Brexit and find that a drop in EU migration to the UK of one million, which when combined to declines in the UK's capital stock exacerbates welfare declines. Using a similar methodology, Ortiz Valverde and Latorre (2020) find larger reductions in welfare than, for example Dhingra et al. (2017). Jafari and Britz (2020) argue that the differential welfare outcome depends on the scope of the model and the fact that capital stocks decline. However, including immigration effects contributes to a significant share of the welfare drop. Considering student immigrants as another temporary or potential future long-term labour source, one may deduce similar adverse comorbidities from reductions in their immigration. Further, Latorre et al. (2020) review the literature on Brexit and the UK economy and state that the size of the impact depends on the restrictiveness imposed in the model. The advantage of this paper is that at the time of writing the UK has already left the EU and the withdrawal period has ended. Thus, it is

possible to estimate a nearly 'realistic' scenario of constraints that apply to student migration between the EU and the UK.

Excepting Jafari and Britz (2020), however, these papers leave out the general equilibrium effects which are one of the fundamental features of international trade. Jafari and Britz (2020), meanwhile, imposes scenarios of increased barriers post-Brexit rather than estimating them as we do. To our knowledge, the only paper using a structural approach to estimating the effect of Brexit on immigration is Campos and Timini (2019) who find that immigration to the UK decreases by 25% while rising to other EU countries. Compared to the 3.8% to 4.9% drop in student immigration to the UK estimated in this paper, Campos and Timini's (2019) findings are considerably larger suggesting that visa restrictions matter more for other immigration reasons than to study. Thus, our results compliment theirs by focusing on a particular kind of migrant. An important feature of their results, however, is that general equilibrium estimates differ from their partial equilibrium counterparts. This is because, in general equilibrium, declines in EU migrants are somewhat offset by increases in non-EU migrants. A similar point is made by Sirries (2016) in his structural estimation analysis of the outcomes from a Turkish accession to the EU.

The paper proceeds as follows. Section 2 lays out the structural gravity model and the data. In Section 3, we present our findings for the partial and conditional general equilibrium focusing on the student outcomes for the UK. Section 4 concludes.

2 Econometric methodology and data

In this section, we lay down the theoretical foundations of employing structural gravity analysis on international student migration. Additionally, we describe the data.

2.1 Econometric model

We apply Anderson's (2011) structural gravity model of migration to international student migration. Then, a student's decision to migrate is a discrete choice based on the utility achieved from studying in a certain location. This utility comprises a benefit of studying in destination country d, b_d, iceberg-type costs of moving from origin country o to d, $m_{od} > 1$, and an individual h's idiosyncratic utility, ϵ_{odh}.[3] Compared with Anderson's (2011) model, the emigration benefit could be understood as the educational benefit of studying abroad rather than at home. Another interpretation as in Dotti et al. (2013) is that the benefit stems from anticipated future wages differences between the destination and home. However, focusing on the present benefit of studying abroad makes the model more tractable. Further, this interpretative difference does not change the adopted theoretical foundations of the model because the logarithmic utility only includes educational quality rather than wage at the destination or origin country.

A student chooses to study abroad if the cost-adjusted benefit of doing so is greater than that of studying at home, $(b_d/m_{od})\epsilon_{odh} \geq b_o$. Assuming a logarithmic utility, u_{od}, of student migration from o to d gives $u_{od} = \ln(b_d) - \ln(m_{od}) - \ln(b_o)$ and with the appropriate assumptions on $ln(\epsilon)$'s distribution, a random individual's migration choice probability is in multinomial logit form (McFadden, 1974). Thus, the number of international students, S_{od}, from origin o in destination d is given by

$$S_{od} = G(u_{od})N_o \tag{1}$$

with N_o as the size of the native student population from an origin country and $G(u_{od}) = \dfrac{exp(u_{od})}{\sum_k exp(u_{ok})}$ as the share of the origin population choosing destination d. By imposing market clearance, Anderson (2011) is able to obtain multilateral resistance terms. Adopting this approach to the tertiary education market for international students means defining total student supply from all origins o to equal

[3] Logged migration costs are zero when students study in o, $m_{oo} = 1$. This is in line with Sirries' (2016) structural migration model.

total student demand from all destinations d.[4] Finally, this leads to the student migration gravity model

$$S_{od} = \frac{N_d N_o}{N} \left(\frac{1/m_{od}}{\Omega_d W_o} \right) \tag{2}$$

with N_d as the size of the student population in the destination country and N as the global number of students.[5] Equation 2 shows a structural gravity model of student migration in which students migrate from origin country o to destination d. This student stock from o in d depends on both countries' population sizes relative to the rest of the world, bilateral migration costs and multilateral resistance terms. The greater the size of either or both countries, the greater migration between them. Similarly, the larger the cost to move abroad, the lower the number of students migrating. Moreover, the attractiveness of alternative destinations affects migration from o to d (Bertoli and Moraga, 2013). Following Anderson (2011) and paralleling Anderson and van Wincoop (2003), these multilateral resistances are given by

$$\Omega_d \equiv \left[\sum_o \frac{1/m_{od}}{W_o} \frac{N_o}{N} \right] \tag{3}$$

and

$$W_o \equiv \left[\sum_d \frac{1/m_{od}}{\Omega_d} \frac{N_d}{N} \right]. \tag{4}$$

Ω_d represents the inward and W_o outward multilateral resistance. Anderson (2011) describes these multilateral resistance terms as the buyers' and sellers' in-

[4] That is, while keeping the demand for students exogenous to the model. We feel that, at least in the short run, this is a reasonable assumption.

[5] Although S_{od} should be the gross flow of international students sticking to Anderson's (2011) notation, we use the stock of international students. The reason is that, to our knowledge, data on the gross flow of international students in this capacity is not available. According to Beine et al. (2016), variations of stocks (first differences) as a second-best option can lead to imprecise and negative values. This would give us net in- and outflows rather than the gross value of foreign student immigration and emigration for a certain time period. For example, let five students immigrate to the UK to study. At the same time, six students finish their studies and move back to their origin. The net immigration flow will then be negative rather than the actual gross immigration of five foreign students. For international students' typically short duration of stay, we therefore choose the stock of international students as a proxy for the gross flow (OECD, 2011). Thus, one can think of the stock of foreign students as a flow that completely depreciates once students graduate and inevitably, one which can span multiple time periods.

cidence of migration costs.[6] Figueiredo et al. (2016) provide further intuition and compare inward multilateral resistance to the destination country's immigration policy and outward multilateral resistance to the origin country's remoteness in order to emigrate to other countries, e.g. availability of train connections.[7]

Following recommendations by Santos Silva and Tenreyro (2006, 2011) and Beine et al. (2016), we use a Poisson pseudo-maximum-likelihood (PPML) estimator. Then, the estimation equation is

$$S_{odt} = exp[\beta_0 + \beta_1 EU_{odt} + \pi_{ot} + \chi_{dt} + \gamma_{od}] \times \eta_{odt} \tag{5}$$

with EU_{odt} as a dummy indicating whether a destination-origin-pair is a member of the European Union. Country-pairs with at least one country not being a member country have zero values for this variable. In the counterfactual experiment this variable becomes zero for all migration with the United Kingdom. Thus, students migrating from an EU or EFTA country to the UK will face higher costs to do so, e.g. applying for a visa additional to getting into college in the UK. An exception is between the United Kingdom and Ireland in the scenario when their Common Travel Area Agreement persists. This agreement allows migration between both countries and without visa restrictions. Furthermore, most EU students benefit from paying reduced tuition. π_{ot} and χ_{dt} are origin-year and destination-year fixed effects that control for multilateral resistance (Beine and Parsons, 2015; Ortega and Peri, 2013).[8] Following Anderson et al. (2018), we leverage the additive property of the PPML estimator and solve for the inward and outward multilateral resistance changes relative to a reference group's inward multilateral resistance (Anderson and

[6]The structural gravity framework in this paper is equivalent to Anderson's (2011) migration model when risk aversion is set to be 2.

[7]Neither Anderson's (2011) migration gravity model nor the translated student migration model applied in this paper include the countries' counterfactual international connectivity or political orientation. This only serves as further intuition about the mechanisms behind the results presented in this paper.

[8]Although originally introduced by Anderson and van Wincoop (2003), Ortega and Peri (2013) adapted the concept of multilateral resistance into a migration context and emphasise the importance of accounting for this effect to avoid estimation biases. The international trade literature employs a similar fixed effects approach to properly control for multilateral resistance (Fally, 2015; Olivero and Yotov, 2012).

van Wincoop, 2003; Anderson and Yotov, 2010; Yotov et al., 2016). The reference country in the following is Korea, both because it has relatively few missing observations (12%) and, due to its distance and cultural differences, should not be heavily affected by the experiment (Yotov et al., 2016). Let γ_{od} denote country-pair fixed effects to pick up bilateral distance, language, colonial history and other costs to migrating from o to d.[9] We employ Anderson and Yotov's (2016) two-step procedure to fill in missing values in the number of students to achieve a full set of bilateral migration costs. From regression (5), migration costs are

$$\hat{m}_{od}^{-1} = exp[\hat{\gamma}_{od} + \hat{\beta}_1 EU_{odt}] \tag{6}$$

the estimated country-pair fixed effects $\hat{\gamma}_{od}$ plus the costs of migrating within the EU. The EU_{odt} dummy separates baseline and counterfactual migration costs: migrating outside the EU adds any potential costs that stem from not participating in the freedom of movement agreement. In this exercise, we regard EU membership as a reciprocal arrangement. Entering the Union opens borders to both immigration and emigration between members. Thus, it enters the gravity equation as a bilateral migration cost. This is similar to Yotov et al.'s (2016) and Anderson and Yotov's (2016) approach to investigate the effects of regional trade agreements. We follow their approach closely and apply it to the removal of a freedom of movement agreement with Brexit.[10] Thus, to fill in missing bilateral migration costs, we regress the estimated country-pair fixed effects from Equation 5, $\hat{\gamma}_{od}$ on the bilateral gravity variables, distance, contiguity, language and colonial relationship. We use the estimated out-of sample predictions to complete the migration cost matrix.

[9] Migration costs are symmetric for computational ease and efficiency (Baier et al., 2019).

[10] Sirries (2016) applies a similar approach to this estimating conditional general equilibrium migration effects for Turkey entering the EU. The effect is also measured as a migration cost change that impacts the multilateral resistances.

$$exp(\hat{\gamma}_{od}) = exp[\alpha_0 + \alpha_1 ln(Distance)_{od} + \alpha_2 Contiguity_{od} + \alpha_3 Language_{od} + \alpha_4 Colony_{od}] \times \epsilon_{od} \quad (7)$$

The complete set of bilateral migration costs is then included as a constraint in the baseline and counterfactual regressions for the year 2015 (Anderson et al., 2018; Yotov et al., 2016). After obtaining student migration in the two scenarios, we compute the conditional general equilibrium effects as the percentage change in the number of students from baseline to Brexit and bootstrap the EU_{odt} estimates drawn in Equation 4 to construct confidence intervals around the effects (Anderson and Yotov, 2016; Baier et al., 2019; Larch and Wanner, 2017). The estimates are conditional general equilibrium effects according to Yotov et al. (2016) and assuming N_o and N_d to be exogenous.[11]

2.2 Data and descriptive statistics

We use aggregate panel data on inbound foreign student stocks by country of origin, destination country and observation year by UNESCO Institute for Statistics (UIS). These span over more than a hundred destination and origin countries but due to missing observations, the final balanced sample only includes 69 countries from 2003 to 2015.[12] To get a full symmetric sample in the main year (2015, and robustness

[11] Although this is a restriction to the scope of this analysis, this assumption is not implausible. Appendix Figure 2.13 shows that the total number of students between 2003 and 2019 disperses by at most 12%. In the year after the referendum, the number of total enrollment in the EU changes by less than one percent compared to the previous year (UNESCO Institute for Statistics , UIS). Indeed, total enrollment seems to be rather sticky than quickly evolving. A reason for this could be short-term capacity constraints in universities.

[12] Armenia, Aruba, Austria, Azerbaijan, Bahrain, Belgium, Benin, Bermuda, Bosnia and Herzegovina, Botswana, Brazil, Brunei, Bulgaria, Canada, Cape Verde, Chile, Colombia, Croatia, Czechia, Denmark, Dominican Republic, El Salvador, Estonia, Finland, France, Germany, Ghana, Honduras, Hungary, India, Ireland, Italy, Ivory Coast, Japan, Kazakhstan, Kyrgyzstan, Laos, Latvia, Lesotho, Malaysia, Mali, Malta, Mauritius, Moldova, Mongolia, Morocco, Namibia, New Zealand, Norway, Oman, Poland, Portugal, Qatar, Rwanda, Saint Lucia, Saudi Arabia, Slovakia, Slovenia, South Africa, South Korea, Sri Lanka, Sweden, Switzerland, Turkey, Ukraine, United Arab Emirates, United Kingdom, United States of America, Vietnam

year 2014) of analysis, we only include those country-pairs that have non-missing student observations in 2015 and 2014 and prefer countries that migrate with the United Kingdom.[13] This leaves in total 4,761 country-pairs. Still, there are pairs with missing values to other years within the 13-year time-frame. Country-pair fixed effects that cannot be derived from Equation 4 take the out-of-sample predicted migration costs estimated in Equation 6 to achieve a complete matrix of migration costs as in Anderson and Yotov (2016). This affects around 20% of all observations.

Similar to the trade literature, we include data on intra-national student migration, meaning the enrollment of students in their respective origin country (Yotov, 2012). To do so, we require data on not just the number of international students in foreign countries but also in their origin countries. We approximate this number by taking the total number of students enrolled and subtracting the number of foreign students from it. Data on total enrollment by destination country and year is again by UNESCO Institute for Statistics (UIS). Finally, bilateral gravity variables, distance, common official language and colonial relationship are retrieved from CEPII (Mayer and Zignago, 2011).

At the time of writing, UNESCO Institute for Statistics (UIS) does not provide data on international students in the United Kingdom beyond the year 2020. However, new migration rules and regulations with Brexit only applied after the end of the transition period on 1st January 2021. Therefore, we exploit regularly updated data by Higher Education Statistics Agency (2023, 2022, 2021) for descriptive purposes.[14] Figure 1a presents the total number of students from EU countries, while 1b plots the total stock of students from non-EU countries studying in the UK. As previously discussed, Brexit occurred almost simultaneously with the COVID-19 pandemic and therefore, a change in international student numbers in the UK in 2020 and after could be the result of either or both events.[15] Still, interestingly,

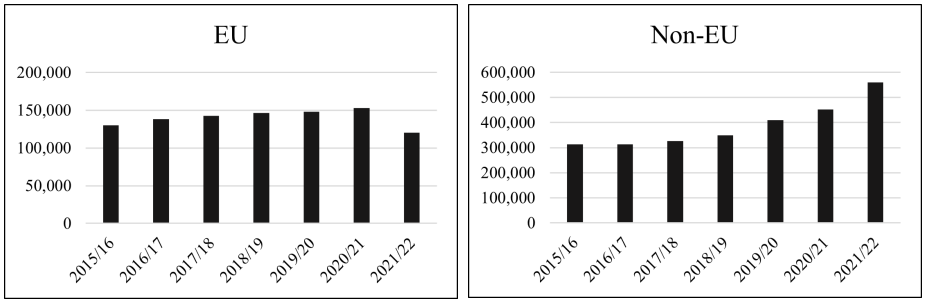
[13]For example, an origin country that has non-missing student values to a country other than the United Kingdom will be disregarded in favour of obtaining a balanced sample.

[14]These cover the academic years from 2015/16 to 2021/22. Whenever a more recent statistic is available, we prefer it over the older one.

[15]Note that the analysed 13-year time frame in this paper is well before the COVID-19 pandemic and therefore does not contain any impact it could have had on migration.

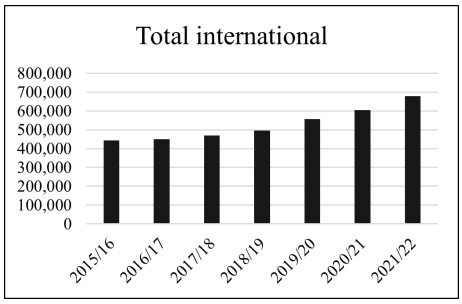
the number of non-EU international students in the UK increases by approximately 24% from 2020 to 2021 while the number of EU students drops by around 21%. Put together Figure 2a shows that the total international student stock in the UK rises by 12% in those years. In light of the pandemic, this is a surprising result and it seems that the rise in non-EU student numbers drives it. Moreover, more native students studied in the UK in 2021 than the year before (see Figure 2b).

In aggregate terms, the stock of students in the UK only slightly grew by 4%, presented in Figure 2c, further supporting the assumption that country-level total student stocks are sticky in the short-run. The fact that the increase in non-EU students studying compensates for the reduction in EU students in the UK supports the idea of student migration diversion due to Brexit. Similarly, the growth in the native student stock points to general equilibrium effects at play. In the following, we take these diversion effects into account when estimating the effects of Brexit on global student migration.

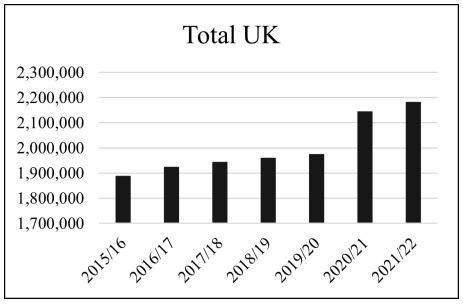


(a) Students from EU countries (b) Students from non-EU countries

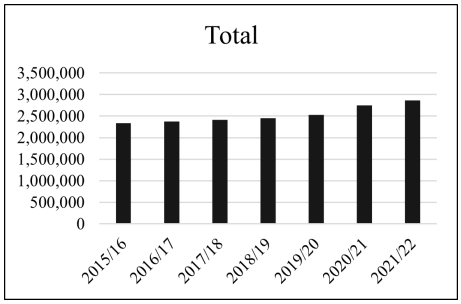
Figure 1: Number of students in the UK from academic year 2015/16 to 2021/22 by EU membership.



(a) International students



(b) Native students



(c) Total students

Figure 2: Number of international, native and total students in the UK from academic year 2015/16 to 2021/22.

3 Regression Analysis

The regression analysis starts with a partial equilibrium and then continues with the estimation of conditional general equilibrium effects. These are separated into student immigration by destination, student emigration by origin and by counterfactual scenario. The conditional general equilibrium model restricts the sample to the year 2015 while the partial equilibrium makes use of the whole panel from 2003 to 2015.

3.1 Partial equilibrium

The results to the estimating Equation 5 are shown in Table 1. The estimation sample spans over the whole 13-year time frame and full set of countries. Notice that the variable of interest varies over country-pair and time. During the sample period there were several countries that entered the European Union. However, due to data availability restrictions the sample time-frame does not include the first members'

entrances. Thus, the variation is limited to those countries joining after 2002. As expected, the coefficient on the EU_{odt} variable is significant and positive. Entering the European Union leads to an on average increase in international student immigration from EU countries by around 83%, *ceteris paribus*.[16,17] That is, controlling for destination-year, origin-year and country-pair fixed effects and thereby absorbing yearly country-level and bilateral variation including distance, contiguity, language and colonial relationship. We keep this estimate constant in the following conditional general equilibrium where it enters the analysis as part of the bilateral migration costs m_{od} (see $\hat{\beta}_1$ Equation 5 of Section 2.1).

Table 1: Partial equilibrium

	Students
EU_{odt}	0.603^{***}
	(0.211)
Constant	15.11^{***}
	(3.505)
N	38171
Destination-year FE	✓
Origin-year FE	✓
Country-pair FE	✓

Standard errors clustered by country-pair in parentheses * p<0.10, ** p<0.05, *** p<0.01.

[16] $[exp(0.603) - 1] \cdot 100\%$

[17] Although this seems large, it is comparable with other studies' findings. Abbott and Silles (2016) estimate a 118% rise using a smaller set of countries and a shorter time frame (from 2005 to 2011). They attribute a large portion of this impact to the European Erasmus programme which makes it considerably easier for students to spend semesters abroad. In actuality, the number of EU students in the UK after Brexit only fell by about 24% as portrayed in Figure 1a. This is, however, not accounting for any previous drop COVID-19 may have caused and includes all anticipatory migration from the referendum.

3.2 Conditional general equilibrium: Impact on student immigration by destination country

3.2.1 'Realistic' scenario: The United Kingdom leaves the EU and keeps CTA with Ireland

The 'realistic' counterfactual scenario is one in which the UK leaves the European Union and loses free movement rights within the European Economic Area but keeps a Common Travel Area with Ireland. It owes its name to its resemblance to the actual scenario that took place after Brexit.

We start by focusing on the conditional general equilibrium effects on student immigration meaning the percentage change in incoming foreign students by destination country. Compared with the partial equilibrium result, these stem from the change in bilateral migration costs plus the subsequent adjustment in the multilateral resistances. Thus, it enables countries not directly affected by the change in freedom of movement between the UK and the EU to be indirectly affected through diversion (Yotov et al., 2016). In this case, diversion could equate to students choosing an alternative destination to the UK and thereby increasing the number of incoming students to a third non-member country.

In the first counterfactual scenario, the UK and Ireland decide to keep their Common Travel Agreement and continue free movement even after Brexit. Figure 3 shows how this impacts student immigration globally.[18] Colours from yellow to red indicate negative outcomes while the darker the green, the higher the positive outcome. Appendix Table 2 lists the respective estimates and confidence intervals. Firstly, countries directly affected by the change in the agreement experience the highest percent reduction in incoming international student numbers with estimates ranging from -23.7% (Malta) to -0.8% (Austria). Secondly, the United Kingdom faces a statistically significant negative impact on student immigration by 3.9%. This is unsurprising since $\hat{\beta}_1$ as in Table (1) predicted a drop in immigration (or

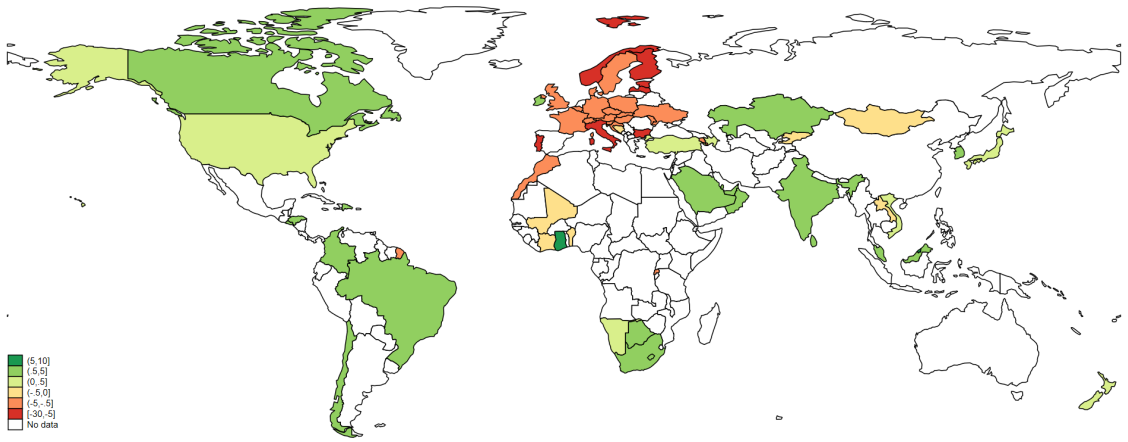
[18] All maps are made with Natural Earth. Free vector and raster map data are at `naturalearthdata.com`.

emigration) between European countries and the UK on average by 83%. However, the reduction in UK's inward multilateral resistance by around 12% mutes this drop significantly. Adopting Anderson's (2011) interpretation of this term as reflecting the incidence of migration costs suggests that buyers have to bear less of the burden than without Brexit. More intuitively, it means that on average, students immigrating to the UK in order to study have an easier time getting in than they used to, keeping the change in bilateral migration costs constant. An example for this is universities increasing funding available for international students making studying in the UK rather than elsewhere generally more attractive. In February 2022, the Welsh government initiated "Taith", a programme which promotes international student exchanges by providing funding to students.[19] Another example is reduced competition with other applicants. Amuedo-Dorantes and Romiti (2021) show that the Brexit referendum and its onset have shrunk EU student applications at UK universities by 7%. Holding all else constant, this makes an application more likely to be accepted, increaing the expected benefit relative to application costs. Thirdly, student immigration to Ireland and most non-EU countries rises. The reason for the first is that Ireland and the United Kingdom share a free movement agreement and therefore, the EU_{odt} variable remains one for migration between both countries in the baseline and counterfactual scenario. The reason for the latter is diversion effects. Some exceptions are Morocco and Armenia, countries relatively close to the European continent in terms of geographical distance.

Figure 2 shows the estimated changes in student immigration to the UK by origin country. With Brexit, the UK hosts 3.8% fewer international students than in the baseline scenario. This stems from a reduction in EU students between 20% and 40%. Again, this is with the exception of Ireland, which has a Common Travel Area with the UK in this 'realistic' counterfactual scenario. Irish student immigration to the UK increases by 7.7% (Appendix Table 3). This result stems from collateral changes in the multilateral resistances because Irish students are not directly affected

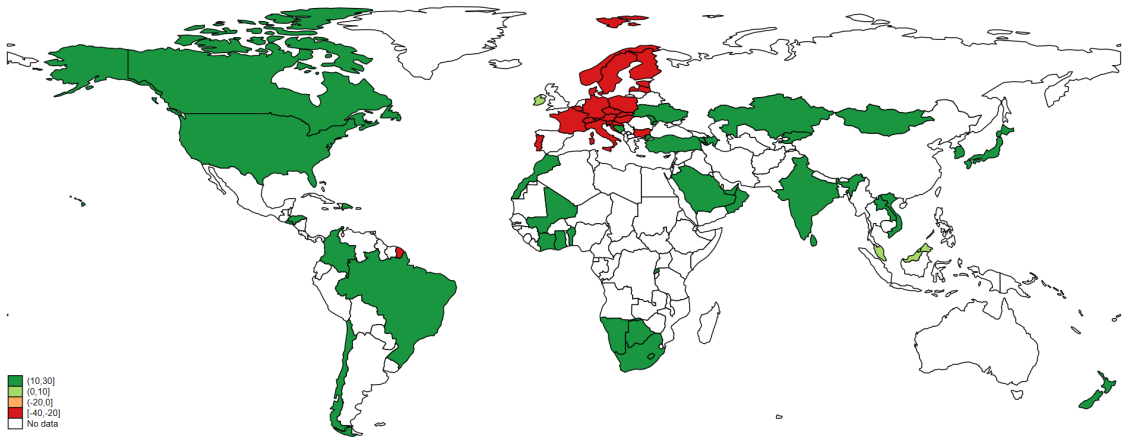
[19] Visit `https://www.taith.wales/` or `https://www.gov.wales/taith-international-learning-exchange-programme` for more details.

Figure 3: Conditional general equilibrium effect (% change in the number of incoming foreign students) with CTA by destination country. Red and orange coloured countries experience negative effects. Shades of green stand for positive effects.



by Brexit. Although an increase in Ireland's outward multilateral resistance (see Appendix Table 6) makes it overall more costly to study abroad, it has gotten relatively less costly to do so in the UK, which finally drives this positive result. Nevertheless, even with more students coming from non-EU countries and Ireland due to UK's favourable reduction in inward multilateral resistance, the overall effect on UK's student immigration remains negative.

Figure 4: Conditional general equilibrium effect (% change in the number of incoming foreign students) with CTA and UK as destination country. Red and orange coloured countries experience negative effects. Shades of green stand for positive effects.



3.2.2 Alternative scenario: The United Kingdom leaves the EU and CTA with Ireland

In this alternative scenario, the UK does not only leave the EU (and EEA) but also repeals its Common Travel Area agreement with Ireland. Figure 5 shows that this counterfactual scenario creates negative student immigration outcomes for the UK with the stock of international students reducing by 4.9% (Appendix Table 4). Although this estimate is not statistically significantly different from the estimate presented in the previous scenario, one can observe the shift in its distribution towards more negative results.

Contrary to the results given by the 'realistic' scenario, Ireland also experiences negative student number changes as large as 23%. Here, this is due to both a direct effect and an indirect effect. The bilateral migration costs of studying in Ireland as a British native without a free movement agreement in place directly rise with the CTA's abolition. Moreover, a rising inward multilateral resistance indicates a greater struggle for international students to study in Ireland. Interestingly, this estimate has reversed its sign between counterfactual scenarios: in the 'realistic' scenario, Ireland becomes a more desirable destination while in the alternative scenario it becomes overall less attractive for international students. Clearly, the one difference between both results is the CTA with the UK. This agreement seems to make Ireland an attainable alternative for British students to other EU countries improving its appeal as a destination country relative to other destinations. Moreover, with its removal Ireland's student immigration and inward multilateral resistance outcomes mirror those of other EU countries. Finally, the rest of the world faces similar student immigration as without the additional agreement.

Similar to the 'realistic' scenario, the number of EU students studying in the UK decreases between 20% and 40% (see Figure 6 and Appendix Table 3). However, without a Common Travel Area agreement, the number of Irish students studying in the UK drops by 31%. Indeed, the beneficial change in the UK's inward multilateral resistance cannot counteract the additional imposed bilateral migration cost.

Figure 5: Conditional general equilibrium effect (% change in the number of incoming foreign students) without CTA by destination country. Red and orange coloured countries experience negative effects. Shades of green stand for positive effects.

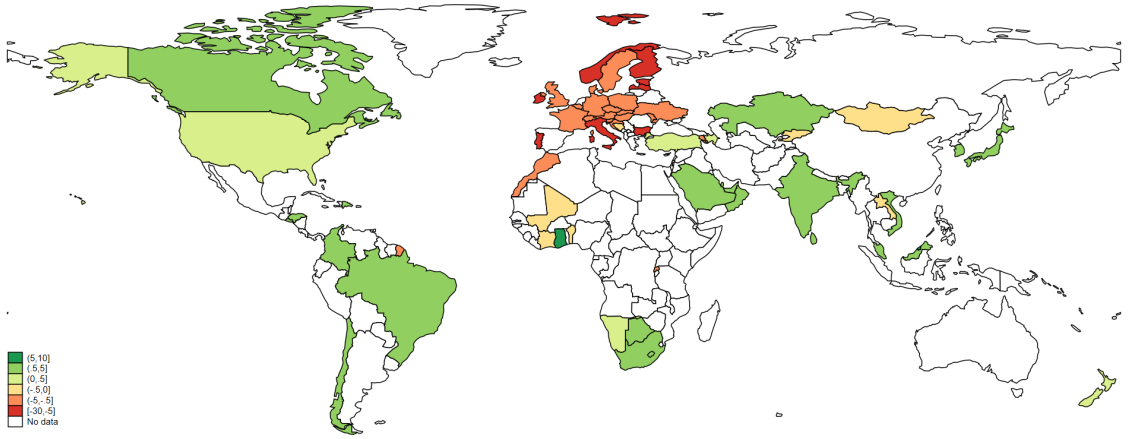
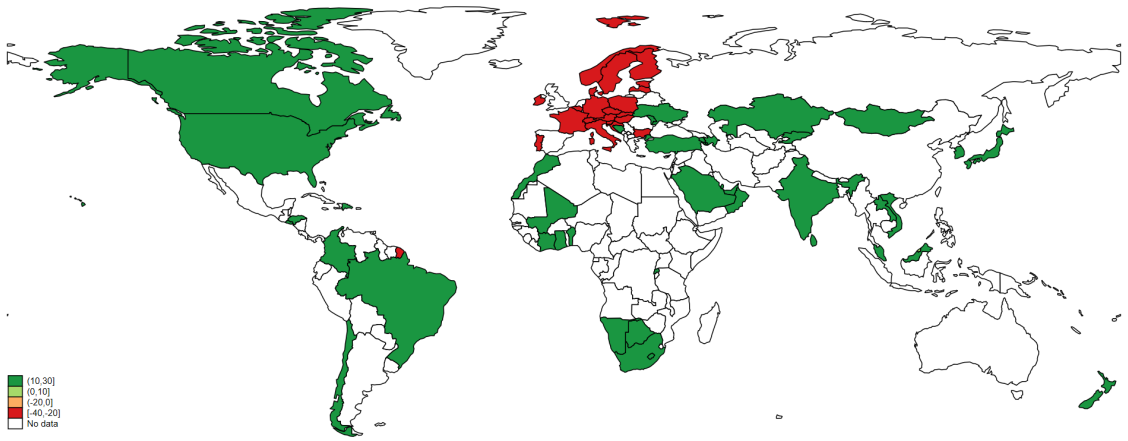


Figure 6: Conditional general equilibrium effect (% change in the number of incoming foreign students) without CTA and UK as destination country. Red coloured countries experience negative effects.



3.3 Conditional general equilibrium: Impact on student emigration by origin country

3.3.1 'Realistic' scenario: The United Kingdom leaves the EU and keeps CTA with Ireland

The conditional general equilibrium effects by origin country are the percent changes in the number of outgoing foreign students for every origin country. Thus, they are the percent changes in the number of student emigrants from a given origin country and show where international students come from. Figure 7 and Appendix Table 6 present these results. With Brexit, the UK experiences a reduction in student emigration by 30%. This is considerably smaller than the expected drop of 83% estimated in the partial equilibrium (Table 1). Nevertheless, an increase in the UK's outward multilateral resistance implies a rise in student emigration frictions. Following Anderson (2011), outward multilateral resistance reflects the sellers' incidence of migration costs. In other words, UK students wishing to emigrate in order to study are now met with higher costs of doing so. Examples for this are a decline in international travel connectivity or monetary means to afford emigration (Figueiredo et al., 2016). There exists evidence on the latter with several studies estimating UK's welfare to plummet due to Brexit (e.g. Dhingra et al. (2017); Jafari and Britz (2020)). Lower means could then contribute to less student emigration.

Analogous to the impact on student immigration, fewer EU students study abroad. Estimates range from -10% (Malta) to -0.27% (Slovakia) less student emigration than in the baseline scenario. Irish students, however, are an exception to this and emigrate more often than before. This is in line with the finding that more Irish students study in the UK with Brexit and a persisting Common Travel Area agreement (see Figure 4). The change in Ireland's outward multilateral resistance is positive, indicating elevated emigration barriers. At the same time, all other EU countries face lower student emigration resistances. The reason for this is not obvious, because EU students encounter higher bilateral migration costs when studying in the UK. Still, it implies that EU students have an advantage in studying abroad,

all else equal. This could be due to an ameliorated competitive or monetary position. Moreover, it lends further evidence why the drop in student immigration from EU countries to the UK is lower than in the partial equilibrium.

Turning to the destinations UK students choose for their studies, Figure 8 and Appendix Table 7 show that fewer British students study in all foreign countries including Ireland. Even with a Common Travel Area agreement in place, the number of British students who study in Ireland declines. In fact, with Brexit, the increased cost of emigration to study prevents them from doing so.

Figure 7: Conditional general equilibrium effect (% change in the number of outgoing foreign students) with CTA by origin country. Red, orange and yellow coloured countries experience negative effects. Shades of green stand for positive effects.

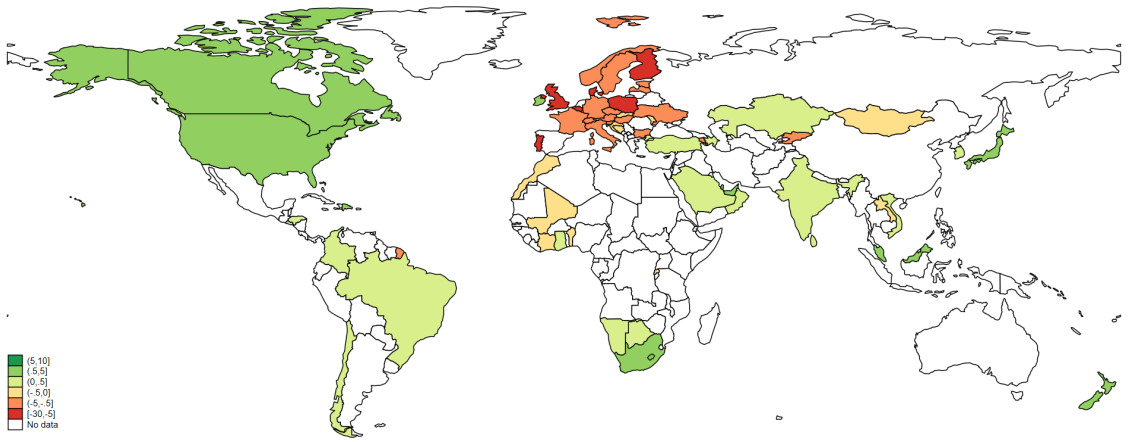
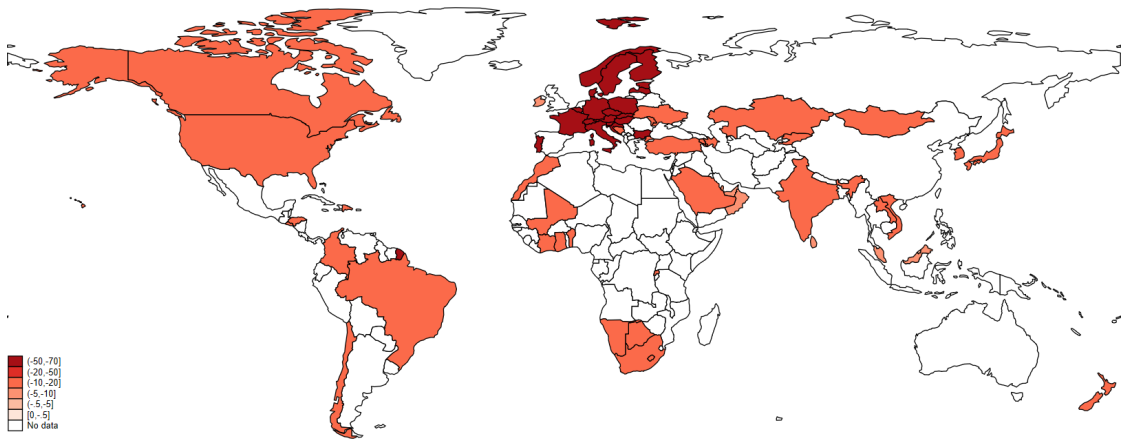


Figure 8: Conditional general equilibrium effect (% change in the number of outgoing foreign students) with CTA and UK as origin country. Red coloured countries experience negative effects.



3.3.2 Alternative scenario: The United Kingdom leaves the EU and CTA with Ireland

In line with the 'realistic' scenario, the model estimates UK student emigration to plummet due to Brexit. Figure 7 and Appendix Table 8 show the conditional general equilibrium effects by origin country. With 38% fewer British students studying abroad, this point estimate is greater than the -30% in the 'realistic' scenario, however, not statistically significantly so.

Without the Common Travel Area agreement between Ireland and the UK in place, Ireland faces comparable student emigration outcomes to other EU member countries: a decline in native students studying abroad by 18% and a significant reduction in its outward multilateral resistance. This change in the resistance term from more emigration frictions to less shows that Irish as well as other EU students have to endure lower costs to study in a country other than their origin. This then mitigates the increase in bilateral migration costs due to Brexit.

At the same time, fewer British students emigrate to study (see Figure 10 and Appendix Table 9). An increased outward multilateral resistance indicates higher resistance to emigration. This leads to fewer UK students studying in both, EU and non-EU countries.

Figure 9: Conditional general equilibrium effect (% change in the number of outgoing foreign students) without CTA by origin country. Red, orange and yellow coloured countries experience negative effects. Shades of green stand for positive effects.

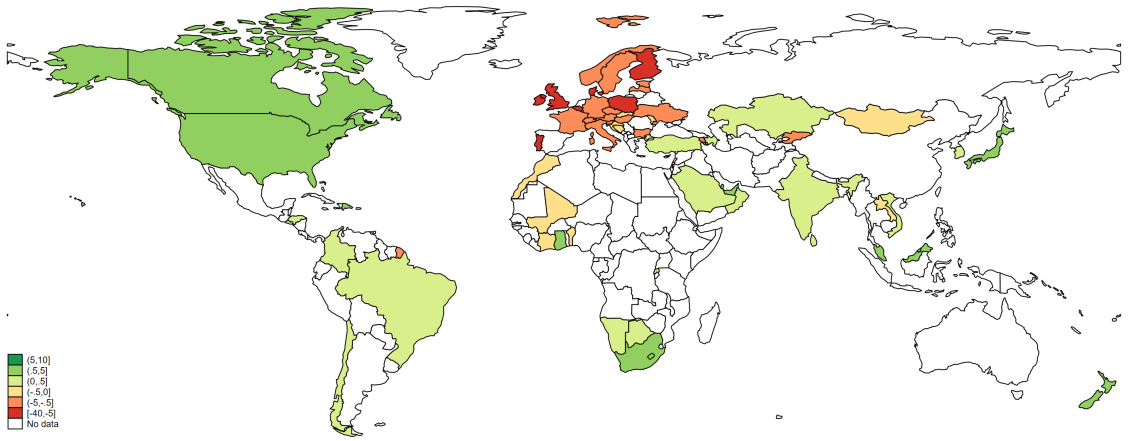
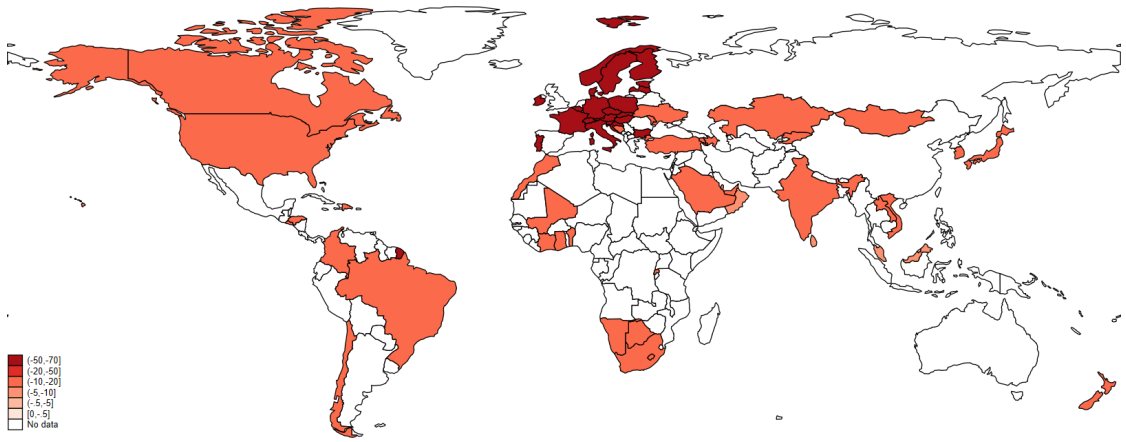


Figure 10: Conditional general equilibrium effect (% change in the number of incoming foreign students) without CTA and UK as origin country. Red coloured countries experience negative effects.



3.4 Robustness

In the following, we test the robustness of the conditional general equilibrium estimates. Due to the time frame in which student migration data are available by UNESCO Institute for Statistics (UIS) the analysis is based on EU enlargements starting in the early 2000s and inevitably excludes the UK's accession. One may expect that the impact of Eastern enlargement differs from that of the UK and that this distorts the partial equilibrium effect and therefore, the conditional general equilibrium outcome. To assess whether this is true we estimate both partial equilibrium and conditional general equilibrium with cross-sectional data for 2015.[20] Doing so, the estimating equation is

$$S_{od} = exp[\beta_1 EU_{od} + \pi_o + \chi_d + \beta_2 ln(Distance)_{od} + \beta_3 Language_{od} + \beta_4 Contiguity_{od} + \beta_5 Colony_{od} + \beta_6 Border_{od}] \times \eta_{od} \quad (8)$$

controlling for origin and destination country fixed effects and approximating bilateral migration costs including common language, contiguity, distance and colo-

[20] That is, using the same data sources for all characteristics described in Section 2 and applied in the baseline analysis.

nial relationship.[21] Moreover, our variable of interest is EU_{od} indicating whether both countries are EU members. This variable varies by country-pair and identifies the impact of migrating within the EU for all countries considered. This includes the UK and not only countries that joined the EU after 2000. As before, EU_{od}'s value changes for the UK and its partners in the counterfactual scenario. To account for differences in intra-national and international student migration we control for an international border dummy, $Border_{od}$, which equals one when destination and origin country are not identical.

Figures 11 and 12 show the point estimates to the 'realistic' scenario with 95% confidence interval bands for student immigration and emigration, respectively. The orange line denotes the cross-sectional analysis estimates for the year 2015.[22] With some exceptions, this line lies within the 95% confidence interval. To examine whether this result is idiosyncratic to the year analysed, in a second step, we estimate Equation 8 for the year 2014. In Figures 11 and 12, this is represented by the green line providing similar results.

Due to the United Kingdom's ties with its colonies and its national language, we interact the EU_{od} dummy with *Colony* (purple line) and *Language* (yellow line). Again, the point estimates seem visibly in line with previous results for the percent change in student immigration and emigration. One outlier which stands out, however, is Malta in Figure 12. Malta used to be a British colony and although the UK leaves the EU in this counterfactual scenario, these colonial ties seem to mitigate Maltese students' additional emigration costs due to the loss of free movement.

Further, to account for differences in the migration direction of students, we estimate the partial equilibrium model controlling for destination and origin EU membership additional to EU_{od} as shown by the following equation

[21] We borrow from Yotov et al.'s (2016) approach to examine the impact of abolishing borders.
[22] See Appendix Table 10 for point estimates.

$$S_{od} = exp[\beta_1 EU_{od} + \pi_o + \chi_d + \beta_2 ln(Distance)_{od} + \beta_3 Language_{od} + \beta_4 Contiguity_{od} + \beta_5 Colony_{od} + \beta_6 Border_{od} + \beta_7 EU_{d=1,o=0} + \beta_8 EU_{d=0,o=1}] \times \eta_{od} \quad (9)$$

with $EU_{d=1,o=0}$ indicating that a destination country is in the EU but not the student's origin and $EU_{d=0,o=1}$ presenting the opposite case. Thus, the baseline destination-origin-pair category is a combination of countries that are not EU members. The blue line in Figures 11 and 12 show the point estimates to the conditional general equilibrium student migration outcomes for immigration and emigration, respectively. Most of these point estimates lie within the 95% confidence interval providing evidence that the preferred specification as in Sections 3.2 and 3.3 are fairly robust to the migration direction.

Figure 11: Conditional general equilibrium effect (% change in the number of incoming foreign students). 'Realistic' Scenario. By destination country excluding Malta. Baseline estimates with 95% CI are black. Estimate and CI band in red shows the United Kingdom. Lines show the cross-section results.

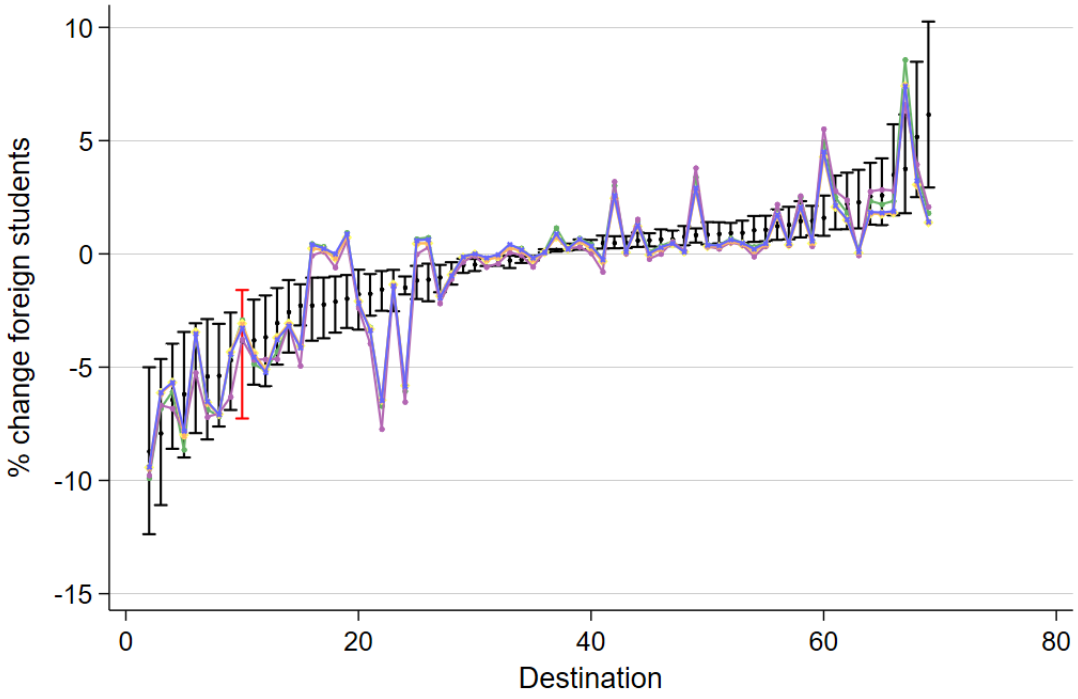
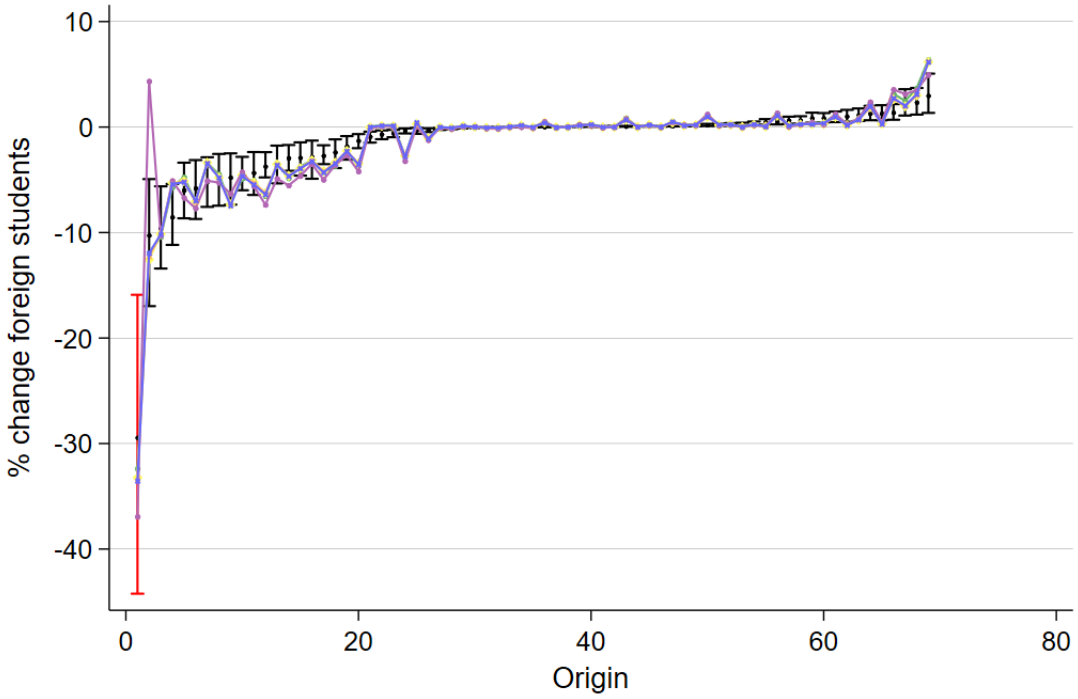


Figure 12: Conditional general equilibrium effect (% change in the number of outgoing foreign students). 'Realistic' Scenario. Baseline estimates with 95% CI are black. Estimate and CI band in red shows the United Kingdom. Lines show the cross-section results.



4 Conclusion

This paper attempts to quantify the impact of Brexit on global international student migration. Employing a structural gravity model of student migration based on Anderson's (2011) migration gravity model, we estimate conditional general equilibrium effects for two counterfactual experiments. First, in 2015, the year before the referendum, the UK leaves the European Economic Area but keeps a Common Travel Area with Ireland. Second, the UK retains membership and its free movement agreement with Ireland. The model estimates an approximately 3.8% to 4.9% reduction in foreign student immigration to the UK. This is in line with previous difference-in-differences estimates by Amuedo-Dorantes and Romiti (2021) who find a drop in international student applications with the referendum and Falkingham et al. (2021) who provide evidence for more EU students intending to leave the UK after their studies. Due to increasing outward multilateral resistance for the UK, leaving the country to study abroad becomes more competitive after leaving the European Union. Additionally our analysis shows important migration diversion effects underlying the net change. Finally, we estimated that emigration student numbers sink between 30% and 38%.

The implications of this study are twofold. First, the results suggest large losses for the UK in terms of foreign students due to Brexit. The effects of this isolation can be felt culturally, politically, and economically (Chellaraj et al., 2008; Specht, 2022). This suggests that policy-makers should take into account the importance of freedom of movement agreements in the migration decision of international students. Second, our analysis points to several ways in which future research can build upon Anderson's (2011) migration model. In particular, researchers who wish to model temporary migration (such as that for education reasons) in addition to permanent migration as is currently the focus.

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5 Appendix

5.1 Impact on student immigration by destination country

Table 2: Destination country with CTA

Country	%ΔStudents	95% CI	%ΔIMR	95% CI
ABW	.85187468	.41167018 ; 1.3640977	1.6165041	.78104252 ; 2.5931503
ARE	.75996756	.37529918 ; 1.1978748	-2.429994	-3.8533173 ; -1.1915631
ARM	-2.2054459	-3.6149231 ; -1.0289727	3.5189463	1.6467449 ; 5.7672593
AUT	-.79971217	-1.317428 ; -.36267548	7.9235571	3.6308524 ; 13.160173
AZE	.39979658	.20761294 ; .60451143	3.2072458	1.5070514 ; 5.2535088
BEL	-2.5371898	-4.2260985 ; -1.1370935	7.3042241	3.1486316 ; 12.567146
BEN	-.17985916	-.28101646 ; -.08940323	4.132012	1.9230165 ; 6.8028285
BGR	-6.1571453	-8.8277877 ; -3.4024508	10.997787	5.4797267 ; 17.195244
BHR	2.5723666	1.2518049 ; 4.1009829	-3.7174415	-5.8614876 ; -1.835935
BIH	-.27158417	-.59098599 ; -.07691004	6.3930972	3.035047 ; 10.336737
BMU	2.1461295	1.0641426 ; 3.3681605	-2.4408622	-3.8482873 ; -1.2041654
BRA	1.4630069	.81335382 ; 2.0850351	2.9283444	1.3824246 ; 4.7760173
BRN	6.1033287	2.8880677 ; 9.9524176	-8.1506113	-12.832186 ; -4.0339844
BWA	1.4482591	.71899579 ; 2.2683534	-1.6011841	-2.5088018 ; -.79557521
CAN	.65564211	.33561388 ; 1.0021243	.34435354	.17915013 ; .51786859
CHE	-1.5079981	-2.4628603 ; -.69415024	7.5544757	3.3752947 ; 12.731995
CHL	1.0717017	.54934866 ; 1.6427171	1.8335347	.85891534 ; 3.0053545
CIV	-.29458531	-.5150708 ; -.12537781	4.1481463	1.9197104 ; 6.8579952
COL	.92705861	.50890875 ; 1.343014	2.3916148	1.118974 ; 3.9231865
CPV	-1.9481767	-3.1758039 ; -.91895473	5.9892933	2.8678411 ; 9.6673107
CZE	-1.0206567	-1.646704 ; -.47869292	8.2438631	3.8973526 ; 13.42936
DEU	-3.7823817	-5.6499411 ; -1.9906434	7.9733112	3.7155595 ; 13.119993
DNK	-1.7454516	-3.2122376 ; -.68652232	7.3771935	3.3138404 ; 12.432546
DOM	.88618234	.45373173 ; 1.3616544	1.1078648	.57133165 ; 1.6920833
EST	-6.4167208	-8.5024381 ; -3.9210365	13.495962	7.0373839 ; 20.386003
FIN	-5.4321867	-7.7692892 ; -3.0221592	10.147629	4.986301 ; 16.046536
FRA	-3.6414713	-5.6938005 ; -1.8117929	7.7867696	3.6344555 ; 12.800432
GBR	-3.8153853	-6.9651126 ; -1.5697864	-11.992158	-18.85425 ; -5.9499737
GHA	5.1333311	2.4699855 ; 8.2444955	-1.555662	-2.3589159 ; -.80524014

HND	1.2824149	.63418745 ; 2.0227171	.86379006	.4272289 ; 1.3620311
HRV	-1.5476285	-2.4476892 ; -.74551023	7.9814241	3.7035356 ; 13.12923
HUN	-1.7359674	-2.6649407 ; -.87766574	7.909707	3.666834 ; 13.048131
IND	1.5915697	.78574348 ; 2.505257	-1.5880824	-2.4920628 ; -.78906445
IRL	3.7346811	1.7695485 ; 5.9924037	-5.4745203	-9.1087376 ; -2.5054539
ITA	-5.3522048	-7.4977338 ; -3.0485736	10.572574	5.2562948 ; 16.584289
JPN	.49738328	.25382628 ; .76354086	-.12827259	-.20382952 ; -.06241562
KAZ	.60951493	.32535643 ; .89464154	.91852836	.40273369 ; 1.5808869
KGZ	-.45722195	-.73524794 ; -.21969071	1.6667502	.77438669 ; 2.7523456
KOR	.64659746	.30645668 ; 1.0517642	0	0 ; 0
LAO	-.47392062	-.81215224 ; -.20964141	1.5982424	.7141305 ; 2.7137049
LCA	1.2236421	.61068467 ; 1.9106288	-.56739044	-.93382254 ; -.26486576
LKA	2.5309524	1.2751484 ; 3.9215753	-3.4557066	-5.3703889 ; -1.7370763
LSO	.48836327	.24346798 ; .76045288	-.30443731	-.4723306 ; -.1516758
LVA	-7.8878853	-10.917974 ; -4.5833933	12.647979	6.519864 ; 19.297693
MAR	-2.0772784	-3.3753577 ; -.97988529	6.4310552	2.995593 ; 10.579881
MDA	-1.1096709	-2.0162261 ; -.42264827	6.819098	3.2179052 ; 11.109704
MLI	-.2910996	-.50585589 ; -.12530998	4.3628828	2.021726 ; 7.2075155
MLT	-23.728308	-33.578204 ; -13.537467	28.003549	14.397486 ; 42.31688
MNG	-.24159191	-.38863252 ; -.11677151	1.4104845	.66559061 ; 2.3040271
MUS	.83861699	.49409568 ; 1.1165572	-1.7234158	-2.5371812 ; -.92347668
MYS	3.4713029	1.6782647 ; 5.5611768	-4.1915913	-6.6042816 ; -2.072942
NAM	.38394354	.18303132 ; .61774946	-.45021188	-.7043178 ; -.22398551
NOR	-8.6807445	-12.173876 ; -4.9408222	12.497389	6.3107676 ; 19.309388
NZL	.13047426	.06632807 ; .20085349	-.25748435	-.4544168 ; -.10816437
OMN	2.2728078	1.1095644 ; 3.6117833	-3.0981065	-4.8839459 ; -1.5306581
POL	-3.0212547	-4.7591651 ; -1.4881086	7.9552	3.6833158 ; 13.139016
PRT	-5.3708401	-8.0138492 ; -2.8383167	9.6615998	4.6956625 ; 15.413736
QAT	2.1957103	1.0734395 ; 3.4879623	-3.9874829	-6.2894698 ; -1.9684509
RWA	-1.1515121	-1.9306426 ; -.52168716	2.1935067	1.0110707 ; 3.6297576
SAU	1.0483253	.52332265 ; 1.6323862	-1.6275287	-2.5768278 ; -.79911103
SLV	.93515307	.48048442 ; 1.4314007	1.2861808	.62112163 ; 2.0631604
SVK	-1.480354	-1.7858927 ; -.98653933	8.836044	4.288797 ; 14.140778
SVN	-2.2640966	-3.1114152 ; -1.325001	9.9084148	4.8136098 ; 15.800328
SWE	-4.6601227	-6.757722 ; -2.5559379	9.3247309	4.4750731 ; 15.007071
TUR	.18670881	.11552912 ; .20906915	3.504771	1.6656817 ; 5.6969096

UKR	-2.2489382	-3.718051 ; -1.0332013	5.487521	2.5731962 ; 8.9812074
USA	.28783131	.14733307 ; .4410084	-.07161728	-.16764195 ; -.0128817
VNM	.48481337	.23177695 ; .785548	1.0697114	.47776186 ; 1.813459
ZAF	.59570095	.30299215 ; .91840033	-.60762055	-.97398865 ; -.29271764

Table 3: UK as destination country with CTA

Country	%ΔStudents	95% CI
ABW	16.714272	8.034436 ; 28.36236
ARE	11.524729	5.571836 ; 19.472462
ARM	19.212136	9.140033 ; 32.845791
AUT	-35.633936	-50.362554 ; -21.623421
AZE	18.798103	8.9582904 ; 32.113916
BEL	-36.001185	-50.604332 ; -22.013793
BEN	19.957704	9.4652763 ; 34.204744
BGR	-33.786067	-48.563082 ; -20.078077
BHR	10.026958	4.8426669 ; 16.958594
BIH	22.766028	10.808698 ; 38.929471
BMU	11.626211	5.6107028 ; 19.677214
BRA	18.450327	8.8084486 ; 31.469983
BRN	4.6033404	2.227595 ; 7.780609
BWA	12.823391	6.1808898 ; 21.721992
CAN	15.197266	7.3379681 ; 25.695254
CHE	-35.777929	-50.430919 ; -21.791161
CHL	17.089823	8.1771932 ; 29.098527
CIV	19.982327	9.4626506 ; 34.288171
COL	17.786537	8.4922316 ; 30.333186
CPV	22.260096	10.603421 ; 38.029549
CZE	-35.470003	-50.302468 ; -21.420632
DEU	-35.59249	-50.379695 ; -21.546519
DNK	-35.956041	-50.668463 ; -21.888832
DOM	16.165003	7.8209973 ; 27.297668
EST	-32.293643	-47.146024 ; -18.792074
FIN	-34.300391	-49.086188 ; -20.491709
FRA	-35.686958	-50.505463 ; -21.605233
GHA	12.886446	6.1711167 ; 21.936319
HND	15.873846	7.652329 ; 26.877563
HRV	-35.669105	-50.49709 ; -21.602164
HUN	-35.679879	-50.482498 ; -21.615211
IND	12.849613	6.1941703 ; 21.759599
IRL	7.6754675	3.9983877 ; 12.197675

ITA	-34.098392	-48.921216 ; -20.300711
JPN	14.64554	7.0631328 ; 24.790189
KAZ	15.96267	7.6297616 ; 27.212611
KGZ	16.903581	8.0842249 ; 28.798203
KOR	14.808259	7.1403315 ; 25.06791
LAO	16.816314	8.0087737 ; 28.746227
LCA	13.773256	6.6583771 ; 23.269706
LKA	10.550655	5.0581773 ; 17.949349
LSO	14.434626	6.9587019 ; 24.445713
LVA	-32.775963	-47.596755 ; -19.20475
MAR	22.828504	10.764598 ; 39.287492
MDA	23.292751	11.026222 ; 39.962018
MLI	20.248446	9.5852716 ; 34.755091
MLT	-23.010335	-36.183148 ; -12.262697
MNG	16.565515	7.9445203 ; 28.162508
MUS	12.689702	6.0308973 ; 21.72511
MYS	9.5979728	4.6356604 ; 16.23039
NAM	14.250695	6.8704676 ; 24.129517
NOR	-32.84682	-47.534363 ; -19.364015
NZL	14.465623	6.9994287 ; 24.42018
OMN	10.950957	5.2877381 ; 18.522225
POL	-35.666526	-50.459523 ; -21.608561
PRT	-34.575405	-49.346047 ; -20.723241
QAT	9.6306422	4.6520651 ; 16.286811
RWA	17.545569	8.3647624 ; 29.948616
SAU	12.793731	6.1789874 ; 21.634079
SLV	16.402049	7.8875815 ; 27.822333
SVK	-35.144632	-50.030771 ; -21.116072
SVN	-34.509176	-49.283886 ; -20.672797
SWE	-34.791267	-49.537229 ; -20.917148
TUR	19.164852	9.1482407 ; 32.702873
UKR	21.650355	10.2538 ; 37.13443
USA	14.706639	7.1193634 ; 24.820878
VNM	16.150017	7.7208702 ; 27.520861
ZAF	14.048811	6.7845063 ; 23.758028

Table 4: Destination country without CTA

Country	%ΔStudents	95% CI	%ΔIMR	95% CI
ABW	.81137602	.42344127 ; 1.2992915	1.6937744	.88699262 ; 2.7082405
ARE	.79613483	.42569834 ; 1.2512291	-2.5222505	-3.9861578 ; -1.3395624
ARM	-2.2783318	-3.7210761 ; -1.1560052	3.5456467	1.7990054 ; 5.8027189
AUT	-.80161439	-1.307686 ; -.3993146	8.0848305	4.023703 ; 13.414819
AZE	.44675042	.24896562 ; .67680016	3.1542867	1.6059089 ; 5.1592547
BEL	-2.5279003	-4.1659315 ; -1.2466928	7.4822438	3.5239897 ; 12.852315
BEN	-.18360699	-.28429625 ; -.09905473	4.2000741	2.1214539 ; 6.9010554
BGR	-6.1842175	-8.8099879 ; -3.6795484	11.053462	5.9606659 ; 17.22404
BHR	2.7529726	1.4521873 ; 4.3748134	-3.9419697	-6.188061 ; -2.1102062
BIH	-.28998124	-.6222615 ; -.09529136	6.5014415	3.3472701 ; 10.49017
BMU	2.3870734	1.2790761 ; 3.7398009	-2.6937915	-4.2270736 ; -1.4412641
BRA	1.4987449	.89185345 ; 2.1367253	2.9750406	1.5246361 ; 4.837241
BRN	6.9994558	3.6018342 ; 11.361334	-8.9399752	-13.965445 ; -4.8126971
BWA	1.4026009	.75246744 ; 2.1939977	-1.5439264	-2.4156154 ; -.82900308
CAN	.67311796	.37182841 ; 1.0274469	.43619912	.24289749 ; .65964491
CHE	-1.4988867	-2.4202308 ; -.75825574	7.6914037	3.7425318 ; 12.944093
CHL	1.1206907	.61831857 ; 1.7168336	1.8273366	.92786053 ; 2.990614
CIV	-.31812682	-.5522101 ; -.14889002	4.2248465	2.122395 ; 6.9724825
COL	.94920705	.55782543 ; 1.3751772	2.4182549	1.2275143 ; 3.9588965
CPV	-2.2069036	-3.543546 ; -1.147094	6.3361588	3.2984393 ; 10.174999
CZE	-1.0357507	-1.6587734 ; -.53051115	8.4295479	4.3148123 ; 13.723836
DEU	-3.8127196	-5.6508544 ; -2.1705412	8.149991	4.1178021 ; 13.400004
DNK	-1.7354937	-3.1576978 ; -.75934475	7.5254357	3.6759169 ; 12.671115
DOM	.87739786	.4837396 ; 1.3464211	1.1719349	.65034228 ; 1.7882182
EST	-6.397929	-8.4069705 ; -4.1818803	13.597025	7.6403524 ; 20.490065
FIN	-5.4841387	-7.7861361 ; -3.2843474	10.300371	5.4726712 ; 16.261341
FRA	-3.6809766	-5.7107045 ; -1.9894984	7.9748862	4.0360314 ; 13.096872
GBR	-4.9095729	-8.8461386 ; -2.2341014	-13.232254	-20.586212 ; -7.1599811
GHA	5.5110087	2.872593 ; 8.8339891	-1.8514943	-2.8087514 ; -1.0305354
HND	1.257708	.67105299 ; 1.9820479	.93247226	.49920897 ; 1.4653913
HRV	-1.5839285	-2.4944643 ; -.82948508	8.1232935	4.0962629 ; 13.332213
HUN	-1.7834102	-2.722247 ; -.97620274	8.1912942	4.1144976 ; 13.513987
IND	1.6504495	.88006863 ; 2.5952968	-1.6968212	-2.6540613 ; -.91239028

IRL	-23.078271	-33.881382 ; -13.385303	12.376046	7.0905367 ; 18.192694
ITA	-5.3876065	-7.4935273 ; -3.297052	10.743182	5.7690877 ; 16.825401
JPN	.54236621	.29788865 ; .83265396	-.17323438	-.27218121 ; -.09245238
KAZ	.68461618	.39076428 ; 1.0101386	.81036787	.37972557 ; 1.4091965
KGZ	-.47733774	-.7650195 ; -.24880835	1.6030579	.80560485 ; 2.6474467
KOR	.62716665	.3208827 ; 1.0208711	0	0 ; 0
LAO	-.49307546	-.84011629 ; -.23893449	1.5772841	.76528963 ; 2.6770283
LCA	1.298512	.69970158 ; 2.0246591	-.64139725	-1.0451352 ; -.32804201
LKA	2.8590681	1.5528909 ; 4.4279339	-3.8184231	-5.9094739 ; -2.0774562
LSO	.47821111	.25704125 ; .74506669	-.27459284	-.42561016 ; -.14796393
LVA	-7.9042707	-10.854782 ; -4.9290412	12.747644	7.0855682 ; 19.40508
MAR	-2.1417895	-3.4724828 ; -1.096526	6.5750382	3.3224699 ; 10.802663
MDA	-1.1722696	-2.1056231 ; -.50251417	6.9445655	3.5552464 ; 11.289326
MLI	-.31354187	-.53952333 ; -.14907461	4.4524638	2.2401646 ; 7.340882
MLT	-23.623426	-33.116577 ; -14.49889	27.935872	15.570398 ; 41.950841
MNG	-.28788505	-.45925565 ; -.15162471	1.4132537	.72270325 ; 2.3038406
MUS	1.0483874	.64290705 ; 1.4388997	-1.9772944	-2.9190689 ; -1.1341663
MYS	3.3838802	1.7726929 ; 5.4103382	-4.1593275	-6.5396094 ; -2.2239729
NAM	.38662083	.19934266 ; .62241781	-.44350541	-.69247057 ; -.23873221
NOR	-8.6757247	-12.053898 ; -5.3170185	12.621515	6.8854589 ; 19.454324
NZL	.14417891	.07898914 ; .22192889	-.27656038	-.48087087 ; -.12925979
OMN	2.360026	1.2471555 ; 3.7423522	-3.2348184	-5.0811408 ; -1.7307213
POL	-3.0462944	-4.7586841 ; -1.6323517	8.1168534	4.0785646 ; 13.390956
PRT	-5.3389818	-7.9015513 ; -3.0523168	9.7627477	5.1461526 ; 15.517825
QAT	2.432066	1.288617 ; 3.8499839	-4.2957369	-6.7416741 ; -2.3001297
RWA	-1.2109249	-2.0130826 ; -.59867378	2.2239473	1.113926 ; 3.6712845
SAU	1.0389554	.55955883 ; 1.6166724	-1.667332	-2.6328961 ; -.88602914
SLV	.91210247	.50470312 ; 1.3942137	1.3581023	.71120111 ; 2.1712324
SVK	-1.4991563	-1.8029554 ; -1.0580447	9.0328282	4.7368395 ; 14.448403
SVN	-2.2714809	-3.1012519 ; -1.4244581	10.055725	5.2888232 ; 16.001449
SWE	-4.6655989	-6.7007963 ; -2.763594	9.4599694	4.9196866 ; 15.194227
TUR	.18006096	.11492053 ; .20061463	3.4833798	1.7938071 ; 5.6501924
UKR	-2.3248359	-3.8307988 ; -1.1629413	5.5706926	2.8325255 ; 9.1041123
USA	.28560601	.15804764 ; .43639023	.0103694	-.04191891 ; .03002586
VNM	.51089781	.26525051 ; .8248447	1.0288002	.49710915 ; 1.7475801

ZAF	.62857012	.34500649 ; .96765114	-.58406511	-.93591323 ; -.30434004

Table 5: UK as destination country without CTA

Country	%ΔStudents	95% CI
ABW	18.178867	9.0153106 ; 30.418591
ARE	12.808265	6.4048958 ; 21.293416
ARM	20.585725	10.10197 ; 34.714133
AUT	-34.386576	-47.88452 ; -21.477064
AZE	20.076429	9.8710847 ; 33.818837
BEL	-34.750836	-48.133118 ; -21.863053
BEN	21.373214	10.456379 ; 36.128831
BGR	-32.58416	-46.114186 ; -19.95433
BHR	11.16109	5.581575 ; 18.554572
BIH	24.209927	11.844269 ; 40.879911
BMU	12.70669	6.3422564 ; 21.16046
BRA	19.854946	9.7802524 ; 33.393563
BRN	5.0897912	2.5594689 ; 8.429259
BWA	14.29124	7.1215227 ; 23.826474
CAN	16.688444	8.3153401 ; 27.819772
CHE	-34.549575	-47.986712 ; -21.654044
CHL	18.442279	9.106771 ; 30.958124
CIV	21.407685	10.458084 ; 36.228864
COL	19.172604	9.4458559 ; 32.239268
CPV	24.0004	11.788485 ; 40.451347
CZE	-34.203273	-47.791833 ; -21.264364
DEU	-34.333349	-47.884567 ; -21.393656
DNK	-34.720198	-48.215316 ; -21.750415
DOM	17.616451	8.7886867 ; 29.347134
EST	-31.0499	-44.598053 ; -18.646443
FIN	-33.044135	-46.568475 ; -20.337877
FRA	-34.42055	-48.004406 ; -21.447237
GHA	13.918501	6.8935201 ; 23.31404
HND	17.331453	8.6208009 ; 28.934732
HRV	-34.431331	-48.037565 ; -21.458848
HUN	-34.357953	-47.898856 ; -21.42508
IND	14.114248	7.0328599 ; 23.530036
IRL	-30.830757	-44.273895 ; -18.539371

ITA	-32.829266	-46.381013 ; -20.139208
JPN	15.973545	7.9528539 ; 26.64709
KAZ	17.198555	8.489584 ; 28.884881
KGZ	18.187469	8.9779822 ; 30.541799
KOR	16.190459	8.0594591 ; 27.012003
LAO	18.150739	8.9258114 ; 30.569992
LCA	15.054466	7.5149278 ; 25.062142
LKA	11.522084	5.7214657 ; 19.263706
LSO	15.855962	7.8934298 ; 26.456586
LVA	-31.53749	-45.068388 ; -19.061785
MAR	24.310862	11.816095 ; 41.295527
MDA	24.749733	12.074825 ; 41.914534
MLI	21.686969	10.590554 ; 36.71297
MLT	-21.832444	-33.582178 ; -12.096716
MNG	17.934404	8.8764197 ; 30.05675
MUS	13.768805	6.7742963 ; 23.177512
MYS	11.06227	5.5390229 ; 18.368523
NAM	15.645275	7.7895596 ; 26.099272
NOR	-31.59842	-44.997512 ; -19.210885
NZL	15.826867	7.9029461 ; 26.341002
OMN	12.196228	6.094659 ; 20.286463
POL	-34.417499	-47.980022 ; -21.461675
PRT	-33.354197	-46.897664 ; -20.583958
QAT	10.652651	5.3292226 ; 17.705801
RWA	18.937496	9.3189461 ; 31.864968
SAU	14.143811	7.0600935 ; 23.547905
SLV	17.858338	8.8609206 ; 29.869684
SVK	-33.867415	-47.498497 ; -20.953654
SVN	-33.259098	-46.781779 ; -20.521196
SWE	-33.551567	-47.057078 ; -20.771809
TUR	20.480053	10.083318 ; 34.466428
UKR	23.070371	11.263782 ; 39.051643
USA	16.191515	8.0891212 ; 26.940033
VNM	17.467319	8.6225773 ; 29.330824
ZAF	15.465813	7.7126743 ; 25.768753

5.2 Impact on student emigration by origin country

Table 6: Origin country with CTA

Country	%ΔStudents	95% CI	%ΔOMR	95% CI
ABW	.62859842	.33274656 ; .99352129	-1.5215367	-2.3954152 ; -.81068339
ARE	2.2156586	1.1831512 ; 3.4797523	2.75912	1.4579169 ; 4.3736829
ARM	-.68406937	-1.1126904 ; -.34874128	-3.4284442	-5.4587827 ; -1.7952343
AUT	-2.733632	-3.4797254 ; -1.8420497	-7.4485052	-11.789259 ; -3.915255
AZE	.02482004	.01405453 ; .03700459	-3.1169902	-4.9678866 ; -1.6348353
BEL	-8.5983566	-11.045184 ; -5.7495314	-6.9111533	-11.325182 ; -3.4395968
BEN	-.01783242	-.02752861 ; -.00965079	-3.9800336	-6.3455599 ; -2.0807564
BGR	-1.8332305	-2.9832303 ; -.93458681	-10.028327	-14.844487 ; -5.7454561
BHR	1.283189	.68765051 ; 2.0089866	4.0764803	2.1499155 ; 6.4713736
BIH	-.28115613	-.60531895 ; -.0914451	-6.0302346	-9.3627085 ; -3.245916
BMU	.06946326	.03820557 ; .10630748	2.6741774	1.4214181 ; 4.213675
BRA	.22662563	.13823469 ; .31550502	-2.8563145	-4.5394921 ; -1.5021325
BRN	.46898013	.2520686 ; .73256769	9.168406	4.7111745 ; 14.884679
BWA	.19002149	.10374896 ; .29236055	1.6520941	.88730262 ; 2.5787367
CAN	1.1324386	.62818439 ; 1.7172456	-.31709348	-.47045447 ; -.17973281
CHE	-4.5641727	-5.9206236 ; -3.0144357	-7.2369493	-11.643366 ; -3.711243
CHL	.33957937	.19093164 ; .51116342	-1.8082033	-2.9030906 ; -.93850721
CIV	-.02325712	-.04025177 ; -.01090096	-3.9948098	-6.3941921 ; -2.0783295
COL	.07390907	.04442184 ; .1048585	-2.3462919	-3.7593828 ; -1.2204655
CPV	-.05486026	-.09006264 ; -.02776583	-5.6720826	-8.8029289 ; -3.0706839
CZE	-3.7576271	-4.732695 ; -2.5353749	-7.6890927	-11.929524 ; -4.1609389
DEU	-4.3556064	-6.295796 ; -2.5529564	-7.5111688	-11.777303 ; -4.0090504
DNK	-9.6558798	-13.187912 ; -6.0260756	-6.9824198	-11.239752 ; -3.5939833
DOM	.85000144	.47348263 ; 1.291151	-1.097736	-1.6502798 ; -.61880592
EST	-2.9071485	-4.4748143 ; -1.5717054	-12.008197	-17.110348 ; -7.2171901
FIN	-5.1827284	-7.4064987 ; -3.0791144	-9.3265176	-13.984595 ; -5.2628342
FRA	-4.7884638	-7.1695659 ; -2.6954166	-7.3772191	-11.567847 ; -3.9386119
GBR	-29.527299	-43.182506 ; -17.142194	13.486066	6.8096984 ; 22.219317
GHA	.49411041	.26853529 ; .76316906	1.6081266	.89717976 ; 2.4285082
HND	.23584048	.12840423 ; .36503288	-.85889761	-1.3337637 ; -.46560949
HRV	-.32265812	-.57695527 ; -.14520241	-7.4038792	-11.59492 ; -3.9416534

HUN	-2.9561268	-4.0764866 ; -1.8246612	-7.3867011	-11.605778 ; -3.9261532
IND	.06588592	.03581112 ; .10175434	1.6293118	.87497625 ; 2.5471065
IRL	2.9670862	1.4658149 ; 4.8928992	6.1525611	2.9583292 ; 10.517468
ITA	-2.392224	-3.7693545 ; -1.2646137	-9.6058222	-14.270087 ; -5.4870126
JPN	.62862557	.34866106 ; .95518603	.13473265	.0717288 ; .21149021
KAZ	.06004387	.03497865 ; .08672595	-.91387562	-1.5468416 ; -.44418033
KGZ	-.89993578	-1.4288893 ; -.47359184	-1.6606202	-2.6870817 ; -.85491189
KOR	.06512203	.03390953 ; .10438848	.00195279	.00102238 ; .00312932
LAO	-.11567833	-.19742533 ; -.05593262	-1.5836704	-2.6350203 ; -.78670481
LCA	.92885935	.5065609 ; 1.4314537	.85041234	.44396612 ; 1.3613269
LKA	.02953771	.01646566 ; .04468	3.621351	1.9450373 ; 5.6562875
LSO	.00700659	.00384277 ; .01072669	.30879332	.16758407 ; .47436818
LVA	-4.8686719	-7.2644575 ; -2.7535408	-11.37769	-16.397872 ; -6.7500958
MAR	-.16171832	-.26164224 ; -.08288769	-6.0531146	-9.5425106 ; -3.2074585
MDA	-.0711452	-.12895687 ; -.03010672	-6.3917929	-9.9698674 ; -3.4318378
MLI	-.00583037	-.01005796 ; -.00275695	-4.1914907	-6.6972932 ; -2.1858566
MLT	-10.253846	-16.417579 ; -5.3591238	-22.423422	-30.818979 ; -14.007082
MNG	-.01019041	-.01618135 ; -.00539262	-1.399463	-2.2438577 ; -.72933879
MUS	.10432738	.06636928 ; .13716842	1.7851778	1.0286369 ; 2.6155403
MYS	1.0105369	.54134183 ; 1.5816761	4.4599233	2.3481811 ; 7.0928025
NAM	.04244645	.02226653 ; .06730573	.45969277	.24871004 ; .7126953
NOR	-2.8354915	-4.7245353 ; -1.3983785	-11.276744	-16.460615 ; -6.5664426
NZL	1.3711265	.74808584 ; 2.1115912	.27651591	.12971655 ; .47921314
OMN	.25700789	.13869549 ; .39974505	3.2605483	1.7264985 ; 5.1591583
POL	-6.0146414	-8.4771917 ; -3.6299589	-7.4053006	-11.641626 ; -3.9341116
PRT	-5.8230224	-8.5099975 ; -3.3762404	-8.9453768	-13.543376 ; -4.9903398
QAT	.849167	.45723238 ; 1.323977	4.4307123	2.332418 ; 7.0450668
RWA	-.00805349	-.01334822 ; -.00402465	-2.1572016	-3.489103 ; -1.1062747
SAU	.07536755	.04130913 ; .11533524	1.673903	.88894408 ; 2.6409016
SLV	.14804297	.08338583 ; .22259044	-1.2755244	-2.0105018 ; -.67826055
SVK	-.27420139	-.46213724 ; -.129423	-8.1544282	-12.417547 ; -4.5261198
SVN	-1.2973498	-1.9508719 ; -.72335819	-9.0376846	-13.653436 ; -5.0496499
SWE	-3.4304125	-5.1996156 ; -1.9054845	-8.6432808	-13.213583 ; -4.7606068
TUR	.10560424	.06924954 ; .11699898	-3.3980328	-5.3688726 ; -1.8030534
UKR	-.56968091	-.93059247 ; -.28797578	-5.2201629	-8.2251079 ; -2.7680862
USA	2.3397466	1.2786058 ; 3.6002275	.07846677	.01979071 ; .17637246

VNM	.0145898	.00769925 ; .02315914	-1.0642501	-1.7728489 ; -.52678682
ZAF	1.2758572	.70184817 ; 1.9551949	.62381413	.32772032 ; .9910405

Table 7: UK as origin country with CTA

Country	%ΔStudents	95% CI
ABW	-13.35902	-20.627481 ; -6.6022321
ARE	-9.7194173	-15.212364 ; -4.717073
ARM	-14.96161	-23.052678 ; -7.4067443
AUT	-55.760908	-73.847349 ; -34.017253
AZE	-14.703652	-22.67101 ; -7.2778033
BEL	-55.510054	-73.711761 ; -33.706786
BEN	-15.463984	-23.812743 ; -7.6605613
BGR	-56.928238	-74.750494 ; -35.183485
BHR	-8.4898846	-13.373427 ; -4.0847846
BIH	-17.259818	-26.285857 ; -8.6677632
BMU	-9.7097601	-15.21824 ; -4.704847
BRA	-14.471217	-22.311362 ; -7.1625183
BRN	-3.9514738	-6.3177216 ; -1.8632823
BWA	-10.493003	-16.40328 ; -5.1016509
CAN	-12.249524	-18.958948 ; -6.0348307
CHE	-55.614236	-73.748196 ; -33.852963
CHL	-13.545982	-20.953025 ; -6.6753861
CIV	-15.477307	-23.853898 ; -7.657616
COL	-14.020581	-21.663521 ; -6.9180724
CPV	-16.944981	-25.829845 ; -8.5172991
CZE	-55.890769	-73.907726 ; -34.187506
DEU	-55.78398	-73.836797 ; -34.071266
DNK	-55.546863	-73.677715 ; -33.812977
DOM	-12.918029	-19.908798 ; -6.4050429
EST	-57.8333	-75.421026 ; -36.134126
FIN	-56.613097	-74.499486 ; -34.876184
FRA	-55.713488	-73.76136 ; -34.019075
GHA	-10.53688	-16.53741 ; -5.092604
HND	-12.706311	-19.64602 ; -6.2695016
HRV	-55.786874	-73.83847 ; -34.06378
HUN	-55.75866	-73.820128 ; -34.040099
IND	-10.505027	-16.417505 ; -5.107971
IRL	-6.7299038	-10.19755 ; -3.4169696

ITA	-56.772567	-74.617332 ; -35.044524
JPN	-11.830092	-18.364557 ; -5.8053138
KAZ	-12.756232	-19.82802 ; -6.246814
KGZ	-13.403284	-20.755905 ; -6.5962537
KOR	-11.944513	-18.533694 ; -5.8647515
LAO	-13.345422	-20.727741 ; -6.5397752
LCA	-11.435229	-17.751294 ; -5.6119191
LKA	-8.7453588	-13.835051 ; -4.1826423
LSO	-11.672628	-18.141368 ; -5.7202159
LVA	-57.530944	-75.196545 ; -35.821348
MAR	-17.28956	-26.458356 ; -8.632705
MDA	-17.588936	-26.810942 ; -8.8313218
MLI	-15.651526	-24.106364 ; -7.7509624
MLT	-62.285397	-79.240984 ; -40.280788
MNG	-13.182174	-20.401242 ; -6.4940833
MUS	-10.383973	-16.386238 ; -4.9784237
MYS	-8.0275375	-12.672787 ; -3.8501662
NAM	-11.541693	-17.946713 ; -5.651156
NOR	-57.46957	-75.200797 ; -35.694734
NZL	-11.713605	-18.153465 ; -5.761562
OMN	-9.0863063	-14.27906 ; -4.3854278
POL	-55.775434	-73.841781 ; -34.050719
PRT	-56.429979	-74.359441 ; -34.693851
QAT	-8.2270302	-12.971007 ; -3.9537424
RWA	-13.853214	-21.438755 ; -6.8176637
SAU	-10.468045	-16.342513 ; -5.0981643
SLV	-13.0741	-20.208271 ; -6.4521834
SVK	-56.121694	-74.070183 ; -34.436413
SVN	-56.521038	-74.445978 ; -34.768129
SWE	-56.300968	-74.268853 ; -34.554896
TUR	-14.949432	-22.999458 ; -7.4238957
UKR	-16.550884	-25.359458 ; -8.2521847
USA	-11.879615	-18.392229 ; -5.8522898
VNM	-12.887784	-20.013442 ; -6.3175683
ZAF	-11.399393	-17.718673 ; -5.5853431

Table 8: Origin country without CTA

Country	%ΔStudents	95% CI	%ΔOMR	95% CI
ABW	.59239721	.27736332 ; .96396	-1.5833678	-2.5560737 ; -.75065868
ARE	2.2958681	1.0913317 ; 3.7003635	2.8386187	1.3322063 ; 4.6197797
ARM	-.69985869	-1.1682548 ; -.31526721	-3.4188789	-5.5947882 ; -1.5835811
AUT	-2.6939635	-3.4839 ; -1.6755001	-7.5080679	-12.204407 ; -3.4949768
AZE	.0273838	.01383147 ; .04206371	-3.0361721	-4.9758658 ; -1.4083477
BEL	-8.4260395	-10.98953 ; -5.2007034	-6.9984843	-11.774084 ; -3.0594884
BEN	-.01799232	-.02832942 ; -.00873269	-4.0021091	-6.5535483 ; -1.8526057
BGR	-1.8224742	-3.0311275 ; -.82503721	-9.9502006	-15.083167 ; -5.1253042
BHR	1.3582146	.64799185 ; 2.1815052	4.2889574	2.0097308 ; 6.9881829
BIH	-.30155954	-.65999485 ; -.08300767	-6.0587481	-9.6531555 ; -2.9000793
BMU	.07634981	.03744334 ; .12000732	2.9285503	1.3844632 ; 4.734678
BRA	.22869653	.12604192 ; .32695048	-2.8707604	-4.6813767 ; -1.3396951
BRN	.53193588	.25496797 ; .85145698	10.055579	4.5756374 ; 16.757098
BWA	.18188664	.08842106 ; .28748276	1.5742025	.75206844 ; 2.5248453
CAN	1.148463	.56953741 ; 1.7888564	-.40293765	-.61827394 ; -.2030575
CHE	-4.4623726	-5.8724229 ; -2.718322	-7.2807234	-12.026189 ; -3.2954289
CHL	.35074111	.17624147 ; .54278014	-1.7843028	-2.9453557 ; -.81801253
CIV	-.02494081	-.04418984 ; -.01027662	-4.0252661	-6.6189246 ; -1.8525358
COL	.07459893	.04044102 ; .10872431	-2.3481477	-3.8654111 ; -1.0803518
CPV	-.06154307	-.10245634 ; -.02793803	-5.9146912	-9.3829954 ; -2.8657732
CZE	-3.7464647	-4.8046438 ; -2.3253485	-7.7621852	-12.369141 ; -3.7353401
DEU	-4.3292922	-6.3795161 ; -2.2960652	-7.5818649	-12.209264 ; -3.5925419
DNK	-9.4670586	-13.133307 ; -5.4069991	-7.0406888	-11.643597 ; -3.1983937
DOM	.83153134	.4137027 ; 1.297743	-1.1466052	-1.7705943 ; -.57834055
EST	-2.8629497	-4.4876028 ; -1.3879531	-11.925868	-17.398797 ; -6.4867427
FIN	-5.157504	-7.5129718 ; -2.7775501	-9.3397747	-14.362109 ; -4.7211531
FRA	-4.7787893	-7.3008115 ; -2.4200707	-7.4600784	-12.011235 ; -3.5369971
GBR	-37.549339	-55.738614 ; -19.763874	14.879849	6.6454775 ; 25.145082
GHA	.52439805	.25377437 ; .83208595	1.8950503	.94118654 ; 2.9486812
HND	.22868809	.11071384 ; .36396106	-.91645652	-1.4591521 ; -.4433262
HRV	-.32814584	-.60160734 ; -.12848536	-7.4449013	-11.961117 ; -3.5207974
HUN	-2.9905458	-4.2117502 ; -1.6762533	-7.5476722	-12.184849 ; -3.5559831
IND	.06753932	.03265001 ; .1072224	1.7235572	.82396424 ; 2.7658357

IRL	-18.086193	-28.120685 ; -9.0089333	-12.199523	-17.868195 ; -6.5831188
ITA	-2.3805185	-3.8282208 ; -1.1232304	-9.6260354	-14.663239 ; -4.9347051
JPN	.6772479	.33479416 ; 1.0586689	.17864664	.08560169 ; .28560376
KAZ	.06650738	.03459444 ; .09920136	-.80097677	-1.4126758 ; -.33313967
KGZ	-.92966626	-1.5146166 ; -.43433828	-1.5841136	-2.6407415 ; -.71723464
KOR	.06253641	.02867769 ; .10329559	.0018754	.00085911 ; .00309434
LAO	-.11945829	-.20850795 ; -.05077611	-1.5503499	-2.6555516 ; -.6742973
LCA	.97428677	.4730438 ; 1.5426359	.93344437	.43394774 ; 1.5291858
LKA	.0329599	.01638497 ; .05124257	3.9724662	1.8982953 ; 6.3714092
LSO	.00677906	.0032972 ; .01067261	.27516944	.13295976 ; .43435183
LVA	-4.8151378	-7.3211076 ; -2.4552797	-11.307966	-16.692336 ; -6.0596438
MAR	-.16509626	-.2744412 ; -.0747062	-6.1155669	-9.9014133 ; -2.8740105
MDA	-.07468871	-.13797697 ; -.02749135	-6.4314622	-10.293107 ; -3.0712103
MLI	-.00623419	-.01097395 ; -.00260349	-4.2310758	-6.9429416 ; -1.9533782
MLT	-10.099222	-16.474235 ; -4.7202291	-22.077279	-30.944566 ; -12.585768
MNG	-.01201585	-.01948309 ; -.00568611	-1.3883632	-2.2875281 ; -.63999571
MUS	.12829644	.07210172 ; .17822214	2.0280193	1.0428093 ; 3.0667706
MYS	.9743186	.46426753 ; 1.5667118	4.3763685	2.0447683 ; 7.1511283
NAM	.04228643	.01954398 ; .06900373	.44773429	.2159483 ; .71298
NOR	-2.8063154	-4.7653518 ; -1.2274567	-11.229455	-16.788324 ; -5.8895334
NZL	1.4976303	.72722342 ; 2.3723706	.29543159	.12308593 ; .52051643
OMN	.26387898	.12669396 ; .42141497	3.3727555	1.5869515 ; 5.4788462
POL	-5.9770991	-8.5842738 ; -3.2772735	-7.4645088	-12.0507 ; -3.5180434
PRT	-5.7099256	-8.5059179 ; -2.9936877	-8.9233646	-13.834909 ; -4.4616015
QAT	.93010121	.44633089 ; 1.4873788	4.7457743	2.2192547 ; 7.7436794
RWA	-.00839609	-.01405995 ; -.00370255	-2.1652627	-3.5969744 ; -.98001113
SAU	.07380715	.03600696 ; .11612096	1.6969653	.80054032 ; 2.7495596
SLV	.14261347	.07185754 ; .22024005	-1.3316546	-2.1526213 ; -.63001561
SVK	-.2751591	-.47388534 ; -.11371402	-8.2248991	-12.861086 ; -4.0755092
SVN	-1.2848718	-1.9712546 ; -.64363143	-9.0517155	-14.020902 ; -4.5256276
SWE	-3.3910845	-5.2325874 ; -1.6968626	-8.6564255	-13.572291 ; -4.2577847
TUR	.09866406	.05656591 ; .11234092	-3.3432096	-5.4263392 ; -1.5736088
UKR	-.5832856	-.97813427 ; -.26005953	-5.239664	-8.4804008 ; -2.4636185
USA	2.2946277	1.1215207 ; 3.6223077	-.00288528	-.0261773 ; .05489948
VNM	.01521573	.00714412 ; .02477462	-1.0154556	-1.7465613 ; -.43798589

ZAF	1.3305266	.65358485 ; 2.0946089	.59389667	.27610964 ; .97091816

Table 9: UK as origin country without CTA

Country	%ΔStudents	95% CI
ABW	-14.099743	-22.395027 ; -7.3444565
ARE	-10.473749	-16.855323 ; -5.3729836
ARM	-15.588061	-24.721294 ; -8.1252073
AUT	-55.365849	-74.512204 ; -35.140503
AZE	-15.278364	-24.250274 ; -7.9612071
BEL	-55.121699	-74.388081 ; -34.837946
BEN	-16.100164	-25.514632 ; -8.3985231
BGR	-56.480951	-75.342612 ; -36.274201
BHR	-9.1738158	-14.859705 ; -4.6698407
BIH	-17.85264	-27.9784 ; -9.424994
BMU	-10.318757	-16.643447 ; -5.2804883
BRA	-15.136057	-24.010293 ; -7.8921479
BRN	-4.240151	-6.9713969 ; -2.1202343
BWA	-11.345263	-18.225971 ; -5.8321922
CAN	-13.053578	-20.7767 ; -6.7835768
CHE	-55.211548	-74.405887 ; -34.971545
CHL	-14.208012	-22.616231 ; -7.3784388
CIV	-16.118758	-25.567058 ; -8.3987516
COL	-14.6883	-23.354361 ; -7.636694
CPV	-17.731483	-27.767849 ; -9.3870125
CZE	-55.504864	-74.579523 ; -35.3156
DEU	-55.395868	-74.507368 ; -35.198297
DNK	-55.150386	-74.343347 ; -34.933253
DOM	-13.670276	-21.672974 ; -7.1408419
EST	-57.391555	-76.013561 ; -37.2269
FIN	-56.203695	-75.138205 ; -35.992537
FRA	-55.331821	-74.437346 ; -35.150483
GHA	-11.072395	-17.893377 ; -5.6495497
HND	-13.469913	-21.421196 ; -7.0077384
HRV	-55.386318	-74.490682 ; -35.184769
HUN	-55.408811	-74.534053 ; -35.195308
IND	-11.210228	-18.021124 ; -5.7572858
IRL	-56.989026	-75.530443 ; -36.922869

ITA	-56.367619	-75.258674 ; -36.164513
JPN	-12.53543	-20.021709 ; -6.4877689
KAZ	-13.365741	-21.384641 ; -6.900726
KGZ	-14.023755	-22.352728 ; -7.2722738
KOR	-12.683309	-20.244172 ; -6.5693772
LAO	-14.001401	-22.37957 ; -7.2357316
LCA	-12.133397	-19.380671 ; -6.2797236
LKA	-9.2882744	-15.12359 ; -4.6984318
LSO	-12.44861	-19.896269 ; -6.4387011
LVA	-57.092083	-75.795107 ; -36.916038
MAR	-17.902859	-28.196858 ; -9.4023111
MDA	-18.178676	-28.512198 ; -9.5963761
MLI	-16.295407	-25.828272 ; -8.4982992
MLT	-61.731582	-79.680886 ; -41.325191
MNG	-13.868	-22.083832 ; -7.2010727
MUS	-10.959732	-17.80314 ; -5.5543031
MYS	-8.9710652	-14.530994 ; -4.5653824
NAM	-12.303535	-19.675957 ; -6.3582293
NOR	-57.036809	-75.807665 ; -36.798846
NZL	-12.44752	-19.847343 ; -6.45598
OMN	-9.8264497	-15.875409 ; -5.0171972
POL	-55.381416	-74.505889 ; -35.174302
PRT	-56.005923	-74.976828 ; -35.803281
QAT	-8.8433444	-14.342559 ; -4.4951923
RWA	-14.530381	-23.137768 ; -7.5379719
SAU	-11.236559	-18.037834 ; -5.7814823
SLV	-13.823124	-21.977784 ; -7.1918524
SVK	-55.737387	-74.740306 ; -35.565752
SVN	-56.110357	-75.083174 ; -35.885153
SWE	-55.889335	-74.907438 ; -35.670025
TUR	-15.540197	-24.608391 ; -8.1223866
UKR	-17.152304	-27.050606 ; -8.9961328
USA	-12.692953	-20.206669 ; -6.5969183
VNM	-13.548176	-21.651213 ; -7.0033285
ZAF	-12.182715	-19.472896 ; -6.3005666

5.3 Robustness tests

Table 10: Robustness tests using cross-sectional data

Country	%Δ Incoming students				%Δ Outgoing students			
	2015			2014	2015			2014
		Colony	Language			Colony	Language	
ABW	.33524991	.32078722	.33286634	.42279528	.24777869	.2355911	.24575362	.29665398
ARE	.09453982	.15534293	.09365599	.13915711	1.9782452	3.1301	1.9690733	2.4768264
ARM	.17421536	.10501346	.17211726	.32836729	.09664633	.0628911	.09549044	.16571724
AUT	-.92712042	-1.0962742	-.91996605	-.91716961	-4.2213775	-4.991615	-4.1883102	-4.3118861
AZE	.23318882	.03149323	.2291318	.44030983	.00766526	.0009827	.0075496	.02181608
BEL	-3.1057129	-3.1159517	-3.068977	-3.135587	-5.3862285	-5.082142	-5.3022188	-5.693105
BEN	-.2699047	-.56727595	-.26658687	-.20523473	-.07904819	-.1615737	-.07800662	-.06776681
BGR	-8.0437863	-7.8367501	-7.9887029	-8.6407139	-2.2746263	-2.68182	-2.2553318	-2.3148759
BHR	1.7726016	2.8392464	1.7633596	2.1964231	.29765495	.4610744	.29514881	.43280543
BIH	.27516314	.06771333	.27410973	.35345285	.28765891	.0707029	.28652796	.39061004
BMU	2.0923832	2.7813312	2.0733665	2.5009814	.01599406	.0202386	.01564395	.0202131
BRA	.46901063	.34499718	.46470483	.60041053	.18906359	.1353795	.18764541	.25721203
BRN	1.392858	2.0842427	1.3889831	1.8089957	.0531529	.0841736	.05267844	.05845336
BWA	1.9829046	2.564836	1.9705436	2.49388	.9738198	1.22349	.96536757	1.0679994
CAN	.45098605	.53471877	.44657008	.55081988	.6725457	.8048056	.66669254	.84345306
CHE	-1.367306	-1.4495995	-1.3536308	-1.3590881	-4.6261016	-4.254381	-4.5487914	-4.8934657
CHL	.39725934	.34163378	.39298818	.50090748	.22130867	.1842622	.21899933	.28074632
CIV	-.26228487	-.57905479	-.25921195	-.19411221	-.05921431	-.1284561	-.0584563	-.04386071
COL	.54768351	.50184147	.54230614	.69108331	.1888062	.1675972	.1870755	.22010057
CPV	.72913189	.56349284	.72548246	.94208383	.02495314	.0187215	.02473907	.02940984
CZE	-1.8744232	-2.1818849	-1.8628345	-1.8515567	-6.2791621	-7.366658	-6.2693367	-6.5377742
DEU	-4.4038559	-4.6726188	-4.3783816	-4.8472331	-5.3000418	-5.590878	-5.2689561	-5.0742163
DNK	-2.107002	-2.3815809	-2.0907402	-2.3224688	-10.160607	-10.27453	-10.125047	-10.393866
DOM	.31357135	.23007119	.31033287	.37586231	.30439482	.2231134	.30125059	.38265881
EST	-5.7120225	-6.8202114	-5.676338	-6.0858833	-3.9281583	-4.636747	-3.9007801	-3.7519841
FIN	-3.4935697	-5.2420495	-3.4513008	-3.4586047	-3.4128441	-5.085567	-3.3718805	-3.3872971
FRA	-5.1198995	-4.6499873	-5.0941464	-5.1718353	-7.3775705	-6.327498	-7.3393406	-7.2956613
GBR	-3.091776	-3.7733197	-3.0722546	-2.9144673	-33.446747	-36.92989	-33.233578	-32.374463
GHA	3.0794578	3.9569007	3.058985	3.6099147	1.0790512	1.329326	1.0691711	1.3116575

HND	.41027341	.38622897	.40651421	.49359556	.22195116	.2030066	.21980869	.28275241
HRV	-6.4862046	-7.7282337	-6.4527758	-6.7082074	-2.750233	-3.227364	-2.7309321	-2.7224401
HUN	-3.3371893	-3.9501911	-3.3191126	-3.2285002	-4.635153	-5.534985	-4.6146609	-4.8506727
IND	4.318696	5.519303	4.2816443	4.9571209	.67545765	.7963035	.6691231	.87116836
IRL	7.4634653	6.6035135	7.4152493	8.5750182	6.2169906	4.957113	6.1818197	6.396993
ITA	-7.1056003	-7.0394811	-7.0693231	-7.1563914	-3.4026479	-3.592978	-3.3817665	-3.6891819
JPN	.06716499	.01824533	.06576635	.11527978	.10268713	.0271801	.10045674	.12643281
KAZ	-.03290063	-.22098281	-.03579185	.09096123	-.01020331	-.0635063	-.01112903	.02870281
KGZ	-.01309796	-.07913389	-.01417499	.03362288	-.02186352	-.1352168	-.02366218	.05319174
KOR	.20404808	.0032402	.19887543	.3548816	.0038301	.0000706	.00374447	.00566045
LAO	-.1589763	-.34937069	-.16042378	-.12430461	-.08542063	-.188537	-.08624956	-.07424714
LCA	1.66568	2.1887589	1.6540647	1.9335131	.96083367	1.248828	.95117107	1.1975045
LKA	1.7856664	2.7619777	1.7721476	2.3381323	.16360267	.2505618	.16265467	.20181359
LSO	2.47131	3.1968284	2.4561749	3.0213156	.41992054	.5247481	.41425936	.47577888
LVA	-6.1685256	-6.6818267	-6.1321135	-6.8183558	-4.8105957	-5.266708	-4.7797732	-4.4797486
MAR	-.1868878	-.59418577	-.17658268	-.11926857	-.02195366	-.0660525	-.02074558	-.01342738
MDA	.47310716	.29211653	.47043882	.72468345	.07911578	.0463492	.07885492	.09339976
MLI	-.14282075	-.42408412	-.13940794	-.07283686	-.03373325	-.0964392	-.03292131	-.01913229
MLT	-20.966913	8.2652829	-21.500937	-23.424566	-12.267877	4.346923	-12.573205	-12.012489
MNG	.12187873	-.05412246	.11817624	.25615304	.02781597	-.0113312	.02706925	.05152455
MUS	2.8058465	3.7996475	2.7853095	3.3960611	.15976903	.207556	.15671687	.22634991
MYS	1.8224851	2.7953511	1.8100851	2.3362597	.18124054	.2728848	.18037691	.21704351
NAM	.55666542	.30924772	.54969417	.69119491	.21689229	.1281772	.21345739	.26607614
NOR	-9.4652153	-9.7750013	-9.4259429	-9.888013	-3.1711735	-3.486351	-3.1514118	-3.1372763
NZL	.07077741	.08751509	.06955388	.11749724	2.6570661	3.557219	2.6334563	3.1572819
OMN	.04772625	-.05982033	.04463608	.14633139	.00578161	-.0070096	.00539117	.02051596
POL	-3.7121838	-4.6405158	-3.6961406	-4.3110798	-5.1388821	-6.701308	-5.1225104	-4.7501886
PRT	-6.5930959	-7.1956962	-6.551782	-6.8675535	-7.095284	-7.70325	-7.0522574	-7.0771135
QAT	1.500574	2.3782652	1.4955644	1.8236263	.27936889	.4583669	.27704929	.44039352
RWA	.46675973	-.0154208	.45803447	.66030582	.14344349	-.0044281	.14006298	.1627864
SAU	.13110236	-.11545964	.12823146	.31626995	.0075284	-.0059443	.00737952	.01597113
SLV	.42581498	.39841646	.42208749	.49443374	.18776254	.1711169	.18583669	.2585451
SVK	-5.8288605	-6.5312234	-5.8118358	-6.0543965	-1.075423	-1.231602	-1.0663202	-1.0581912
SVN	-4.0693518	-4.9346436	-4.0578825	-4.119236	-3.4730734	-4.200332	-3.4607944	-3.64888
SWE	-4.3745561	-6.3066412	-4.3276791	-4.4686021	-3.5582464	-4.883348	-3.5224532	-3.4529724
TUR	.75156652	.77624981	.74667602	1.1531073	.42716402	.4462075	.42504915	.49280725

UKR	.23985304	-.06997359	.24210779	.45201707	.07193113	-.0199412	.07282189	.19987829
USA	.21643009	.24045281	.21452005	.26495225	3.0277671	3.492994	3.010369	3.6828123
VNM	-.32560264	-.78816372	-.32842622	-.23888198	-.0197122	-.0457736	-.01994641	-.01889085
ZAF	1.2268871	1.5329872	1.2168123	1.4435256	1.8960395	2.382285	1.8830491	2.2932032

Table 11: Robustness tests using cross-sectional data (cont'd)

Country	%Δ Incoming students	%Δ Outgoing students
Controlling for EU_d and EU_o		
ABW	.38999683	.28279494
ARE	.09091001	2.0222228
ARM	.2440619	.13133067
AUT	-.95951603	-4.3002011
AZE	.35362839	.01085424
BEL	-3.1686849	-5.4044769
BEN	-.16996645	-.04802767
BGR	-7.8094442	-2.2760222
BHR	1.8277068	.28674865
BIH	.42218049	.44167465
BMU	2.1414806	.01460472
BRA	.57620811	.22606886
BRN	1.4251067	.04909289
BWA	2.0750967	.99496349
CAN	.46876731	.70050178
CHE	-1.4050789	-4.6302706
CHL	.46849577	.25450783
CIV	-.16309704	-.0354445
COL	.63387798	.21027613
CPV	.89123638	.02777417
CZE	-1.9312391	-6.3902793
DEU	-4.5395007	-5.4441314
DNK	-2.1668335	-10.171759
DOM	.37341962	.36200831
EST	-5.6655267	-3.9239528
FIN	-3.5193331	-3.4392017
FRA	-5.2263031	-7.4500621
GBR	-3.2703099	-33.558605
GHA	3.2395232	1.0992637
HND	.46916035	.24749778
HRV	-6.4731051	-2.7878883
HUN	-3.3722952	-4.6590841

IND	4.508147	.6823503
IRL	7.4087973	6.1771811
ITA	-7.0821213	-3.4529328
JPN	.08853547	.13805676
KAZ	.02165758	.00655292
KGZ	.00701025	.01185863
KOR	.29314577	.0049582
LAO	-.12564393	-.06602295
LCA	1.7411593	.97504144
LKA	1.8531849	.15673636
LSO	2.5897667	.41182352
LVA	-6.1073991	-4.791311
MAR	.00654463	.00075596
MDA	.6413614	.10344291
MLI	-.02788405	-.00640759
MLT	-20.426247	-11.953766
MNG	.19258262	.04229401
MUS	2.9207184	.15053194
MYS	1.8874228	.17486452
NAM	.65527321	.24562751
NOR	-9.4027923	-3.2396132
NZL	.06673752	2.7425656
OMN	.08980191	.01035818
POL	-3.7812095	-5.2129856
PRT	-6.5023077	-6.9845347
QAT	1.5336367	.27187789
RWA	.60060788	.17681425
SAU	.22175631	.01219956
SLV	.48843656	.20742806
SVK	-5.845403	-1.1024358
SVN	-4.1387468	-3.5362605
SWE	-4.4176248	-3.605624
TUR	.88851124	.50135471
UKR	.41941679	.124793
USA	.21813866	3.1207754
VNM	-.25076776	-.01413383

ZAF	1.2620334	1.981665

5.4 Other

Figure 13: Log total number of students in EU from 2003 to 2019