

Drivers of brain gain at EU level: institutional versus regional attractiveness for student mobility

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Abstract: This paper analyses the competition for human capital attraction between European higher education institutions (HEIs) through a multi-level model predicting their ability to attract mobile students. Predictions of the model are tested on a dataset of 1,329 HEIs located in 134 regions and 12 European countries. Our results suggest that: a) The attractiveness of students to a particular university is based on both institutional as well as regional factors although the first ones are more relevant; b) Research-oriented institutions attract more students, specifically at higher levels of education (PhDs), while teaching-oriented institutions negatively influence brain gain; c) Regional characteristics and specifically the regional quality of education is a factor of students' attraction, particularly at lower levels of education (for bachelor and master students). These results have relevant implications for HEI's international attraction policies, as well as for national and regional policies concerning mobility of students.

Keywords: student mobility; brain gain; university and regional attractiveness.

1 Introduction

Globalization of higher education, through mobility of students, has grown considerably over the past 40 years. The number of students who study abroad has been steadily rising since 1970s. It has grown fourfold between 1975 and 2008. Among the various categories of migrants, international students are the ones who have experienced the most rapid increase in relative terms (Beine et al., 2014) with the number of international students in Europe increased by roughly 114% from 2000 to 2010 (ICEF, 2013). For this reason, internationalization in higher education has become one of the priorities of the European Commission in recent years and it has been stressed the importance of student mobility by setting an ambitious benchmark of an EU average of at least 20% of higher education graduates to have undertaken a period of

higher education-related study or training abroad, representing a minimum of 15 ECTS credits or lasting a minimum of three months. Increasing mobility of students within the EU may be crucial to develop Europe's highly skilled labour force in order to strengthen its position as a knowledge-based economy. That is why institutions, regions and countries are interested in receiving students in order to increase their human capital value and improve their higher education systems. However, there is little research in international student mobility determinants in general (Findlay et al., 2006).

Haupt et al. (2010) deal with migrations of students from the perspective of 'brain gain' and show that 'brain drain' cannot be only due to individuals from developing territorial incentives to acquire human capital but also by incentives in the rich countries and regions to improve their education policy. The need for host territories to retain foreign students indeed leads them to increase the quality of their educational system in order to benefit from the externalities of human capital accumulation. From a policy point of view brain gain is an interesting phenomenon to study because there are incentives in the rich countries and regions to improve their education policy.

Studies in the literature have largely paid attention to the factors influencing mobility and emphasizing the role played by economic determinants (Rodríguez-González et al., 2011) as well as higher education characteristics (Lepori et al., 2015). Economic determinants configure the attractiveness of the areas, i.e. the influence of political, social, cultural and economic conditions of territories (Beine et al., 2012) while the institutional configuration shapes university attractiveness based on the nature and quality of the institutions (Baryla & Dotterweich, 2001). Although both institutional factors and regional attractiveness could influence student mobility in higher education, what still remains unclear is which of these two groups of factors exercises higher influence at different education levels.

The importance of looking at the institutional and regional level as relevant for student mobility is twofold. First, at the institutional level, attracting students from other countries is expected to improve the quality of HEIs and their ability to recruit talented researchers, as well as having improving education and research quality (Lepori, 2016). Second, at regional level, attraction and retention of students will increase the high skill human capital pool that is available as workforce and might have an influential role in regional development and growth. In addition, putting the emphasis in regions has an additional value added to those studies analysing student mobility at national level by complementing between countries differences with within countries diversity.

Using the European Tertiary Education Register (ETER) at EU level, this paper analyses which are the main drivers of brain gain at EU level through the comparison of institutional factors (teaching and research capacity of universities) with regional attractiveness

(sociodemographic characteristics, employment opportunities and regional education systems) affecting student mobility.

The rest of the paper is structured as follow: next section does a review of the literature highlighting student mobility based on migration theoretical models. Section 3 introduces the database, variables as well as the empirical methodological issues. Section 4 presents main results of the analysis and finally Section 5 concludes.

2 Literature review

2.1 Theoretical models explaining student mobility

Using two different streams of the literature, student mobility could be explained from different approaches. Within traditional migration theory in general and the rational choice approach of the cost-benefit models for migration in particular, a potential migrant is likely to move if the present value of the anticipated benefits is greater than the monetary costs of moving. It is assumed that the prospects of higher real income levels, associated with future labour market employment in the host country, are the main anticipated benefits associated with migration; the main costs are those of transporting the migrant. Or in other words, students migrate for non-pecuniary reasons, benefiting from the pleasure of studying and for a better quality of life (consumption reasons). Students not only focus on the returns of higher education in the future, but also take into account the context in which they will study.

The second approach of the literature uses a human capital perspective where migration is considered as an investment and the decision to move is made to grab better job opportunities and/or to increase the future expected income. Rosenzweig (2006) proposes two models to explain the international mobility of students to developed countries. First, migration takes place because of the lack of educational facilities in the home country regardless the level of education returns (school-constrained model). In that case, students migrate to acquire human capital and return home to reap the benefits of education investment at origin. Second, migration under a student visa could be a mean to enter and stay in a foreign country to escape low returns in education in the origin country. The quest for higher income is the main determinant of student migrations in this so called migration model.

These two models are competing in terms of predictions and implications. In the school-constrained model, an increase in the return from education in the home country leads more students to study abroad, whereas, in the migration model, it rather tends to reduce the flows of students. Moreover, other things being equal, if the quality and the quantity of education increase, the number of students who seek education abroad will be reduced in the school-constrained model, but the outflows of students in the migration model will increase.

2.2 *Mobility of students: a priority in the policy agenda*

Increasing mobility of students within the EU may be crucial to develop Europe's highly skilled labour force in order to strengthen its position as a knowledge-based economy. Beyond the central role assigned to student mobility, there is also some evidence proving that studying abroad helps a person to cope more successfully with increasing international dimensions at work and helps with career enhancement, in general (Teichler, 2007). It also helps to improve international competences, enabling former students to be placed in visible international professional positions (Bracht et al., 2006) and increases the probability of a person working abroad later in life (Parey and Waldinger, 2007). This economic discourse, regarding the benefits of studying abroad, also includes an overlapping socio-cultural discourse about European integration and shared European cultural values, which underlies the relevance of student mobility as a prime mechanism to foster a sense of European identity and citizenship (Rodríguez-González et al., 2011). Improving student mobility is a core goal of the European Higher Education Area and a major policy priority in the EU's agenda for modernizing higher education. On the words of the European Council, it is "one of the fundamental ways in which young people can strengthen their future employability, as well as their intercultural awareness, personal development, creativity and active citizenship"¹.

In the 2000s, the Council Resolution develops a mobility action plan that sets out three major objectives: a) to define and democratise mobility in Europe; b) to promote appropriate forms of funding; and c) to increase mobility and improve the conditions for it. Since then, mobility of students has been highly present in the policy agenda and constitutes an important asset within the EU priorities².

At tertiary level, internationalization in higher education has become one of the priorities of the European Commission and in 2011, a specific benchmark for learning mobility has been established, requiring that by 2020 an EU average of at least 20% of higher education graduates have undertaken a period of higher education-related study or training abroad, representing a minimum of 15 ECTS credits or lasting a minimum of three months. To quantify and measure this benchmark, in 2015, it was developed the *Methodological Manual on Learning Mobility in Tertiary Education* that includes the official definition of mobility adopted for the benchmark on learning mobility in higher

¹ EUR-Lex (Access to European Union Law) Council Recommendation of 28 June 2011 – "Youth on the move" – promoting the learning mobility of young people (2011/C199/01). Available at: [http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32011H0707\(01\)](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32011H0707(01))

² More information about EU mobility legislation and policy available here: <http://www.cedefop.europa.eu/es/events-and-projects/projects/mobility-scoreboard>

education³ and identifies learning mobility in tertiary education as the physical crossing of national borders between a country of origin and a country of destination and subsequent participation in activities relevant to tertiary education (in the country of destination). The country of origin is defined as the country of prior education, i.e. the country where upper secondary diploma was obtained.

Two types of mobility are identified, namely degree mobility and credit mobility, both of which are included in the benchmark: *Degree mobility* is defined as the physical crossing of a national border to enrol in a degree programme at tertiary-level in the country of destination. The degree programme would require the students' presence for the majority of courses taught. *Credit mobility* is defined as temporary tertiary education or/and study-related traineeship abroad within the framework of enrolment in a tertiary education programme at a "home institution" (usually) for the purpose of gaining academic credit (i.e. credit that will be recognised in that home institution). Although credit mobility also constitutes an interesting area of research, this work will focus on degree mobility of students due to data availability (see Section 3.1).

2.3 Where should I go? Main drivers of brain gain

There are push and pull factors affecting student mobility. Push factors refer to home country/region and relate to student's decision to study overseas, while pull factors affect host country and refer to those factors that made countries/regions more attractive than other potential destinations. Haupt, Krieger, and Lange (2010) deal with migrations of students from the perspective of brain gain and show that brain drain cannot be only due to individuals from developing countries incentives to acquire human capital but also by incentives in the rich countries/regions to improve their education policy. The need for host countries/regions to retain foreign students indeed leads them to increase the quality of their educational system in order to benefit from the externalities of human capital accumulation. It enhances the human capital of all students, included those who return home. Then, it can generate a brain gain. From a policy point of view brain gain is an interesting phenomenon to study because there are incentives in the rich countries/regions to improve their education policy. The study of brain gain will help in the understanding of national and regional policies concerning the attractiveness of students.

Different studies in the literature have largely paid attention to the factors influencing mobility and emphasizing the role played by economic determinants (Rodríguez-González et al., 2011) as well as higher education characteristics (Lepori et al., 2015). Economic determinants configure the attractiveness of the areas, i.e. the influence of political, social,

³ The methodological manual on learning mobility, which provides the relevant definitions, can be found [here](#).

cultural and economic conditions of territories (Beine et al., 2012) while the institutional configuration shapes university attractiveness based on the nature and quality of the institutions (Baryla & Dotterweich, 2001). Although both institutional factors and regional attractiveness could influence student mobility in higher education, what still remains unclear is which of these two groups of factors exercises higher influence at different education levels.

The geography of student mobility is usually explained as an investment process in the human capital theory, or as a simple short-term cost-benefit assessment (Sá et al., 2004). According to these authors, students move away from regions with low university resources to those with higher resources. They conclude also the importance of economic factors saying that, for the case of The Netherlands, the behaviour of prospective students is governed by a distance deterrence effect and a downward rent effect, but a positive impact results from regional/urban amenities. Similarly, McCann and Sheppard (2001) show that for the initial decision to move, better higher education institutions induce more migration. Agasisti and Dal Bianco (2007) using a gravity approach confirm the role of distance but also show that the socio-economic conditions of the area have a positive impact on the attractiveness of a university.

At institutional level, Lepori et al. (2015) compare institutional versus country attractiveness for the attraction of researchers at EU level. They conclude that country factors are more important than HEI's characteristics in driving internationalization and, particularly, that research-oriented HEIs in attractive countries have a larger share of international staff, whereas this happens only to a limited extent with similar HEIs in low attractive countries. Other authors highlight the role played by the quality of university programs as an important driver of mobility (Sá et al., 2004; Beine et al., 2014). Agasisti and Dal Bianco (2007) add the number of faculties and the resources invested in student aids as important factors while Beine et al. (2014) conclude that there is a limitation in the role played by registration fees, having a negative effect in the effect of migration of students.

In our case particular case HEI characteristics are expected to influence the share of mobile students through different mechanisms. First, more research oriented universities and less teaching oriented HEIs will be more attractive to potential mobile students at higher levels of education (mainly PhD students), while a more teaching oriented HEIs could move away students mainly in the first levels of education (undergraduates). In addition, as mentioned previously mobility increases with the level of quality: therefore the student queue of high quality HEIs will still comprise a higher share of mobile students.

There are also other studies that highlight the importance of both institutional and regional factors as drivers of brain drain. For example, Beine et al. (2014) analyse 13 OECD countries and support that having a significant network affect the migration of students. In addition, they identify the significant role for cost factors such as housing prices and attractiveness variables

such as the reported quality of universities. Similarly, Rodríguez-González et al. (2011) test those factors influencing student flows and found that country size, cost of living, distance, educational background, university quality, the host country language and climate are all significant determinants. This study will contribute to this literature by analysing student mobility at tertiary level following the last definition proposed by the EC (EC, 2015) at the EU level and taking into account differences between ISCED levels (ISCED6-8: from bachelor to PhD students).

3 Data and methodology

3.1 Data

This study will focus on the analysis of drivers of inward mobility (brain drain) of students between 2011/12 and 2013/14 (3 years) at EU level. For the purpose of this paper, we will use different sources of information. At institutional level, information about universities is coming from the European Tertiary Education Register (ETER) while regional characteristics are defined using different indicators collected by Eurostat.

The ETER database is a register of higher education institutions in Europe, providing data on the number of students, graduates, international doctorates, staff, field of education, income and expenditure as well as descriptive information on their characteristics. It also collects information on degree mobility, in particular on ‘international/mobile students’, that is students who have physically crossed a national border and moved to another country with the objective of studying; country of origin is defined here as country of prior education. The information is collected at the level of the receiving HEI, so the available figures concern inward degree mobility⁴. This in principle makes the information comparable to the administrative data collected by UOE, i.e. the joint UIS (UNESCO Institute of Statistics)/OECD/Eurostat data collection on education statistics, which is the basis for the construction of the learning mobility benchmark.

3.2 Mobile students

ETER distinguishes between degree mobility (students moving after obtaining their secondary level degree to acquire a degree in another country) and credit mobility (students studying abroad for a defined period to acquire credits for the qualification on their home country) within the Erasmus program. However, due to the particularities of Erasmus mobility information (numerus clausus of Erasmus grants as well as the limitations in the possibilities of destination), this paper will focus only on degree mobility, that is students who move to a different country for the purpose of studying. Using the definition included in ETER, in this

⁴ No information is available on the country of origin of the incoming mobile students.

work we understand mobile students as those students who have physically crossed a national border for studying. The country of origin is defined as the country of prior education, where the upper secondary diploma was obtained. This definition excludes foreigners born in the country or those that migrated before obtaining an upper secondary diploma. Then the percentage of mobile students over total students in each university constitutes our dependent variable. The database allows the identification of mobile students at the level of undergraduates doing bachelor -3 or 4 years- (ISCED6), master students (ISCED7) and PhD students (ISCED8) between 2011/12 and 2013/14.

3.3 Institutional level variables

Following the literature in higher education in general, and mobility studies in particular, we capture institutional attractiveness mainly through two different variables: teaching and research orientation of the university (Lepori et al., 2014). First, teaching orientation of the university is measured through two variables: student fees and teaching loads. Students fees are measured as the percentage of money the institutions get from students' fees over total budget of the institution. Teaching loads are captured as the ratio between students and teachers in each institution. Second, research orientation is measured using two variables: research intensity and research active institutions. Research intensity is defined as the ratio between the number of students at PhD level (ISCED8) divided by the total number of students (ISCED5-8). Research active institution is a dummy variable with the value 1 if the institution has institutionalised research activities⁵ and 0 otherwise. Two additional variables are included as controls: size of the institution and a measure of decentralization. Size of the institution is measured as the logarithm of the total staff in full time equivalent (FTE) while decentralization is a dummy variable with the value 1 if the university has a foreign campus and 0 otherwise.

3.4 Regional level variables

ETER includes information about the geographical location of the headquarters of the universities based on the NUTS2 level code. We use this information to merge with regional characteristics based on the information collected by Eurostat for different issues. The information refers to the period 2011-2013. In particular, we identified regional attractiveness through three main groups of variables: socioeconomic characteristics of the region, employment opportunities and regional education systems. Each of these groups are defined below.

⁵ Criteria for inclusion are the following: a) The existence of an official research mandate; b) The existence of research units institutionally recognised (for example on the institutional website); c) The inclusion in R&D statistics (availability of R&D expenditure data), as sign of institutionalised research activity; d) Awarding doctorates or ISCED 8 degrees; e) Consideration of research in an institution's strategic objectives and plans; f) Regular funding for research projects either from public agencies or from private companies. Institutions fulfilling at least three of these criteria should be included (ETER, 2016).

- a) Socioeconomic characteristics of regions are measured by density, that is number of inhabitants per km² (*demo_r_d3dens*) and quality of life captured through income of households based on balance of primary incomes over national income (*nama_10r_2hhinc*).
- b) Employment opportunities are captured by employment rates (*lfst_r_lfe2emprr*) and expected earnings measured as compensation of employees in purchasing power parities (*nama_10r_2coe*).
- c) Regional education systems measured by quality of education is defined as the percentage of universities in Shanghai ranking⁶ over the total number of universities in the region and educational background measured as the percentage of population aged 25-64 with tertiary education (*edat_lfse_04*).

Variables and definitions are summarized in Table 1. Correlation matrix is included in the Annex to highlight the absence of collinearity problems among the selected variables.

[Insert Table 1 about here]

3.5 Methodology

We perform an analysis using aggregate values for the share of mobile students at EU level for HEIs. We run regression models in order to analyse the impact of institutional and regional attractiveness on the proportion of mobile students. The data has a two-level hierarchical structure: at level 1, we consider institutional-level variables such as teaching and research orientation as well as institutional controls. Level 2 variables include regional variables such as socioeconomic characteristics, employment opportunities and regional education systems.

Due to the proportion nature of the dependent variable, we based our analysis in a mixed method approach where denoting by y_{ir} the response for university i in region r , we are interested in predicting the probability (π_{ir}) that a HEI i receives mobile students in region r , considering a two-level structure where a total of I institutions (at level 1) are nested within R regions (at level 2) with ir institutions in region r . x_{ir} are institutional-level explanatory variables and x_r are regional-level explanatory variables. Accordingly, we estimate the following multi-level model:

$$\pi_{ir} = \beta_0 + \beta_1 x_{ir} + \beta_2 x_r + u_r + e_{ir}$$

where the group effects or level 2 residuals u_r and the level 1 residuals e_{ir} are assumed to be independent, heteroskedastic and to follow normal distributions with zero means:

$$u_r = N(0, \sigma_u^2) \quad e_{ir} = N(0, \sigma_e^2)$$

⁶ This variables is obtained from the Shanghai Ranking (<http://www.shanghairanking.com/ARWU2016.html>)

The coefficients in this specification are identified by the variation among the independent variables. To mitigate any bias induced by potential omitted variables, we include year and country fixed effects to control for a wide array of unobserved specific variables.

In order to guarantee a homogeneous register of universities, this study focus only on public institutions, that is, those HEIs where the ultimate control over the institution depends on the public agency. After this selection, a simplified dataset with all variables explained above is created. This new dataset of HEIs is constituted by 1,329 universities located in 134 regions and 12 EU countries (BE, CZ, DE, DK, HU, IE, IT, LT, NL, PT, SE, UK). This will be the information used in the rest of this work.

4 Results

4.1 Student mobility in EU countries

Graph 1 presents the box plot at country level for student mobility between 2011/12 and 2013/14 for the selected countries in our study. In general terms, graph shows that UK is the country receiving the highest percentage of students (around 20% of the total students in 2013/14). In countries like BE, DE and DK, figures are quite constant in the years studied (around 8% for BE and DE and more than 11% for DK) while IE has exhibited an important increment in the number of students received (an increment of around 3% between 2011/12 and 2013/14). In PT and SE, the number of mobile students varies depending on the year analysed, with the first country receiving the highest number in 2012/13, while the latest received the highest number in 2011/12. Information for the rest of the countries is quite limited and graphical description is not easy to interpret.

[Insert Graph 1 about here]

Graph 2 includes similar information but dividing mobile students by level of education (ISCED6-8). In this case, information is quite different across countries. Results show that the higher the level of education is the higher the percentage of mobile students in all EU countries. This means that mobility is a phenomenon particularly important at PhD level (ISCED8). Following UK that is always the leader country for mobility at all ISCED levels, for bachelor students, DK is an important destination with figures that move from 8% of mobile students in 2011/12 until 12% in 2013/14. For master students, DE and BE are the favourite destinations with around 15% of students on average in DE and 10% in BE. For PhD students, IE and SE are important destinations with more than 15% of mobile students in IE and more than 20% in SE on average in the three years analysed.

[Insert Graph 2 about here]

4.2 Descriptive statistics: University-level and regional-level data

Descriptive statistics at university level are presented in Table 2 Part A. On average student fees represent 10% of the total income in universities, although this varies quite a lot from one university to another, with a maximum of 94% of the representation of the fees over the total. Teaching loads represents the ratio between students and teachers and, on average, there are 11 students per teacher. Among the universities studied, 82% of these institutions are research active while on average PhDs represent only 2% of the total students. 26% of these institutions have a site abroad.

Table 2 Part B includes the descriptive statistics at regional level for the selected variables. In terms of the socioeconomic characteristics of the regions, results suggest that the quality of life, captured through available income of households, accounts for more than 17 thousand EUR while the density of the population is more than 443hab/km². Employment opportunities suggest that in the studied regions employment rates are located, on average, on 65% with a mean wages of more than 7 thousand EUR. Related to the quality of education, small figures suggest that only 1.34% of the selected universities appear in the Shanghai ranking and less than one third of the population has tertiary education.

[Insert Table 2 around here]

4.3 Determinants of student mobility

Table 3 and 4 present the regression results analysing the determinants of student mobility. Table 3 includes the results at all ISCED levels (ISCED6-8) while Table 4 presents the results by levels of education (bachelor, master and PhD students). Each table includes 3 columns. Column (1) represents regression analysis where only institutional variables are included, Column (2) those where only regional variables are included and Column (3) represents the full model where both, institutional and regional variables are included. For simplicity in the results presented here and for space reasons, results in this section will focus only on Column (3).

At global level, results suggest that institutional variables are more relevant than regional variables, because there are more university factors affecting student mobility than regional characteristics. Specifically, more teaching-oriented universities attract less amount of students while, on the contrary, more research-oriented institutions attract more. Within teaching orientation, both student fees and teaching loads act as negative determinants for brain gain, while higher numbers of PhDs over total students acts as positive factor for student mobility. At regional level, only the quality of education is a determinant of brain gain, being the level of education of the population the only significant variable.

Table 4 distinguishes the results on the determinants of student mobility by three levels of education: bachelor students (ISCED6), master students (ISCED7) and PhD students (ISCED8). At different levels of education some differences emerge in relation to the determinants of student mobility. At lower levels of education both institutional and regional level variables are significant while at upper level, only institutional factors are important. For bachelor students, a particular teaching or research orientation of the university affect negatively brain gain. Specifically, higher student fees and higher number of PhDs enrolled at the university decrease student mobility. At regional level, more educated people also acts as an attraction effect for human capital at undergraduate level. All these factors are also affecting student mobility for master students. In addition, student fees have also a negative effect in students' attraction at ISCED7 level. At PhD level, almost all institutional variables are significant while regional characteristics do not affect student mobility. In this case, teaching orientation is a negative factor for student mobility while research-oriented institutions are a factor of attraction.

[Insert Table 3 around here]

5 Conclusions

Increasing mobility of students within the EU may be crucial to develop Europe's highly skilled labour force in order to strengthen its position as a knowledge-based economy. In fact, improving student mobility is a core goal of the European Higher Education Area and a major policy priority in the EU's agenda for modernizing higher education. At institutional level, attracting students from other countries is expected to improve the quality of Higher Education Institutions as well as having improving education and research quality. The need for host territories to retain foreign students indeed leads them to increase the quality of their educational system in order to benefit from the externalities of human capital accumulation. Both economic as well as institutional factors are considered as key drivers of student attraction, retention and the brain drain phenomenon. Specifically, economic determinants configure the attractiveness of the areas, i.e. the influence of political, social, cultural and economic conditions of territories (Beine et al., 2012) while the institutional configuration shapes university attractiveness based on the nature and quality of the institutions (Baryla & Dotterweich, 2001).

The European Commission in recent years has stressed the importance of student mobility by setting an ambitious benchmark of an EU average of at least 20% of higher education graduates to have undertaken a period of higher education-related study or training abroad, representing a minimum of 15 ECTS credits or lasting a minimum of three months. Even so, the distribution of mobile students across EU Members States is quite heterogeneous. Countries like UK are top leaders attracting students, particularly due to language reasons. The language

effect' is a phenomenon already studied in the literature as an important attraction factor. (Rodríguez-González et al-. 2011).

Following the traditional migration theory in general and the rational choice approach of the cost-benefit models for migration, our results suggest that students not only focus on the returns of higher education in the future, but also take into account the context in which they will study. At global level, institutional variables are more relevant than regional variables and, in particular, more research-oriented institutions and higher quality systems of education at regional level are important determinants of brain gain and students' attraction. This is in line with one of the models proposed by Rosenzweig (2006) where migration takes place because of the lack of educational facilities in the home country regardless the level of education returns (school-constrained model) and students migrate to acquire human capital. When different levels of education are taken into account some differences emerge. At lower levels of education both institutional and regional level variables are significant while at upper level, only institutional factors are important. For bachelor and master students, a particular teaching or research orientation of the university affect negatively brain gain while more educated people acts as an attraction effect for human capital at undergraduate level. At PhD level, almost all institutional variables are significant while regional characteristics do not affect student mobility. In this case, teaching orientation is a negative factor for student mobility while research-oriented institutions are a factor of attraction.

In sum, mobility is an important migration phenomenon still under research specifically due to the new definitions established among international institutions. Due to the high priority of mobility within the European agenda, more research is needed in order to understand how institutions, regions and countries can improve their education systems to increase the attraction and retention of human capital.

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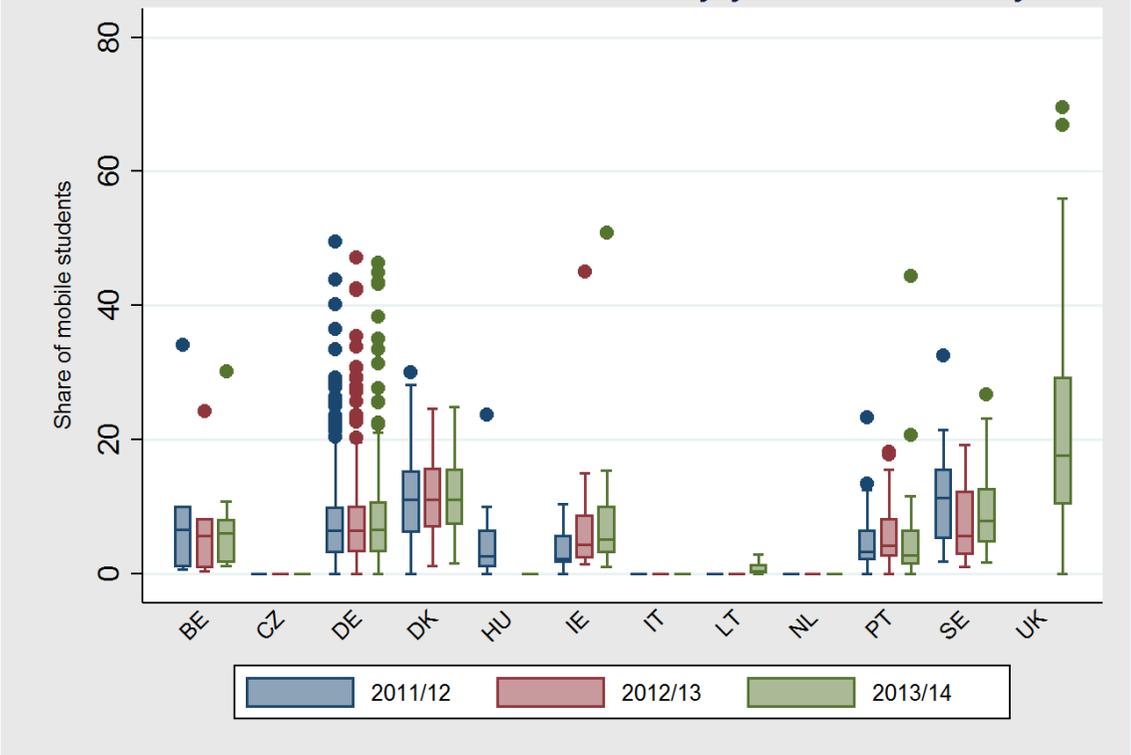
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Table 1. Summary of the variables of the study

Name	Definition	Type of variable
<i>Dependent variable</i>		
Mobility of students	Percentage of mobile students over total students (ISCED6-8) in each university.	Quantitative
<i>Institutional level variables</i>		
Teaching orientation		
Student fees	Percentage of money the institutions get from students fees over total budget of the institution.	Quantitative
Teaching load	Ratio between students and teachers in each institution.	Quantitative
Research orientation		
Research intensity	Ratio between the number of students at PhD level (ISCED8) divided by the total number of students (ISCED5-8).	Quantitative
Research active institutions	Dummy variable with the value 1 if the institution has institutionalised research activities and 0 otherwise.	Dummy
Institutional controls		
Size	Total staff in full time equivalent (ln).	Quantitative
Decentralization	Dummy variable with the value 1 if the university has a foreign campus and 0 otherwise.	Dummy
<i>Regional level variables</i>		
Socioeconomic characteristics		
Density	Number of inhabitants per km ² .	Quantitative
Quality of life	Income of households.	Quantitative
Employment opportunities		
Employment rates	Rate of employment.	Quantitative
Expected earnings	Compensation of employees in purchasing power parities (PPP).	Quantitative
Quality of education		
Univ. Shanghai ranking	Percentage of universities in Shanghai ranking over the total number of universities in the region.	Quantitative
% population with tertiary education	Percentage of population aged 25-64 with tertiary education.	Quantitative

Graph 1. Share of mobile students at country level (ISCED6-8)



Graph 2. Share of mobile students at country level by level of study



Table 2. Descriptive statistics

	Obs.	Mean	Std. Dev.	Min.	Max.
<i>Part A. Institutional variables</i>					
Student fees	2,180	0.10	0.16	0	0.94
Teaching loads	2,555	11.38	9.59	0	213.29
Research active institutions	4,015	0.82	0.38	0	1
Research intensity	3,772	0.02	0.07	0	2.97
Multi-site	4,180	0.26	0.44	0	1
Total staff	3,008	1,382.34	1,999.46	0	14,286
<i>Part B. Regional variables</i>					
Quality of life	4,073	17,761.63	6,139.03	4,000	32,400
Density	4,229	443.6	1,111.02	3	10,438.2
Employment rate	4,201	65.01	8.48	38.9	83.2
Compensation of employees	3,914	7,170,755	6,760,000,000	6,918,388	81,600,000,000
Univ. Shangai ranking	4,235	1.34	2.07	0	10
Population with tertiary education (%)	4,191	28.52	8.49	9.9	52.3

Table 3. Determinants of student mobility

	(1)	(2)	(3)
<i>Institutional variables</i>			
Teaching orientation			
Student fees	-2.135 (2.555)		-4.217* (2.460)
Teaching load	-0.198*** (0.0230)		-0.170*** (0.0209)
Research orientation			
Research active institutions	0.523 (1.478)		0.147 (1.293)
Research intensity	4.688** (2.077)		5.167*** (1.837)
Institutional controls			
Multi-site	-0.672 (0.510)		-0.354 (0.465)
Size (ln)	0.147 (0.172)		0.215 (0.154)
<i>Regional variables</i>			
Socioeconomic characteristics			
Quality of life		-4.265** (2.042)	-2.775 (2.533)
Density (ln)		1.194*** (0.323)	0.885** (0.414)
Employment opportunities			
Employment rates (ln)		4.657 (3.836)	-1.705 (5.205)
Expected earnings		-0.538 (0.365)	-0.160 (0.388)
Quality of education			
Univ. Shangai ranking		0.0769 (0.171)	0.0295 (0.375)
Population with tertiary education (%)		4.886*** (1.530)	5.267*** (1.961)
Chi-squared	412.0	850.9	238.9
P-value	0.000	0.000	0.000
N	1,423	2,896	1,375

Note: Standard errors between brackets. *P-value<0.1; **P-value<0.05; ***P-value<0.001

Table 4. Determinants of student mobility by level of education

		ISCED 6			ISCED 7			ISCED 8		
		(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Institutional variables	Teaching orientation									
	Student fees	0.999 (2.538)		-0.274 (2.433)	-4.551 (4.077)		-9.638** (4.208)	-4.129 (3.563)		-4.855 (3.764)
	Teaching load	-0.125*** (0.0235)		-0.0990*** (0.0214)	-0.212*** (0.0372)		-0.161*** (0.0362)	-0.102*** (0.0330)		-0.122*** (0.0330)
	Research orientation									
	Research active institutions	0.417 (1.295)		-0.285 (1.154)	3.851* (2.323)		2.424 (2.238)	9.657*** (1.831)		9.108*** (1.772)
	Research intensity	-8.235** (3.678)		-7.879** (3.613)	-20.04*** (5.472)		-19.76*** (5.554)	34.60*** (4.970)		45.05*** (5.285)
	Institutional controls									
	Multi-site	-0.518 (0.547)		-0.210 (0.504)	1.434 (0.943)		1.712* (0.923)	-3.631*** (0.771)		-3.061*** (0.768)
	Size (ln)	-0.0846 (0.191)		-0.0581 (0.178)	0.356 (0.309)		0.339 (0.303)	3.820*** (0.275)		3.579*** (0.280)
	Regional variables	Socioeconomic characteristics								
Quality of life			-1.053 (1.720)	-1.068 (2.472)		-0.474 (2.130)	1.463 (4.205)		-2.235 (2.745)	0.130 (4.162)
Density (ln)			1.179*** (0.288)	0.517 (0.408)		1.151*** (0.333)	1.137 (0.699)		0.663 (0.439)	-1.112 (0.677)
Employment opportunities										
Employment rates (ln)			7.023 (5.134)	-10.69 (9.146)		-8.064 (6.163)	-19.32 (15.45)		0.118 (5.777)	-13.52 (14.93)
Expected earnings			-0.447* (0.260)	0.412 (0.495)		0.148 (0.374)	-0.0870 (0.646)		-0.207 (0.510)	-0.261 (0.677)
Quality of education										
Univ. Shanghai ranking			-0.481*** (0.141)	-0.140 (0.407)		0.165 (0.166)	0.0144 (0.676)		-0.253 (0.219)	-0.199 (0.692)
Population with tertiary education (%)			2.337 (1.497)	4.035* (2.101)		4.227** (1.746)	8.365** (3.462)		3.741* (2.238)	5.797 (3.678)
Chi-squared		107.1	99.34	65.54	237.1	400.0	125.4	329.8	617.8	239.6
P-value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
N	1238	2295	1192	1191	2335	1144	1227	2486	1180	

Note: Standard errors between brackets. *P-value<0.1; **P-value<0.05; ***P-value<0.001

Annex. Correlation matrix

	1	2	3	4	5	6	7	8	9	10	11
1. Student fees	1										
2. Teaching loads	0.24***	1									
3. Research active institutions	-0.04**	0.10***	1								
4. Research intensity	-0.09***	-0.14***	0.18***	1							
5. Multi-site	-0.03	0.11***	0.08***	-0.05***	1						
6. Total staff	0.10***	0.08***	0.49***	0.32***	0.20***	1					
7. Quality of life	-0.30***	-0.22***	0.18***	0.11***	0.03*	-0.0*	1				
8. Density	0.13***	-0.17***	0.11***	0.10***	-0.01	0.02	0.51***	1			
9. Employment rate	-0.20***	-0.12***	0.27***	0.09***	0.04**	0.06***	0.59***	0.15***	1		
10. Expected earnings	-0.23***	0.08***	0.03**	0.00	0.14***	0.08***	0.13***	0.22***	0.12***	1	
11. Univ. Shangai ranking	0.03	-0.11***	0.05***	0.09***	0.04**	0.04*	0.51***	0.50***	0.16***	0.29***	1
12. Population with tertiary education	0.13***	-0.01	0.30***	0.04**	0.04**	0.22***	0.32***	0.19***	0.50***	0.18***	0.37***