The Effect of EU enlargement on International Student Mobility

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1. Introduction

The European Union (EU) experienced the largest single enlargement in terms of population and number of countries in 2004, followed by further accession of Romania and Bulgaria in 2007. Undoubtedly, such enlargement had huge implications on every aspect of the EU. Despite the important role of higher education in such integrated governance system (de Prado Yepes, 2007), the enlargement effect on European higher education, particularly on international student mobility (ISM), is barely discussed and not empirically studied. Therefore, this research project aims to examine how EU enlargement has affected the size of ISM. Effectively, as generalization, it implies how removal of national border and associated barriers to study abroad affects ISM.

1.1. Relevance

There has always been a heightened political importance attached to ISM, which plays an important socio-economical role. Therefore, higher education modernization with special emphasis on ISM has become one of the main priorities of EU policy over the last decades as a contributing factor on growth, employment, innovation and welfare through development of highly skilled labour force in European single market, according to human capital theory. (ENEE 2007) For instance, number of papers (Bracht et al. 2006; Teicher, 2007; Parey & Waldinger, 2007) show that ISM increases employability in today's increasingly international labour market. Additionally, ISM stimulates deeper cultural integration and contributes to build a sense of European identity.

The EU has supported ISM in tertiary education since 1976, through Joint Studies Programmes. (Rodrigues, 2012) After a pilot program of student exchange (1981-1986), ERASMUS[1] Program was launched in 1987. As an illustration of its success, nearly 3 million EU students have taken part since it started. (European Commission) Then, it has become part of the Socrates programme since 1995 and the EU's Lifelong Learning Programme more recently.

Likewise, the Sorbonne Declaration of 1998, the Bologna Declaration of 1999 and subsequent milestones, designed to bring standardization, single quality assurance and mutual recognition of academic qualifications, were initiated to reduce divergence in higher education systems in Europe and increase their international competitiveness and attractiveness primarily through promotion of ISM. (Papatsiba, 2006) Table **A1** provides detailed information of these summits, which eventually led to formation of European Higher Education Area (EHEA) in 2010.

Recently, the European Council set minimum of 20% target rate for higher education in the EU to have on average a 'period of higher education-related study abroad' by 2020. (Myklebust, 2011) It signifies that political and social-economic importance of ISM in the EU is not only valid, but also ascending, especially when higher education is becoming more as a tradable service in a highly

[1] European Region Action Scheme for the Mobility if University Students

globalized world, where the size of global ISM has quadrupled since 1975, reaching 3.7 million students in 2009. (OECD, 2011)

1.2. Motivation

There is no empirical evidence showing how EU enlargement has affected ISM. Even migration literature, the second best approximation, gives contrasting and inconclusive results. Therefore, the present study offers an advantage of sharing clear empirical evidence on the significance of removal of national border and associated barriers to study abroad in determining ISM by analyzing EU enlargement of 2004 and 2007. To test the hypothesis of its significant effect, gravity model is applied in its log-linearized and multiplicative forms using panel data of bilateral student flows between 26 EU member states over the period 1999-2009. The hypothesis is confirmed, implying at least **40%-45%** increase in ISM, symmetric in both directions, as a result of enlargement. Among important pull factors are the degree of freedom and international exposure of a host country, whereas among significant push factors are the size of student population, average income level, financial support and control of corruption in a sending country.

1.3. Outline

The paper is organized as follows:

Section 2 reviews the relevant literature and presents the paper's main contributions and the hypothesis. In section 3, one outlines theoretical framework and methodologies employed. Section 4 presents the data and preliminary statistical analysis. Section 5 includes interpretation of the econometric analysis and verifies the hypothesis of the project. Finally, section 6 states the conclusion, evaluation and possible policy implications, and then it highlights project's limitations and proposes further improvements.

2. Literature review

ISM has been extensively studied from theory building to regression analysis. Figure **A3** illustrates conceptual framework of ISM phenomenon. The present research project is related to literature on determinants of ISM. Particularly, more attention is given to studies using gravity model due its empirical strength in analysis of flows (Deardorff, 1984:503), though overview of other studies in determinants of ISM is provided in table **A2** in the appendix.

2.1. Gravity model

Starting from the first application of Newton's law about universal gravitation (1687) in the social sciences by H. Carey in the 1860s, gravity-type model was introduced in the realm of economics by Tinbergen (1962), in migration economics by Lowry (1966) and Lee (1966) and more recently in literature of ISM determinants. To the author's knowledge, there are only three papers: Bessey (2012), Rodriguez Gonzalez et al. (2010) and Van Bouwel & Veugelers (2009).

These papers concur that there are increasing student outflows from Eastern Europe. For instance, Van Bouwel and Veugelers (2009), by adding regional dummy for EU new member states (NMS), find its significance in determining ISM. Others find increasing outflows from NMS in their descriptive statistics analysis. However, they refer nothing about EU enlargement effect on ISM.

2.2. EU enlargement as a determinant

The present study focuses on EU enlargement effect. Despite a wide range of literature on various implications of EU enlargement, its effect on ISM is barely discussed and studied.

2.2.1. Academic mobility

There is only one paper, which has very soft evidence about EU enlargement effect on academic mobility. Guth (2008) investigates the impact of Eastern enlargement in 2004 on the mobility of scientists from NMS to older member states (OMS). The analysis is based on extensive empirical study of the MOBEX2[2] Project that has some focus on prospective doctoral students. Against its initial expectations, the paper finds no significant effect of opening of the borders and following free movement rights on the mobility of early researchers. This effect is modest even in movements to the UK, where access to its labour market has not been restricted for NMS from the beginning.

However, it does not necessarily imply the similar pattern for ISM on the whole since doctoral students only constitute part of these flows, whereas students at bachelor and master levels tend to be much more mobile. Moreover, these results might be biased as the primary analysis of the MOBEX2 Project has predominantly focused on the flows between Poland and Bulgaria (sending)

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[2] Mobility and Excellence in the European Research Area

and the UK and Germany (receiving), so that the results has been broadly generalized to the rest of the EU.

Additionally, Rodriguez Gonzales et al. (2010) observe that ERASMUS Program enlargement in 1998/99 by inclusion of NMS and Turkey increased the flows of ERASMUS students, whose positive effect lasted up to 2003 and dissipated after that. The significance of this enlargement has not been tested empirically as it is out of their main focus of analysis, but the change in numbers of exchange students is sizeable as shown in their descriptive statistics. Although such positive effect is observed for enlargement of ERASMUS Program, it could be the case for the EU enlargement as well.

2.2.2. Migration in general

Since the study of ISM is particular element of the migration phenomenon, literature on EU enlargement effect on migration could contribute some relevant insights, as Bessey (2012) finds that they have fairly similar determinants. Majority of papers uses descriptive statistics for the empirical analysis and indicates that there has been increase in the number of migrants from NMS to OMS after EU enlargement but overall at a modest level.

Nevertheless, Kahanec et al. (2009) point out to the uneven distribution of flows across countries, showing that immigration from NMS is the largest to Ireland and the UK. These two countries have opened access to their labour markets after the enlargement, whereas most of OMS have been reluctant to remove their restrictive 'transitional measures' in migration policy up to 2009. Thus, it is argued that the actual effect of enlargement on migration flows would be sizeable in the absence of such restrictions.

In respect that Barrell et al. (2010) emphasize temporary nature of the flows and Zaiceva & Zimmermann (2008) point out migration of predominantly younger population, significant positive effect from EU enlargement on ISM could be assumed since migration includes student flows, for whom free movement rights are applicable. (European Union, 2004)

However, Kans (2011) disproves such proposition on the basis of his empirical simulations using structural NEG approach, showing that liberalization of migration policy does not lead to substantial increase in migration flows.

2.4. Contribution

To sum up, there is no empirical evidence showing how EU enlargement has affected ISM. Even migration literature, the second best approximation, gives contrasting and inconclusive results. Therefore, this research project is the first to offer an advantage of sharing clear empirical evidence on the significance of "removal of national border and associated barriers to study abroad" in determining ISM by analyzing EU enlargement of 2004 and 2007.

Moreover, the second major contribution of this study is that it supplements gravity literature on ISM determinants by providing robust and comprehensive results. Effectively, it extends current analysis on the topic by considering larger sample, more determinants and extensive sensitivity check of results via application of consistent econometric techniques that some previous studies have been ignorant about. Besides, using panel data allows estimating more sophisticated models and avoiding biases common to cross-section or time-series analysis.

2.5. Hypothesis

The research hypothesis states that the size of ISM increases noticeably as a result of EU enlargement. It is expected due to the predictions of neoclassical theory of migration, based on the rational choice approach of the cost-benefit models. (Borjas, 2008:321-364)

It stresses that a potential student is likely to go abroad to study if the present value of expected benefits exceeds costs of moving (monetary and non-monetary). It includes transportation costs, foregone gains during moving, physical costs of leaving family[3] and friends, accommodation costs, tuition fees and mobility barriers such as passport/visa control. For instance, Choudaha and Chang (2012) emphasize the role of student visa regulations in determining ISM: tightening visa requirements in 2010 resulted in sizeable drop of student inflows in Australia, whereas Canadian increasingly friendly student visa policy contributed to 30% increase of student inflows in 2011.

While under European Community Law students have the right to easily study in another member state as long as they are not a financial burden on the host state. (European Union, 2004) Therefore, opening of national border and following free movements of students between member states, as a result of EU enlargement, reduce costs of moving given certain level of expected gains ceteris paribus, thus increasing ISM to a certain extent.

[3] Accounting for socio-cultural dimension implicates the new economy of migration, so-called "social choice approach" (Wolf et al. 1997)

3. Methodology

3.1. Theoretical framework

ISM is not a random process, but rational choice that implies two independent and sequential decisions: to migrate and where to migrate. While the first represent microeconomic approach, the second refers to the macroeconomic approach. (Bunea, 2012) Gravity model, supported by neoclassical migration theory, successfully incorporates both approaches, but focuses more on macro dimension. Therefore, this research project predicts gravity relationship for ISM analogous to Newton's law of universal gravitation:

$$IS_{ij} = \alpha_0 \frac{{H_i}^{\alpha_1} * {S_j}^{\alpha_2}}{{D_{ij}}^{\alpha_3}}$$

IS_{ij} is international student flow from country *"j"* to country *"i"*. H_i includes pull factors, operating within host country to make that country relatively more attractive than others, whereas S_j consists of push factors that operates within sending country, initiating student's decision to study abroad. Mainly, they include country's population, income levels etc. Distance between *"i"* and *"j"* is denoted as D_{ij}, representing not only physical distance, but also cultural and linguistic distances that alter costs of moving. $\alpha_1, \alpha_2, \alpha_3$ are elasticities and α_0 is a constant common to all country-pairs (all years). According to Buch et al. (2004), it captures additional distance costs.

Bigger effect from push/pull factors or both increases IS flows between countries. However, such effect diminishes the farther apart the two countries are. This phenomenon is known as distance decay or Tobler's first law of geography (Tobler, 1970). Greenwood (1997:648-720) considers that distance elasticity declines over time due to globalization and modern information, communication and transport technologies, thus decreasing costs of going abroad.

3.2. Empirical model

In order to apply this model empirically, three transformations are used: log-linearization for convenient elasticity interpretation of the coefficients; augmentation to increase explanatory power of the model; and inclusion of stochastic term to account for deviations from theory since analogy between Newtonian gravity and ISM is not precise. Additionally, time dimension is included because of panel data analysis.

$$ln(IS_{ijt}) = \ln(\alpha_0) + \alpha_1 \ln(H_{it}) + \alpha_2 \ln(S_{jt}) + \alpha_3 ln(D_{ij}) + \phi E_{ijt} + u_{ijt}$$

Without loss of generality, two-error component model is considered:

$$u_{ijt} = \mu_{ij} + \mu_{ji} + \lambda_t + v_{ijt}\,, v_{ijt} \sim \text{iid N}(0, \sigma_v^2)$$

for: $i, j = 1,2 \ldots 26, i \neq j$ and $t = 1,2 \ldots 11$

In order to test the hypothesis, enlargement dummy variable, $\boldsymbol{E_{ijt}}$, is included:

$$\boldsymbol{E_{ijt}} = \begin{cases} 1, & i\ and/or\ j \in NMS\ after\ their\ accession \\ 0, & otherwise \end{cases}$$

Essentially, it captures overall effect of EU enlargement (both 2004, 2007) and implies impact of opening national border and removing associated mobility barriers. As discussed in section **2.5**, significant positive sign of its coefficient "$\boldsymbol{\phi}$" is expected.

Additionally, separate dummies for host ($\boldsymbol{E_{it}}$) and sending ($\boldsymbol{E_{jt}}$) NMS are considered, in order to account for direction of IS flows, as many studies mention increasing outflows from NMS:

$$\boldsymbol{E_{ij}} = \begin{cases} 1, & i \in NMS\ after\ their\ accession \\ 0, & otherwise \end{cases}$$

$$\boldsymbol{E_{jt}} = \begin{cases} 1, & j \in NMS\ after\ their\ accession \\ 0, & otherwise \end{cases}$$

Asymmetric flows, particularly, major movements from NMS to OMS are expected: $\boldsymbol{\phi_H} < \boldsymbol{\phi_S}$

"$\boldsymbol{\mu_{ij}}$" and "$\boldsymbol{\mu_{ji}}$" are unobserved time invariant factors specific to individual pair of countries, one for each direction of flows. "$\boldsymbol{\lambda_t}$" represents the effect common to all pairs of countries for given year $\boldsymbol{t}$. "$\boldsymbol{v_{ijt}}$" is independent identically distributed (iid) disturbance term with zero mean and constant variance for all observations, assumed to be pairwise uncorrelated.

Alternatively, one estimates a multiplicative version of the gravity equation using Poisson pseudo-maximum likelihood (PPML) estimation following approach of Santos Silva and Tenreyro (2006):

$$\boldsymbol{IS_{ijt}} = \mathbf{exp}(\boldsymbol{x}'\boldsymbol{\beta}) + \boldsymbol{\mu_{ij}} + \boldsymbol{\mu_{ji}} + \boldsymbol{\lambda_t} + \boldsymbol{\varepsilon_{ijt}}$$

for $\boldsymbol{IS_{ijt}} \geq 0$ and $E\left[\boldsymbol{\varepsilon_{ijt}} \middle| x'\right] = 0$; where $\boldsymbol{x'}$ is vector of all explanatory variables; $v_{ijt} = \ln \varepsilon_{ijt}$.

3.3. Econometric issues

First of all, omitting at least one of the terms $(\mu_{ij}, \mu_{ji}, \lambda_t)$ of error component model, when they are present, results in endogeneity bias, arisen from non-stochastic disturbance. Therefore, if applicable, one adds year and country-pair dummy variables (LSDV) or use either fixed-effects or random-effects estimations, based on the results of Hausman specification test (Hausman, 1978).

Secondly, log-transformation of the dependent variable leaves out all zero-valued observations. As 12% (856 out of 7150) of observations have no IS flows, unbalanced truncation of the sample may delude results. Therefore, transformed dependent variable, $\ln\,(IS_{ijt} + 1)$, is applied as a standard way of dealing with prevalence of zeros.

Thirdly, one uses robust clustered standard errors for two reasons. Firstly, they consistently estimates true standard errors even under heteroskedasticity, which is largely expected because dissimilar country-pairs exhibit different variation, and whose presence is confirmed in figure **A10**. Also, they are robust to misspecification and serial correlation within panel, which is also highly expected due to presence of the same country-pairs over time.

As a robustness check, one applies PPML estimation that account for last two issues simultaneously. It avoids selection bias from the unbalanced truncation, as its multiplicative form naturally allows estimating the dependent variable in level, $\boldsymbol{IS_{ijt}}$, which includes zero-valued observations and better copes with heteroskedasticity issue. Additionally, PPML is much more superior estimation technique, just because only sufficient condition for estimators' consistency is that conditional expectation of the mean be correctly specified: $E\left[\boldsymbol{IS_{ijt}} \middle| x'\right] = \exp(x'\beta)$.

4. Data

The analysis covers cross-section of 26 EU countries[4] over period of 1999-2009. Hence, multidimensional balanced panel dataset consists of 7150 observations of 650 bilateral IS flows (26x25 pair of countries).

4.1. Dependent variable

As the dependent variable, this paper employs 'bilateral internationally mobile student flows' from UNESCO Institute for Statistics (UIS) to proxy for ISM. It includes 'degree mobility', which covers students who pursue a tertiary[5] education degree outside their country of residence, but excludes 'credit mobility', which covers students under short-term, for credit-study and exchange programs that last less than a full academic year. On the one hand, such measure underestimates total number of students who have at least some experience of being internationally mobile. On the other hand, it helps to capture genuine effect of EU enlargement on ISM, because 'credit mobility' programs such as ERASMUS has been available to NMS a long before their accession since 1998. Although it does not allow for a distinction between temporary and permanent nature of flows and does not contain any information on the former educational attainment of students, the numbers are still valid as a measure of overall ISM.

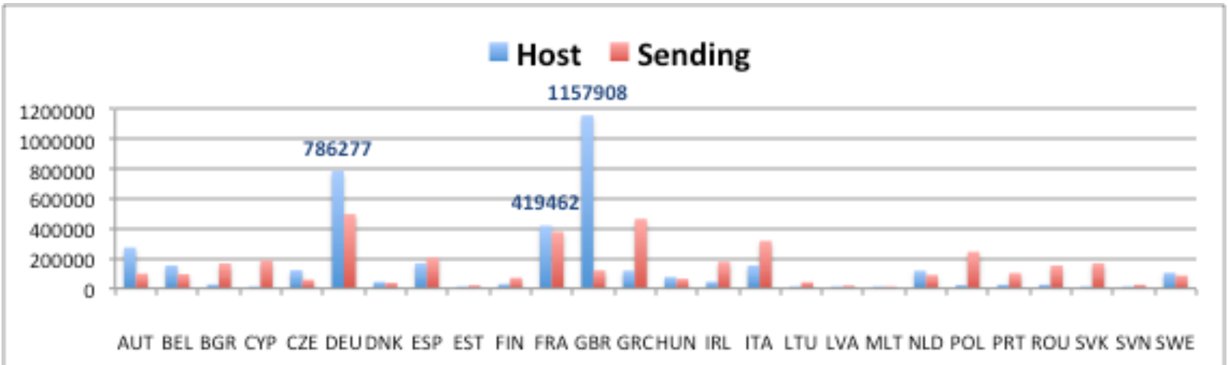


Figure 1. Total IS flows of period 1999-2009 by countries

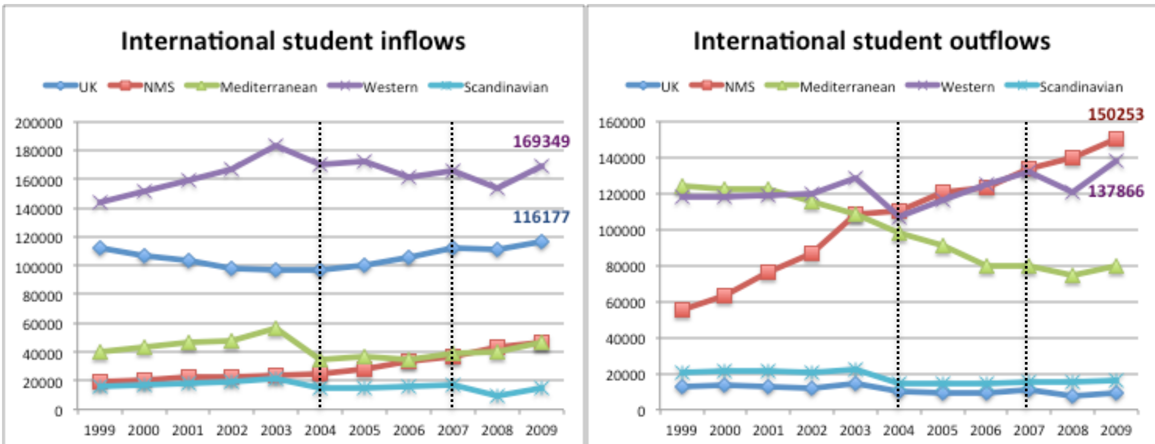
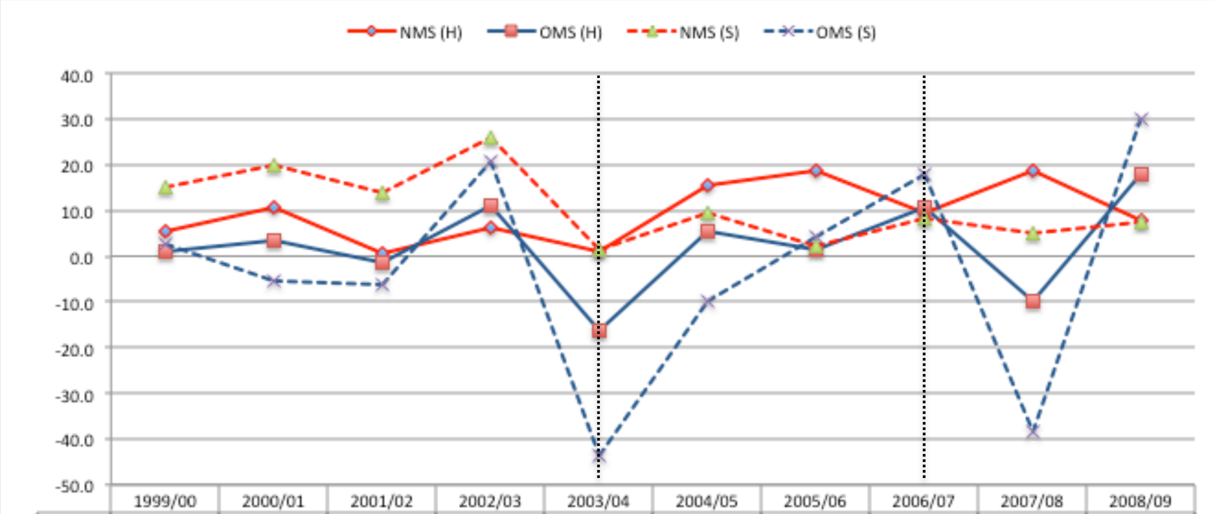


Figure 2. IS inflows and outflows

4 Sample of countries is reported in Table **A4**

5 Description of the dependent variable is given in Table **A5**, whereas the rest in Table **A6, A7, A8**



	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09
NMS (H)	5.5	10.7	0.6	6.1	1.2	15.3	18.6	9.4	18.7	7.9
OMS (H)	1.1	3.3	-1.6	11.0	-16.5	5.5	1.3	10.5	-9.7	17.9
NMS (S)	15.2	19.8	13.7	25.9	1.4	9.4	2.2	8.1	5.1	7.3
OMS (S)	2.7	-5.6	-6.2	20.8	-43.8	-9.8	4.3	17.9	-38.5	30.0

Figure 3. % growth of IS flows

Figure 1 reveals that the UK, Germany and France are the most popular destinations for students from the rest of the EU. Figure 2 illustrates continuously increasing outflows from NMS, whereas increasing inflows to NMS only after the enlargement. However, figure 3 demonstrates fall in growth rates both for NMS and OMS in 2004, possibly because of general uncertainty and adjustment period arisen out of enlargement process. Nevertheless, hereinafter IS flows mostly start increasing at a faster rate, though still being subject to fluctuations, possibly due to economic cycles such as the financial crisis of 2007/08. Figures imply stimulating effect of the border removal on ISM, predominantly to NMS. However, inference cannot be made simply based on the descriptive analysis since IS flows might be subject to other unobserved factors.

4.2. Control variables

	mean	overall	between	within
IS flows	**548.4**	1897.7	**1802.9**	595.9
S.Pop	**1198.5**	1409.9	**1407.5**	97.7
Distance	**1467.0**	737.5	**738.0**	0.0
Income	**23.6**	8.6	**8.4**	2.0
Unempl	**8.2**	3.8	**3.1**	2.2
Quality	**1.1**	2.3	**2.3**	0.3
Fin.aid	**16.0**	11.6	**10.7**	4.4
Int.exp	**0.1**	0.1	**0.1**	0.0
Edu.opp	**1.0**	0.3	**0.3**	0.2
VA	**84.6**	10.8	**10.5**	2.5
RL	**80.7**	15.2	**14.8**	3.2
CC	**79.6**	15.4	**15.0**	3.5
		Standard deviations		

Table 1. Summary statistics (reduced version)

Selection of ISM determinants follows integrative approach of Van der Gaag et al. (2003) and is supported by consumer behaviour, human capital, migration and demand theories. Table 1 supports an appropriateness of controls in explaining bilateral IS flows by demonstrating their large variation between countries and small variation within each country.

Tertiary aged student population is included to control for tendency that larger countries send more students abroad and have more capacity to absorb additional incoming students. (**Fig.1**) Positively correlated with the dependent variable, correlation[6] coefficients vary between 0.17 and 0.36, providing descriptive evidence for the importance of 'mass' in the gravity equation.

Another important variable is average income level, measured as real GDP per capita adjusted to differences in PPP. It captures the fact that wealthier countries have better options to send students abroad and their higher standard of living makes an appeal to majority of students. In addition, unemployment rate, measured as percentage of total labour force, captures country's labour market condition. Countries with lower rates are attractive as prospective place of work after graduation.

Moreover, financial support for tertiary students decreases expected costs of higher education ceteris paribus, thus allowing more prospective students to enter universities. International grants and scholarship facilitate IS flows, whereas support given domestically tends to retain students.

Additionally, there are two important pull factors. First of all, it is international exposure of country's higher education institutions, measured as proportion of foreigners out of total tertiary level students. For instance, survey by Opper et al. (1990) emphasizes that students are highly motivated to experience international setting, even more than quality considerations. Nevertheless, country's quality[7] of higher education institutions is another significant driver, according to human capital theory of education. As proxy to teaching and research quality, this paper counts the number of institutions in the top 100 of Academic Ranking of World Universities (ARWU).

Among push factors, many papers[8] refer to educational opportunities that capture the possibility that students have to seek higher education abroad because of under-supply of university places in their home country. It is measured as proportion of students in tertiary level relative to those in upper secondary education. Data on all above variables are constructed from Eurostat, complemented with data from UIS and World Bank's World Development Indicators (WDI).

Also, CEPII[9] database provides geographic information about weighted distance, contiguity, linguistic similarity and colonial link. These various distance measures, as discussed in section **3.1**, alter moving costs. Hence, larger IS flows are expected for close, contiguous countries that share common language and history.

Additionally, Karemera et al. (2000) emphasize political impact, as better-governed countries tend to attract and retain migration. Therefore, measures of freedom (VA), stability (RL) and corruption control (CC) are taken from World Bank's World Governance Indicators (WGI).

Since sources from which this data is extracted are internationally recognized, values reported are accurate and of high quality.

[6] Table **A9** provides list of all pairwise correlations
[7] Kemp et al. (1998), Bourke (2000), Szelenyi (2006), Van Bouwel & Veugelers (2009)
[8] Agarwal & Winkler (1985), Cummings (1984), McMahon (1992), Gribble (2008)
[9] Centre d'Etudes Prospectives et d'Informations Internationales

Expected sign	Estimation method / VARIABLES	POLS ln(IS flows)	POLS ln(IS flows+1)	FE (one-way) ln(IS flows+1)	FE (two-way) ln(IS flows+1)	RE (two-way) ln(IS flows+1)	PPML FE IS flows	PPML FE IS flows	FE (two-way) ln(IS flows+1)
		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
+	Total enlargement	-0.102	-0.0404	0.343***	**0.591*** **	0.538***	**0.458*** **		
		(0.0823)	(0.0782)	(0.0490)	(0.0696)	(0.0697)	(0.0915)		
+	(**H**) enlargement							**0.383*** **	**0.364*** **
								(0.144)	(0.0680)
+	(**S**) enlargement							**0.386*** **	**0.163** **
								(0.0910)	(0.0662)
+	(**H**) ln(stud. pop)	0.864***	0.847***	-0.653**	-0.706***	0.657***	0.457	0.491	-0.711**
		(0.0545)	(0.0491)	(0.271)	(0.271)	(0.0509)	(0.540)	(0.533)	(0.280)
+	(**H**) ln(income)	0.382	0.424	1.460***	1.910***	1.857***	0.944	0.450	1.842***
		(0.292)	(0.274)	(0.223)	(0.276)	(0.180)	(0.674)	(0.797)	(0.297)
-	(**H**) ln(unempl)	0.242*	0.185	0.0164	0.0415	0.0208	0.169	0.139	0.0425
		(0.130)	(0.120)	(0.0635)	(0.0644)	(0.0645)	(0.113)	(0.113)	(0.0671)
?	(**H**) ln(fin. support)	0.0212	-0.0207	-0.0140	-0.0158	-0.0314*	-0.0115	-0.0148	-0.0134
		(0.0357)	(0.0333)	(0.0168)	(0.0169)	(0.0178)	(0.0345)	(0.0364)	(0.0180)
+	(**H**) ln(VA)	1.870**	1.749**	0.586	1.884***	1.997***	**3.289*** **	**3.265*** **	1.904***
		(0.782)	(0.727)	(0.358)	(0.427)	(0.385)	(0.804)	(0.800)	(0.445)
+	(**H**) ln(RL)	1.953**	2.135***	0.240	-0.700**	-0.836**	0.0794	0.225	-0.703*
		(0.787)	(0.670)	(0.305)	(0.356)	(0.352)	(0.711)	(0.696)	(0.364)
+	(**H**) ln(CC)	-0.854	-0.812*	-0.976***	-1.040***	-0.763***	-0.553	-0.606	-1.041***
		(0.579)	(0.473)	(0.251)	(0.261)	(0.254)	(0.494)	(0.506)	(0.262)
+	(**H**) Int. exposure	0.528***	0.503***	0.273***	0.261***	0.363***	**0.803*** **	**0.767*** **	0.257***
		(0.0591)	(0.0530)	(0.0509)	(0.0569)	(0.0411)	(0.187)	(0.187)	(0.0588)
+	(**H**) HE quality	0.126***	0.139***	0.138***	0.183***	0.194***	-0.00558	0.000645	0.182***
		(0.0278)	(0.0271)	(0.0517)	(0.0485)	(0.0286)	(0.0485)	(0.0505)	(0.0516)
+	(**S**) ln(stud. pop)	0.526***	0.510***	0.0906	0.0771	0.540***	**0.871** **	**0.967** **	0.149
		(0.0469)	(0.0417)	(0.302)	(0.297)	(0.0416)	(0.420)	(0.416)	(0.308)
+	(**S**) ln(income)	0.417	0.402	-0.315	0.164	0.0312	**1.175** **	**1.140** **	0.500
		(0.267)	(0.250)	(0.279)	(0.294)	(0.179)	(0.559)	(0.574)	(0.319)
+	(**S**) ln(unempl)	0.0214	0.0508	-0.0118	0.0197	-0.00549	0.0432	0.0342	0.0189
		(0.119)	(0.109)	(0.0684)	(0.0740)	(0.0683)	(0.101)	(0.0979)	(0.0755)
+	(**S**) ln(fin. support)	0.0957**	0.0583	0.0991***	0.0977***	0.0866***	**0.145*** **	**0.138*** **	0.0768***
		(0.0435)	(0.0374)	(0.0194)	(0.0193)	(0.0178)	(0.0471)	(0.0453)	(0.0219)
-	(**S**) ln(VA)	-1.577*	-1.461*	-0.849**	0.417	0.309	0.759*	0.693	0.376
		(0.825)	(0.767)	(0.429)	(0.425)	(0.407)	(0.438)	(0.425)	(0.429)
-	(**S**) ln(RL)	-1.742***	-1.795***	0.121	-0.816**	-0.942***	-0.521	-0.502	-0.785**
		(0.544)	(0.535)	(0.379)	(0.369)	(0.336)	(0.431)	(0.441)	(0.385)
-	(**S**) ln(CC)	1.266***	1.477***	0.646***	0.602**	0.631***	**1.130*** **	**1.054*** **	0.537**
		(0.430)	(0.418)	(0.234)	(0.241)	(0.228)	(0.286)	(0.292)	(0.251)
-	(**S**) ln(edu.opport)	0.501***	0.381***	-0.322***	-0.326***	-0.205**	-0.171	-0.138	-0.280**
		(0.154)	(0.143)	(0.103)	(0.107)	(0.0949)	(0.192)	(0.199)	(0.112)
-	ln(distance)	-0.774***	-0.795***			-0.723***			
		(0.113)	(0.107)			(0.112)			
+	contiguity	1.078***	1.097***			1.294***			
		(0.254)	(0.251)			(0.264)			
+	common language	0.820**	0.797*			0.744*			
		(0.413)	(0.421)			(0.421)			
+	colonial link	0.706	0.701			0.539			
		(0.433)	(0.436)			(0.439)			
	Constant	-20.65***	-21.90***	0.875	-10.31	-27.34***	-52.87***	-48.87***	-13.52*
		(3.313)	(3.036)	(6.462)	(7.168)	(2.517)	(14.78)	(15.32)	(7.574)
	2000.year				-0.0234	-0.0255	-0.0565*	-0.0428	-0.0384
	2001.year				0.0466	0.0454	-0.0525	-0.0322	0.0214
	2002.year				0.000694	0.0175	-0.108	-0.0767	-0.0324
	2003.year				0.0889	0.0970**	-0.190**	-0.148*	0.0475
	2004.year				-0.565***	-0.524***	**-0.622*** **	**-0.566*** **	-0.452***
	2005.year				-0.395***	-0.352***	**-0.597*** **	**-0.528*** **	-0.293***
	2006.year				-0.355***	-0.316***	**-0.761*** **	**-0.676*** **	-0.266**
	2007.year				-0.393***	-0.353***	**-0.826*** **	**-0.728*** **	-0.305**
	2008.year				-0.487***	-0.451***	**-0.853*** **	**-0.757*** **	-0.402***
	2009.year				-0.107	-0.0715	**-0.718*** **	**-0.637*** **	-0.00587
	country-pair FE			YES	YES	YES	YES	YES	YES
	Observations	6,294	7,150	7,150	7,150	7,150	7,150	7,150	7,150
	R-squared	0.692	0.725	0.941	0.944	0.702	0.948	0.948	0.943
	AIC criteria	21530.1	24095.1	13085.0	12679.1	n/a	n/a	n/a	12873.1
	RESET test p-values	0.0000	0.0000	n/a	n/a	n/a	0.0594	0.0385	n/a

Robust standard errors corrected for clustering by country-pair in parentheses *** p<0.01, ** p<0.05, * p<0.1
Hausman test between (4) and (5) suggests (4), since country-pair effects and regressors are correlated: chi2(28)=164.16; p > chi2 = 0.000

Table 2. Key results

5. Results

Table 2 includes eight different specifications. 1-6 analyze total effect of enlargement[10], whereas last two separate its effect to account for relative strength of directions of IS flows. All variables except dummy variables, HE quality and IS flows under PPML estimation are expressed in natural logarithms. The year dummies are measured relative to that of 1999, to prevent collinearity; and their standard errors are omitted for space consideration. Different criteria such as goodness of fit (R^2), Akaike Information Criteria (AIC) and heteroskedasticity-robust RESET test (Ramsey, 1969) are used to check adequacy of these models (where applicable).

5.1. Main results

Inferences of this study are primarily based on the results of columns 7 and 8 that apply multiplicative gravity model using PPML FE estimation due to being the best-fitted[11] and correctly specified model, thus satisfying the sufficient condition for consistency. RESET test shows no evidence of $[E[\boldsymbol{IS_{ijt}}|x'] = \exp(x'\beta)]$ misspecification and possibility of omitted variable bias. While column 8 reveals symmetric increase in IS flows, specification 7 estimates strongly significant and positive coefficient on enlargement dummy variable, thus confirming the hypothesis that removal of national border and associated mobility barriers increases IS flows approximately by at least **40%-45%** after controlling for various factors, discussed below:

For instance, pooled ordinary least squares (POLS), standard estimation method in gravity analysis, has restrictive assumption of a single intercept, same parameters over time and across pair of countries ($\alpha_{ij} = 0, \alpha_{ji} = 0, \lambda_t = 0$), whereas country-pairs are fundamentally different. Therefore, contradicting effects (**-10%**, **-4%**) of enlargement in columns **1** and **2** suffer from unobserved heterogeneity bias, because of not controlling for fixed pair-specific factors that are correlated with IS flows and with explanatory variables. Although it tries to capture some heterogeneity by considering common language, colonial link, contiguity and distance differences, most of cultural, historical, geographical and political factors (specific to country-pairs) are difficult to observe, let alone quantify.

Therefore, column **3** applies fixed-effects (FE) estimation, which effectively accounts for unobserved heterogeneity by allowing intercept to vary over country-pairs for each direction of IS flows. As a result, it gives significant positive coefficient on enlargement dummy and considerably alters estimates[12] of other regressors. Hence, removal of national border and associated barriers to study abroad increases IS flows by **40%**. Since within transformation (Wallace and Hussain, 1969) of FE leaves out all time invariant variables, it effectively eliminates the need to include them. On the one hand, it enhances accuracy of analysis, as there is a long-standing difficulty with

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[10] $(e^{\phi} - 1)\times 100$ is used to compute effect of dummy variables as % in log-linearized specifications
[11] Model performs strongly, accounting for 95% of the variation in IS flows ($R^2 = 0.948$)
[12] Coefficients are highly **sensitive** because of conditioning on large set of control variables

measuring[13] these factors. On the other hand, they are out of primary focus of the current analysis.

However, assuming one-way error component model ($\lambda_t = 0$) in the presence of time effects gives inconsistent estimates, especially for large sample of country-pairs over fixed period. Thus, by adding (jointly significant) year-dummies, specifications **4** and **8** controls for effects of any omitted variables affecting IS flows that vary over time, but constant across country-pairs. For instance, as discussed in section **4.1**, IS flows are subject to economic cycles such as the financial crisis of 2007-2008, and possibly to general uncertainty or adjustment period arisen out of enlargement process. Furthermore, highly significant coefficients on last six year-dummies might indicate integration of EU member states in the space of single economic market. As a result, coefficient substantially rises, implying enlargement effect of the order of approximately **60%**.

Alternatively, specification **5** applies random-effects (RE) estimation that usually gives more efficient[14] estimates than FE under assumption[15] of exogeneity of all explanatory variables and country-pair effects, treated as part of random disturbances. However, this assumption is rejected, based on Hausman test[16]. Since violation of the assumption infers biased estimates under RE, the analysis of the current paper is based on FE approach, consistent in both cases. Appropriateness of FE has been expected, as data consist of ex ante predetermined selection of country-pairs for finite period of 11 years. (Egger, 2000, Baltagi, 2005:12)

The significance of enlargement effect is **robust**, though slightly lower, under multiplicative form of gravity using PPML FE in columns **6** and **7**. As discussed in section **3.3**, these results are much more prepotent. Firstly, using IS flows in levels naturally accounts for zero-valued observations, thus avoiding bias from transformation. Nevertheless, robustness of results for subset of only positive values of IS flows in table **A18** implies that ln $(IS_{ijt} + 1)$ transformation is valid. Also, PPML is consistent in the presence of heteroskedasticity, whereas transformed error term (ln $\boldsymbol{\varepsilon_{ijt}}$) in log specifications is likely to be correlated with covariates, simply because of Jensen's inequality $E(\ln y) \neq \ln E(y)$, thus violating assumptions of classical disturbance-term. (Santos Silva & Tenreyro, 2006) This explains lower coefficient on enlargement dummy variables in 6,7.

5.2. Auxiliary results

Additionally, columns **6** and **7** predict other significant determinants of IS flows. The level of freedom (3%) and international exposure (0.8%) are important pull factors, which, as expected, considerably attract students. Apparently, it characterizes the most developed member states with long-standing, internationally recognized reputation of their higher education system such as the UK, Germany and France (Fig.1), which are a mainstay of international students and foreigners.

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[13] Head and Mayer (2001) discuss problems of measuring economic distance
[14] It uses both between and within dimensions efficiently
[15] Wooldridge (2008:493) emphasizes practical unlikeliness of such assumption
[16] Table **A18** considers intermediate case, based on Hausman-Taylor (1981), which allows exogeneity for subset of regressors and estimation of time invariant variables (**out of main focus of the analysis**)

Among critical push factors are tertiary-aged population (0.9%), average income per person (1.2%) and (international) financial support (0.15%), which, as expected, extensively facilitate outflows of students. Contrary to initial expectation, lower level of corruption encourages IS outflows at surprisingly large rate (1.1%). Possibly, less corrupted countries tend to have more evenly distributed income among population, so that foreign education is affordable not only to high class, but also to lower and middle-income groups. Based on these findings, one can assure that majority of push factors are common in one: financial considerations play an increasingly crucial role.

Finally, although specifications **1**, **2** and **5** are biased, they could suggest that students tend to choose less distant options to study, whose official language is more or less familiar.

5.3. Overview

The hypothesis of this paper is proved by strongly significant and positive coefficient on enlargement dummy variable, implying that ISM increases at least by 40% as a result of opening the national border. Contrary initial expectations, this effect on ISM is symmetric in both directions of flows, implying that enlargement has facilitated outflows from NMS relatively at the same rate as inflows to NMS, though their absolute numbers differ a lot.

Additionally, some of ISM determinants, that previous studies find influential, turn out to be insignificant, possibly due to analyzing countries that are highly integrated and similar in nature. However, Rodriguez Gonzalez et al. (2010) and Van Bouwel & Veugelers (2009) also analyze EU member countries, but reveal significantly positive coefficient on quality. Similarly, the latter finds significance of educational opportunities. Possibly, such controversial results partially come from their restrictive models. For instance, despite fixed-effects application to their panel data of 30 European countries over 1996-2006, Rodriguez Gonzalez et al. (2010) consider only unilateral IS flows in one direction, whereas Van Bouwel & Veugelers (2009) use cross-country analysis between 19 European countries in 2005. However, since the results, under columns **1-5** and **8,** largely overlap with previous studies, major issue is that their (standard) application of log-linearized gravity model is subject to (overestimation) bias arisen from transformed error term ($\ln \boldsymbol{\varepsilon_{ijt}}$), which is no longer random in the presence of heteroskedasticity. (Santos Silva & Tenreyro, 2006, 2011)

Finally, overall results are not driven by outliers, since being robust to excluding the UK, Germany and/or France in table **A16**.

6. Conclusions

This research project is the first empirical evidence that revealed importance of removal of national border and associated mobility barriers in promoting ISM using EU enlargement of 2004 and 2007. Symmetry of the effect might indicate that this research has managed to discover genuine effect of opening the border, thus feasibly making it applicable to migration literature in general. Moreover, it suggests that conclusions based solely on descriptive statistics analysis are inadequate and subject to biases arisen out of ignoring various factors that are unobserved, but important. Therefore, one should not over-rely on descriptive analysis especially when considering similar countries as highly integrated EU member states.

Additionally, this paper finds other important determinants of ISM by dint of application of sophisticated panel models and consistent econometric techniques that some previous empirical studies have failed to do. The findings are also superior over surveys, which are based on small sample of respondents, whose actual actions might largely differ from desired or supposed ones.

5.1. Limitations

However, the present analysis is also subject to some limitations. First of all, it is a time-in-sample bias[17]. Although the coefficient on enlargement variable is sensitive to a sample period, its alteration is not so large. Therefore, this paper refers to the lowest approximation of enlargement effect since the main focus of the analysis is to determine its significance, but not the exact value. Secondly, some factors are measured by proxy variables that might not effectively capture their true impact. Finally, it assumes a static relationship; whereas there might be presence of hysteresis of IS flows, though considering dynamic panel data drastically changes the focus of this analysis.

5.2. Implications

The most affected groups by ISM are higher education institutions, society and nation. (Fig.A3) Thus, the findings of this paper are of particular interest of country's policymakers. For instance, positive enlargement effect could encourage Croatia (acceding country that will become 28th member of the EU on 01.07.13) and candidate countries including Macedonia, Iceland, Montenegro, Serbia and Turkey to join the EU as one more expected benefit arisen out of their accession. Similarly, these results might be practical to other blocs of countries that are interested in higher education integration through ISM. Shoot up in mobility capital through removal of educational barriers could be a decisive incentive in fostering further mobility exponentially.

Additionally, information about drivers of ISM is valuable source for higher education institutions in their strategic actions in response to internal and external factors in increasingly competitive environment where higher education is becoming more as a tradable service in highly globalized

[17] Table **A17** considers different sample periods

world. Similarly, on the country level, governments could manipulate student flows by effectively altering relevant determinants of ISM, which might be feasible on general migrants as well.

5.3. Future improvements

This paper is subject to further extensions and modifications. One could re-estimate the model conditioning on other/larger set of controls, better proxy variables, alternative econometric techniques (Tobit) and more sophisticated (dynamic) models. Alternatively, one could re-estimate the results for subset of bachelor, master or doctoral level students, if such separate data exist. Due to typical age differences between these groups, different factors play role in the determination of their mobility. Also, one could consider possible third-party effect by extending analysis to other countries. Finally, one could undertake in-depth analysis using interaction terms with enlargement dummy variable, thus allowing for possibility of structural change and estimating determinants' relative effects on NMS and OMS flows.

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Appendix

1999	2001	2003	2005	2007
Bologna Declaration:	**Prague Declaration:**	**Berlin Summit:**	**Bergen Summit:**	**London Summit:**
Six action lines: 1) Adoption of easily readable and comparable degrees 2) System of two-cycle of degrees (undergraduate and graduate degrees) 3) System of credits (ECTS) 4) Promotion of mobility 5) Promotion of quality assurance 6) Promotion of the European Dimensions of Higher Education	Three action lines: 7) Lifelong learning 8) Involvement of students in HE institutions 9) Attractiveness and competitiveness of European HE	One action line: 10) Third-cycle (doctoral studies)		
Signatories: Austria, Belgium, Bulgaria, Czech republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, Swiss Confederation. United Kingdom	**Signatories:** Croatia, Cyprus, Liechtenstein, Turkey	**Signatories:** Albania, Andorra, Bosnia and Herzegovina, the Holy See, Russia, Serbia and Montenegro, Former Republic of Macedonia	**Signatories:** Armenia, Azerbaijan, Georgia, Moldova, Ukraine	**Signatory:** Montenegro

Table A1. Milestones in the Bologna Process (the European world of higher education), Davies (2008)

Survey analysis	
Authors	Variables
Opper et al. (1990)	International experience (+), learn foreign language (+), academic motives (+)
Orr et al. (2011)	Educational background (+), foreign language abilities (+)
Wiers-Jenssen (2011)	Educational background (+), international exposure (+)
Gonzalez et al. (2011)	Price level (-), geographic distance (-), quality of HE (+), warm climate (+)

Regression analysis		
Authors	Countries	Variables
Lee & Tan (1984)	From 103 countries to the USA, France and the UK	Distance (-), per capita income (+), cost of living (+), GNP growth rate (+), excess demand (+), share of science (-), staff-student ratio (-), real cost per student (+), colonial links (+)
Cummings (1984)	From 34 countries to the USA	Population (-), financial capacity (+), HR capacity (+), domestic opportunities (-), interdependence (+), previous overseas students (+)
Agarwal & Winkler (1985)	From 15 developing countries to the USA	Income (+), educational opportunity (-), English speaking (+), French speaking (+/-), probability of migration (+/-)
McMahon (1992)	From 18 developing countries to the USA	Economic strength (-), global trade (+), state priority on education (+), availability (-), relative economic strength (-)
Thissen & Ederveen (2006)	19 European countries	Physical distance (-), religious distance (-), cultural & linguistic distance (.), population (+), GDP per capita (+), quality (+), unemployment (-)

Gravity models		
Van Bouwel &Veugelers (2010)	19 European countries	Quality (+), student population (+), distance (-), border (+), openness (+), educational opportunities (+)
Rodríguez González et al. (2011)	EU27, Iceland, Norway, Turkey	Distance (-), population (+), quality (+), cost of living (-/+), climate (+), language ()
Bessey (2012)	From 172 countries to Germany	Distance (-), population (+), stock of students (+), GDP per capita (+), freedom (+), contiguity (-), landlocked (+)

Table A2. Overview of empirical studies on the determinants of international student mobility

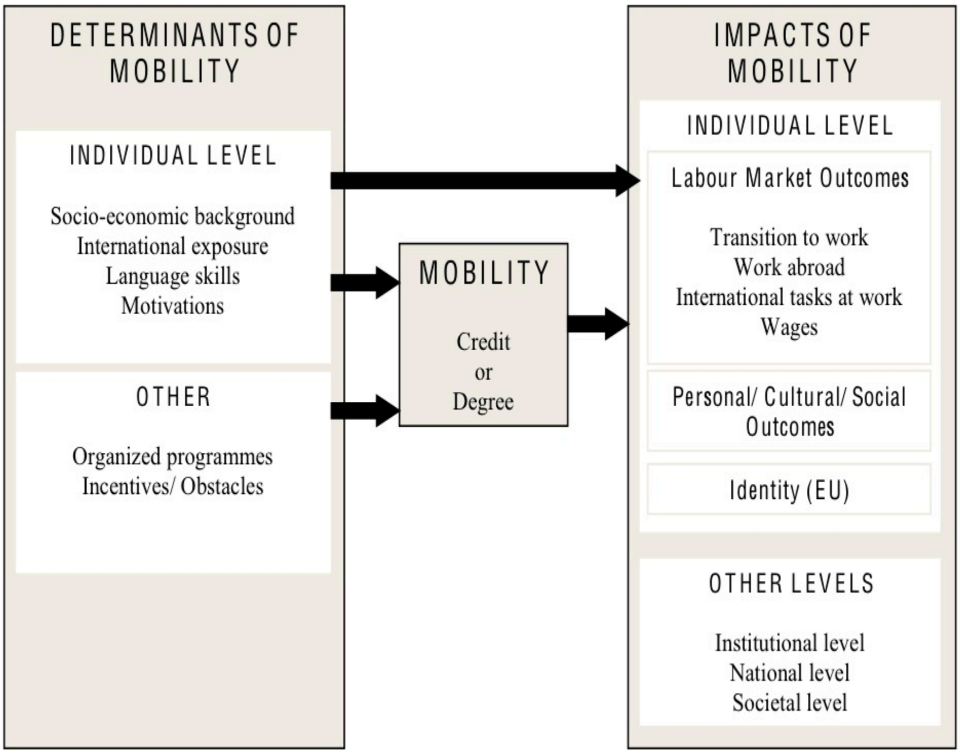


Figure A3. Conceptual framework of ISM phenomenon (Rodrigues, 2012)

OMS (before 2004)	NMS (joined in 2004)	NMS (joined in 2007)
Austria (AUT)	Republic of Cyprus (CYP)	Bulgaria (BGR)
Belgium (BEL)	Czech Republic (CZE)	Romania (ROU)
Denmark (DNK)	Estonia (EST)	
Finland (FIN)	Hungary (HUN)	
France (FRA)	Latvia (LVA)	
Germany (DEU)	Lithuania (LTU)	
Greece (GRC)	Malta (MLT)	
Ireland (IRL)	Poland (POL)	
Italy (ITA)	Slovakia (SVK)	
~~Luxembourg (LUX)~~	Slovenia (SVN)	
Netherlands (NLD)		
Portugal (PRT)		
Spain (ESP)		
Sweden (SWE)		
United Kingdom (GBR)		

Table A4. Sample of countries

Table A4 Note: Luxembourg is excluded from the analysis because of largely missing data. In fact, Luxembourg had its first higher education institution only since 2004, while previously being a net exporter of students only. Groups in OMS are coloured in accordance with Figure 1 and 2 in section 4.1

The International Standard Classification of Education (ISCED) was designed by UNESCO in the early 1970's to serve 'as an instrument suitable for assembling, compiling and presenting statistics of education both within individual countries and internationally'. It was approved by the International Conference on Education (Geneva, 1975), and was subsequently endorsed by UNESCO's General Conference when it adopted the Revised Recommendation concerning the International Standardization of Educational Statistics at its twentieth session (Paris, 1978). The present classification, now known as ISCED 1997, was approved by the UNESCO General Conference at its 29th session in November 1997.

Level 5: First stage of tertiary education (not leading directly to an advanced research qualification): Bachelor or equivalent, Master or equivalent

This level consists of tertiary programmes having an educational content more advanced than those offered at levels 3 (upper secondary education) and 4 (post-secondary non- tertiary education). Entry to these programmes normally requires the successful completion of ISCED level 3A or 3B or a similar qualification at ISCED level 4A.

For the definition of this level, the following criteria are relevant:

- ✓ normally the minimum entrance requirement to this level is the successful completion of ISCED level 3A or 3B or ISCED level 4A;
- ✓ level 5 programmes do not lead directly to the award of an advanced research qualification (level 6); and
- ✓ these programmes must have a cumulative theoretical duration of at least 2 years from the beginning of level 5.

There is a distinction between the programmes which are theoretically based/research preparatory (history, philosophy, mathematics, etc.) or giving access to professions with high skills requirements (e.g. medicine, dentistry, architecture, etc.) (level 5A), and those programmes which are practical/technical/occupationally specific (level 5B).

Level 6 – Second stage of tertiary education (leading to an advanced research qualification): Doctoral or equivalent

This level is reserved for tertiary programmes, which lead to the award of an advanced research qualification. The programmes are therefore devoted to advanced study and original research and are not based on course-work only.

It typically requires the submission of a thesis or dissertation of publishable quality which is the product of original research and represents a significant contribution to knowledge. It prepares graduates for faculty posts in institutions offering ISCED 5A programmes, as well as research posts in government, industry, etc.

Table A5. International Standard Classification of Education (ISCED, 1997)

Sign	Variable	Definition	Unit	Source
n/a	IS flows	Internationally mobile students enrolled at tertiary level education (ISCED5,6), includes degree mobility, but excludes credit mobility	tertiary level students	UIS
H: + S: +	Student population	Tertiary age population	thousands people	UIS
H: + S: +	Average income per person	Real GDP per capita adjusted to differences in purchasing power parity (PPP), constant 2005 international US dollars. Measure of wealth of country's population; country's standard of living and quality of life, since PPP adjusts to	thousands $	WDI

		differences in cost of living and inflation rates		
-	Weighted distance	Weighted distance between two countries based on bilateral distances between the biggest cities of those countries	kilometers	CEPII
+	Contiguity	Dummy variable set equal to 1 for contiguous countries	1; 0	CEPII
+	Colonial link	Dummy variable set equal to 1 for having a colonial link	1; 0	CEPII
+	Common language	Dummy variable set equal to 1 for language spoken by at least 9% of the population in both countries	1; 0	CEPII
H:+	HE quality	Number of higher education institutions included in top 100 of Academic Ranking of World Universities (ARWU)	universities	ARWU
H: - S: +	Unemploymen t rate	Unemployment rate as % of total labor force	percentage point	WDI
H: + S: +	Financial support	Financial aid to students as % of total public expenditure on education, at tertiary level of education (ISCED 5,6)	percentage point	Eurostat
S: -	Educational opportunity	The proportion of students in tertiary education (ISCED5,6) relative to the number of students in upper secondary education (ISCED 3)	proportion	UIS
	Tertiary level students	Enrolment in total tertiary education (ISCED 5,6)	students	UIS
	Upper secondary	Enrolment in upper secondary education (ISCED 3)	students	UIS
H: +	International exposure	The proportion of foreign students relative to the number of students in tertiary education (ISCED5,6)	proportion	Eurostat
	Foreign students	Students whose nationality differs from that of the country in which they enroll	students	Eurostat
H: + S: -	Voice and accountability (VA)	Reflects perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	percentile rank (ranges from 0 (lowest) to 100 (highest) rank)	WGI
H: + S: -	Rule of law (RL)	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	percentile rank (ranges from 0 (lowest) to 100 (highest) rank)	WGI
H: + S: -	Control of corruption (CC)	Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	percentile rank (ranges from 0 (lowest) to 100 (highest) rank)	WGI

Table A6. Description of variables

Kaufmann et al. (2010) give detailed info of WGI; Mayer & Zignago (2006) give detailed info of CEPII variables

Dependent variable	unit of measure	source	obs	mean	overall	between	within	min	max	skew.	kurtosis
IS flows	**tertiary level students**	**UIS**	7150	**548.4**	1897.7	**1802.9**	595.9	**0.0**	**30186.0**	6.6	61.3
Gravity var.											
Student population	tertiary aged people (000)	UIS	7150	**1198.5**	1409.9	**1407.5**	97.7	**30.3**	**5046.6**	1.3	3.2
Weighted distance	kilometers	CEPII	7150	**1467.0**	737.5	**738.0**	0.0	**160.9**	**3779.7**	0.6	2.9
Economic var.											
real GDP/capita	000 (2000's USD) PPP	WDI	7150	**23.6**	8.6	**8.4**	2.0	**6.7**	**41.1**	-0.2	1.9
Labour market var.											
Unemployment rate	% of labour force	WDI	7150	**8.2**	3.8	**3.1**	2.2	**2.1**	**19.9**	1.2	4.2
Educational var.											
HE quality	# of institutions in top100	ARWU	7150	**1.1**	2.3	**2.3**	0.3	**0.0**	**11.0**	2.7	10.3
HE financial support	% of total educ. expend.	Eurostat	7150	**16.0**	11.6	**10.7**	4.4	**0.1**	**59.0**	1.4	5.7
Int. exposure	foreign/tertiary	Eurostat	7150	**0.1**	0.1	**0.1**	0.0	**0.0**	**0.3**	1.7	5.8
Edu. opportunties	tertiary/upper secondary	Eurostat	7150	**1.0**	0.3	**0.3**	0.2	**0.3**	**2.0**	0.9	3.6
Political var.											
Voice and account.	percentile rank [0;100]	WGI	7150	**84.6**	10.8	**10.5**	2.5	**55.8**	**100.0**	-0.5	2.5
Rule of law	percentile rank [0;100]	WGI	7150	**80.7**	15.2	**14.8**	3.2	**37.3**	**100.0**	-0.7	2.6
Corruption control	percentile rank [0;100]	WGI	7150	**79.6**	15.4	**15.0**	3.5	**47.3**	**100.0**	-0.4	2.1
					Standard deviations						

Table A7. Summary statistics for full sample

Dependent variable	unit of measure	source	obs	mean	overall	between	within	min	max	skew.	kurtosis
IS flows	**tertiary level students**	**UIS**	6294	**623.0**	2011.1	**1817.0**	634.6	**1.0**	**30186.0**	6.2	54.3
Gravity variables											
Student population	tertiary aged people (000)	UIS	6294	**1302.7**	1457.8	**1414.3**	102.8	**30.3**	**5046.6**	1.1	2.7
Weighted distance	kilometers	CEPII	6294	**1418.5**	724.1	**733.1**	0.0	**160.9**	**3779.7**	0.6	2.8
Economic var.											
real GDP/capita	000 (2000's USD) PPP	WDI	6294	**24.6**	8.4	**8.2**	1.9	**6.7**	**41.1**	-0.4	2.0
Labour market var.											
Unemployment rate	% of labour force	WDI	6294	**8.0**	3.6	**3.0**	2.1	**2.1**	**19.9**	1.3	4.7
Educational var.											
HE quality	# of institutions in top100	ARWU	6294	**1.3**	2.4	**2.4**	0.4	**0.0**	**11.0**	2.5	9.1
HE financial support	% of total educ. expend.	Eurostat	6294	**15.8**	11.1	**10.9**	4.1	**0.1**	**59.0**	1.4	5.8
Int. exposure	foreign/tertiary	Eurostat	6294	**0.1**	0.1	**0.0**	0.0	**0.3**	**0.3**	1.6	5.6
Edu. opportunties	tertiary/upper secondary	Eurostat	6294	**1.0**	0.3	**0.3**	0.2	**0.3**	**2.0**	1.0	3.6
Political var.											
Voice and account.	percentile rank [0;100]	WGI	6294	**85.6**	10.5	**10.4**	2.5	**55.8**	**100.0**	-0.6	2.7
Rule of law	percentile rank [0;100]	WGI	6294	**82.1**	14.7	**14.6**	2.9	**37.3**	**100.0**	-0.8	2.7
Corruption control	percentile rank [0;100]	WGI	6294	**80.9**	15.1	**14.9**	3.3	**30.2**	**100.0**	-0.6	2.5
					Standard deviations						

Table A8. Summary statistics for subset of positive-valued IS flows

		Host country's characteristics		Sending country's characteristics	
Enlargement	-0.1091	(H) Enlargement	-0.1226	(S) Enlargement	-0.0407
Weighted distance	-0.1432	(H) Student population	0.358	(S) Student population	0.1741
Contiguity	0.2667	(H) Income per capita	0.2048	(S) Income per capita	0.048
Common language	0.2051	(H) Unemployment rate	-0.0698	(S) Unemployment rate	0.0459
Colonial link	0.189	(H) Financial support	0.0378	(S) Financial support	-0.0405
		(H) Voice and accountability	0.1479	(S) Voice and accountability	-0.0077
		(H) Rule of Law	0.1725	(S) Rule of Law	-0.0124
		(H) Control of corruption	0.1788	(S) Control of corruption	-0.105
		(H) HE Quality	0.4562	(S) Educational opportunity	0.0031
		(H) International exposure	0.1745		
		(H) Scandinavian	-0.063	(S) Scandinavian	-0.0589
		(H) Western	0.1562	(S) Western	0.0764
		(H) Mediterrainian	-0.0278	(S) Mediterrainian	0.1003
		(H) UK	0.386	(S) UK	-0.0113
		(H) NMS	-0.2204	(S) NMS	-0.0951

Table A9. Pairwise correlations of all variables with the dependent variable (IS flows)

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of lstudent1

         chi2(1)      =    12.15
         Prob > chi2  =   0.0005
```

Figure A10. Breusch-Pagan test for heteroskedasticity. Reject the null of homoscedasticity. There is a strong evidence for presence of heteroskedasticity under various specifications. Therefore, this paper applies robust standard errors. It is prudent to use robust standard errors as they are correct irrespective of whether the error term is heteroskedastic, but are inefficient if the error term is homoskedastic; whereas OLS standard errors are efficient only when the error term is homoskedastic, but are wrong, if the error variance is heteroskedastic.

```
Test:  Ho:  difference in coefficients not systematic

                 chi2(28) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      164.16
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```

Figure A11. Hausman specification test. Reject the null of equality of coefficients between FE (4) and RE (5) from Table 2. Hence, it suggests FE as better specified model.

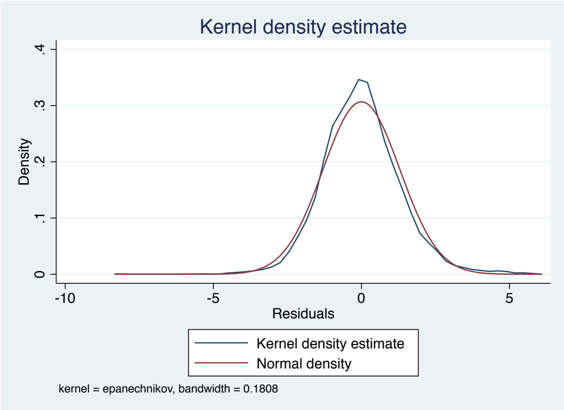
```
Breusch and Pagan Lagrangian multiplier test for random effects

        lstudent1[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                    |       Var     sd = sqrt(Var)
            --------+-----------------------------
          lstudent1 |   6.153587       2.480642
                  e |   .3779263       .6147571
                  u |   1.177594        1.08517

        Test:   Var(u) = 0
                             chibar2(01) = 19139.17
                          Prob > chibar2 =   0.0000
```

Figure A12. Breusch-Pagan LM test for random effects rejects the null hypothesis that specific country-pair effects are not random in specification 5 from Table 2. Therefore, there is some evidence that country-pair effects are random (but not entirely). However, Hausman test (Fig.A11) favours FE as better specified model. Therefore, truth is somewhere in between. It gives support to use Hausman-Taylor estimation that consider intermediate cases that allows exogeneity of subset of regressors. See table A18.

```
. test h_enlarge = s_enlarge

 ( 1)  [student]h_enlarge - [student]s_enlarge = 0

           chi2(  1) =    0.00
         Prob > chi2 =    0.9832
```

```
. test h_enlarge = s_enlarge

 ( 1)  h_enlarge - s_enlarge = 0

       F(  1,   649) =    5.14
            Prob > F =    0.0237
```

Figure A13. (Left) Specification 7 (PPML FE) from Table 2: there is largely strong evidence that the coefficients on two enlargement dummies are equal. (Right) Specification 8 (FE) from Table 2: equality of coefficients on two enlargement dummies are rejected at 5% significance level, though do not rejected at 1% level. Since inferences are based on PPML FE, enlargement effect is symmetric in both directions.



Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
lstudent1_~s	7.2e+03	0.0000	0.0000	.	0.0000

Figure A14. There is strong evidence that disturbance term is normally distributed under all 1-8 specification in table 2, because according to central limit theorem, error term is approximately normally distributed for n > 30, regardless of the error term. Normality assumption allows undertaking standard testing procedures such as F-test etc.

VARIABLES	(1) IS flows	(2) IS flows	(3) IS flows	(4) IS flows	(5) IS flows	(6) IS flows	(7) IS flows	(8) IS flows	(9) IS flows	(10) IS flows
Total enlargement	-0.342*	-0.101	-0.0869	-0.0862	-0.109	-0.275	-0.308	-0.303	0.408***	0.458***
	(0.200)	(0.166)	(0.166)	(0.200)	(0.195)	(0.188)	(0.192)	(0.207)	(0.0808)	(0.0915)
(H) ln(stud. pop)	0.970***	0.869***	0.972***	0.970***	0.980***	0.854***	0.705***	0.704***	-0.0783	0.457
	(0.110)	(0.0961)	(0.123)	(0.117)	(0.107)	(0.0973)	(0.144)	(0.145)	(0.590)	(0.540)
(H) ln(income)		2.137***	1.637***	1.447***	0.678	0.492	0.799	0.814	-1.205**	0.944
		(0.376)	(0.355)	(0.420)	(0.782)	(0.775)	(0.819)	(0.842)	(0.480)	(0.674)
(H) ln(unempl)			-0.608**	-0.547**	-0.541**	-0.325	-0.134	-0.130	-0.0550	0.169
			(0.275)	(0.263)	(0.256)	(0.282)	(0.301)	(0.305)	(0.108)	(0.113)
(H) ln(fin. support)				0.127	0.189	-0.0557	-0.132	-0.133	-0.00640	-0.0115
				(0.171)	(0.164)	(0.141)	(0.149)	(0.150)	(0.0331)	(0.0345)
(H) ln(VA)					-4.056***	-2.296	-2.016	-1.958	1.985***	3.289***
					(1.522)	(1.490)	(1.431)	(1.471)	(0.697)	(0.804)
(H) ln(RL)					6.462***	2.054	1.869	1.835	1.657*	0.0794
					(2.082)	(1.770)	(1.846)	(1.810)	(0.870)	(0.711)
(H) ln(CC)					-2.077	-0.605	-0.987	-1.017	-0.602	-0.553
					(1.860)	(1.608)	(1.590)	(1.659)	(0.478)	(0.494)
(H) Int. exposure						0.758***	0.663***	0.667***	0.464***	0.803***
						(0.134)	(0.164)	(0.167)	(0.177)	(0.187)
(H) HE quality							0.0574	0.0576	-0.00708	-0.00558
							(0.0505)	(0.0505)	(0.0420)	(0.0485)
(S) ln(stud. pop)	0.469***	0.474***	0.418***	0.418***	0.343***	0.347***	0.347***	0.344***	0.827**	0.871**
	(0.101)	(0.0995)	(0.0961)	(0.0985)	(0.114)	(0.112)	(0.110)	(0.109)	(0.420)	(0.420)
(S) ln(income)		0.167	0.432*	0.441*	1.684***	1.476***	1.464***	1.478***	0.0769	1.175**
		(0.199)	(0.234)	(0.265)	(0.509)	(0.502)	(0.490)	(0.475)	(0.541)	(0.559)
(S) ln(unempl)			0.476**	0.461**	0.454**	0.465**	0.460**	0.471**	-0.0699	0.0432
			(0.215)	(0.206)	(0.214)	(0.216)	(0.219)	(0.232)	(0.117)	(0.101)
(S) ln(fin. support)				-0.0131	-0.0903	-0.0834	-0.0834	-0.0895	0.123*	0.145***
				(0.122)	(0.120)	(0.116)	(0.115)	(0.0983)	(0.0632)	(0.0471)
(S) ln(VA)					-4.172***	-4.815***	-4.931***	-4.944***	-0.410	0.759*
					(1.486)	(1.505)	(1.576)	(1.571)	(0.525)	(0.438)
(S) ln(RL)					-1.896**	-1.655*	-1.592*	-1.530	0.456	-0.521
					(0.912)	(0.946)	(0.963)	(1.027)	(0.473)	(0.431)
(S) ln(CC)					2.056***	2.487***	2.492***	2.442***	1.307***	1.130***
					(0.751)	(0.794)	(0.810)	(0.782)	(0.252)	(0.286)
(S) ln(edu.opport)								-0.0582	-0.146	-0.171
								(0.270)	(0.168)	(0.192)
Constant	-13.54***	-35.66***	-33.73***	-32.21***	-19.49***	-6.383	-6.356	-6.597	-12.96	-52.87***
	(2.163)	(5.271)	(4.503)	(4.358)	(6.073)	(6.285)	(6.444)	(6.596)	(11.96)	(14.78)
country-pair FE	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
year FE	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
R-squared	0.3928	0.4763	0.493	0.4943	0.5366	0.5747	0.5776	0.5777	0.9667	0.9698
Observations	7,150	7,150	7,150	7,150	7,150	7,150	7,150	7,150	7,150	7,150
(robust s.e.)	*** p<0.01,	** p<0.05,	* p<0.1							

Table A15. This extra table demonstrates how inclusion of control variables one by one affects the size of enlargement effect under multiplicative gravity model using PPML approach. 1-8 POLS; 9-10 FE. Apparently, adding each additional control improves goodness-of-fit of the model. However, accounting for country-pair fixed-effects and time effects improves the model the most.

	FE	FE	FE	FE	FE	FE PPML	FE PPML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	ln(IS flows+1)	ln(IS flows+1)	ln(IS flows+1)	ln(IS flows+1)	ln(IS flows+1)	IS flows	IS flows
Total enlargement	0.570***	0.610***	0.601***	0.589***	0.601***	0.503***	0.639***
	(0.0725)	(0.0740)	(0.0756)	(0.0772)	(0.0852)	(0.0949)	(0.110)
(**H**) ln(stud. pop)	-0.637**	-0.667**	-0.825***	-0.564*	-0.673**	0.478	0.00999
	(0.283)	(0.280)	(0.282)	(0.300)	(0.315)	(0.483)	(0.532)
(**H**) ln(income)	1.793***	1.701***	1.997***	1.563***	1.602***	1.054	1.253
	(0.275)	(0.284)	(0.305)	(0.281)	(0.313)	(0.720)	(0.787)
(**H**) ln(unempl)	0.0160	0.00639	0.0787	-0.0198	0.0106	-0.0475	-0.0139
	(0.0669)	(0.0671)	(0.0691)	(0.0696)	(0.0752)	(0.116)	(0.126)
(**H**) ln(fin. support)	-0.0165	-0.00840	-0.0135	-0.00728	-0.00416	-0.0697	0.0118
	(0.0176)	(0.0176)	(0.0174)	(0.0184)	(0.0190)	(0.0720)	(0.0676)
(**H**) ln(VA)	1.901***	1.940***	1.870***	1.996***	1.999***	4.540***	4.417***
	(0.454)	(0.434)	(0.437)	(0.469)	(0.483)	(0.766)	(0.758)
(**H**) ln(RL)	-0.639*	-0.811**	-0.842**	-0.772**	-0.922**	-0.382	-1.225
	(0.369)	(0.361)	(0.368)	(0.378)	(0.389)	(0.813)	(0.874)
(**H**) ln(CC)	-1.093***	-0.964***	-1.059***	-1.016***	-1.008***	-1.076**	-0.855*
	(0.248)	(0.263)	(0.271)	(0.249)	(0.259)	(0.505)	(0.479)
(**H**) Int. exposure	0.270***	0.228***	0.249***	0.239***	0.229***	0.612***	0.590***
	(0.0590)	(0.0573)	(0.0578)	(0.0593)	(0.0605)	(0.188)	(0.201)
(**H**) HE quality	0.171**	0.205***	0.208***	0.208**	0.233**	0.0640	0.0997
	(0.0678)	(0.0551)	(0.0532)	(0.0889)	(0.100)	(0.0791)	(0.105)
(**S**) ln(stud. pop)	0.0822	0.0228	-0.00145	0.00716	-0.133	0.159	0.286
	(0.309)	(0.310)	(0.311)	(0.322)	(0.340)	(0.476)	(0.532)
(**S**) ln(income)	0.0610	0.165	0.280	0.0531	0.189	0.980**	0.883
	(0.300)	(0.303)	(0.307)	(0.309)	(0.323)	(0.482)	(0.541)
(**S**) ln(unempl)	0.0221	0.0228	0.0524	0.0252	0.0640	0.178*	0.189
	(0.0770)	(0.0780)	(0.0784)	(0.0811)	(0.0866)	(0.102)	(0.141)
(**S**) ln(fin. support)	0.101***	0.0961***	0.0992***	0.0985***	0.0975***	0.214***	0.236***
	(0.0205)	(0.0199)	(0.0199)	(0.0211)	(0.0219)	(0.0552)	(0.0594)
(**S**) ln(VA)	0.475	0.387	0.263	0.436	0.231	1.315**	1.477*
	(0.441)	(0.445)	(0.450)	(0.462)	(0.491)	(0.615)	(0.893)
(**S**) ln(RL)	-0.867**	-0.875**	-0.805**	-0.916**	-0.880**	-0.906	-1.069
	(0.385)	(0.384)	(0.387)	(0.402)	(0.426)	(0.618)	(0.821)
(**S**) ln(CC)	0.616**	0.601**	0.538**	0.616**	0.541**	1.264***	1.691***
	(0.247)	(0.250)	(0.252)	(0.257)	(0.270)	(0.347)	(0.401)
(**S**) ln(edu.opport)	-0.348***	-0.312***	-0.322***	-0.328***	-0.308**	0.0195	0.0295
	(0.112)	(0.111)	(0.111)	(0.117)	(0.123)	(0.162)	(0.167)
Constant	-9.394	-8.072	-8.405	-7.154	-4.336		
Observations	6,600	6,600	6,600	6050	5500	6050	5500
country-pair FE	YES	YES	YES	YES	YES	YES	YES
year FE	YES	YES	YES	YES	YES	YES	YES
Excluded	GBR	DEU	FRA	GBR, DEU	GBR, DEU, FRA	GBR, DEU	GBR, DEU, FRA

Robust standard errors in parenthes
*** p<0.01, ** p<0.05, * p<0.1

Figure A16. This extra table illustrates how excluding certain countries (regarded as outliers due to the sizeable difference in IS flows from the rest of sample as discussed in section 3.1 and shown in fig.1) affects the size of enlargement effect, as well as estimates of other determinants. 1-5 FE; 6-7 PPML FE. It shows that the results, found in Table 2, are robust to excluding the largest countries such as the UK, Germany and France, thus proving that key results under Table 2 are not driven by the outliers.

	FE PPML	FE PPML	FE PPML	FE PPML	FE	FE	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	IS flows	IS flows	IS flows	IS flows	ln(IS flows+1)	ln(IS flows+1)	ln(IS flows+1)	ln(IS flows+1)
Total enlargement	0.384***	0.308***	0.287***	0.177	0.511***	0.412***	0.450***	0.440***
	(0.0842)	(0.0823)	(0.0910)	(0.137)	(0.0717)	(0.0674)	(0.0751)	(0.0780)
(**H**) ln(stud. pop)	0.624	-0.238	-1.272*	1.577	-0.682**	-1.096***	-1.386***	-2.059***
	(0.552)	(0.574)	(0.752)	(1.313)	(0.315)	(0.362)	(0.444)	(0.663)
(**H**) ln(income)	1.102	0.843	0.522	-0.0860	2.399***	1.833***	1.948***	0.0328
	(0.694)	(0.830)	(1.143)	(2.248)	(0.364)	(0.427)	(0.524)	(0.805)
(**H**) ln(unempl)	0.287**	0.469**	0.597**	0.530	0.134	0.0981	0.146	0.0571
	(0.139)	(0.199)	(0.246)	(0.388)	(0.0937)	(0.115)	(0.142)	(0.176)
(**H**) ln(fin. support)	-0.0298	-0.0329	0.0221	-0.0125	-0.0144	0.00201	0.00592	-0.0360*
	(0.0368)	(0.0306)	(0.0556)	(0.0880)	(0.0177)	(0.0173)	(0.0194)	(0.0187)
(**H**) ln(VA)	4.280***	4.814***	4.703***	3.398***	2.153***	2.976***	3.703***	5.476***
	(0.850)	(0.870)	(0.826)	(0.780)	(0.495)	(0.504)	(0.525)	(0.662)
(**H**) ln(RL)	0.272	0.195	0.993	6.620***	-0.476	-0.439	-0.218	4.875***
	(0.607)	(0.536)	(0.641)	(1.321)	(0.454)	(0.404)	(0.440)	(0.698)
(**H**) ln(CC)	-0.943*	-1.153**	-0.992*	-5.592***	-1.146***	-1.546***	-1.626***	-2.604***
	(0.565)	(0.529)	(0.591)	(1.141)	(0.325)	(0.307)	(0.339)	(0.462)
(**H**) Int. exposure	0.704***	0.201	-0.216	-0.224	0.308***	-0.00773	-0.132	0.0980
	(0.166)	(0.187)	(0.254)	(0.332)	(0.0673)	(0.0670)	(0.0859)	(0.127)
(**H**) HE quality	0.0223	0.0997***	0.170***	0.161***	0.168***	0.224***	0.274***	0.313***
	(0.0414)	(0.0357)	(0.0369)	(0.0328)	(0.0525)	(0.0498)	(0.0506)	(0.0497)
(**S**) ln(stud. pop)	0.707	0.826*	0.504	-0.482	0.0649	0.248	0.658	1.194*
	(0.433)	(0.438)	(0.515)	(0.915)	(0.349)	(0.382)	(0.476)	(0.680)
(**S**) ln(income)	1.211**	1.265*	1.980**	0.884	-0.143	-0.237	-0.616	-2.637***
	(0.592)	(0.658)	(0.785)	(1.153)	(0.345)	(0.421)	(0.541)	(0.866)
(**S**) ln(unempl)	0.0147	0.0377	0.153	0.106	-0.0340	-0.0303	-0.0360	-0.124
	(0.133)	(0.150)	(0.174)	(0.219)	(0.0957)	(0.111)	(0.130)	(0.180)
(**S**) ln(fin. support)	0.170***	0.160***	0.142***	0.104***	0.0999***	0.0879***	0.0652***	0.0247
	(0.0458)	(0.0419)	(0.0343)	(0.0389)	(0.0208)	(0.0204)	(0.0213)	(0.0254)
(**S**) ln(VA)	0.386	0.0826	-0.0360	0.191	0.0187	-0.172	-0.144	0.416
	(0.521)	(0.492)	(0.490)	(0.706)	(0.482)	(0.460)	(0.473)	(0.633)
(**S**) ln(RL)	-0.120	-0.0210	0.450	2.093*	-0.455	-0.617	-0.501	-0.938
	(0.560)	(0.488)	(0.453)	(1.134)	(0.486)	(0.449)	(0.500)	(0.859)
(**S**) ln(CC)	1.006***	0.852***	0.132	-0.778	0.689**	0.691**	0.761*	1.219*
	(0.297)	(0.308)	(0.455)	(1.178)	(0.314)	(0.308)	(0.394)	(0.627)
(**S**) ln(edu.opport)	-0.285	-0.396*	-0.764***	-0.763**	-0.381***	-0.383***	-0.315*	-0.307
	(0.203)	(0.209)	(0.283)	(0.369)	(0.128)	(0.142)	(0.177)	(0.190)
y01	0.0127				0.0690***			
	(0.0228)				(0.0221)			
y02	-0.0523	-0.0625			0.0161	-0.0506*		
	(0.0475)	(0.0486)			(0.0343)	(0.0295)		
y03	-0.128**	-0.0729	0.0532		0.0963*	0.0742	0.128***	
	(0.0629)	(0.0655)	(0.0394)		(0.0505)	(0.0452)	(0.0358)	
y04	-0.578***	-0.523***	-0.413***	-0.425***	-0.511***	-0.455***	-0.445***	-0.526***
	(0.125)	(0.136)	(0.103)	(0.123)	(0.113)	(0.108)	(0.0990)	(0.0841)
y05	-0.529***	-0.409***	-0.245**	-0.203	-0.345***	-0.243**	-0.197**	-0.0785
	(0.129)	(0.138)	(0.109)	(0.154)	(0.108)	(0.106)	(0.0957)	(0.0896)
y06	-0.697***	-0.503***	-0.287**		-0.318***	-0.150	-0.0751	
	(0.145)	(0.159)	(0.138)		(0.118)	(0.117)	(0.111)	
y07	-0.753***	-0.502***			-0.357***	-0.140		
	(0.160)	(0.176)			(0.131)	(0.130)		
y08	-0.774***				-0.462***			
	(0.162)				(0.142)			
Constant	-58.52***	-47.70***	-37.90**	-47.19	-14.10	-6.027	-10.30	3.700
	(15.69)	(14.95)	(16.48)	(41.30)	(8.783)	(9.906)	(11.66)	(16.08)
Observations	5,850	4,550	3,250	1,950	5,850	4,550	3,250	1,950
country-pair FE	YES	YES	YES	YES	YES	YES	YES	YES
year FE	YES	YES	YES	YES	YES	YES	YES	YES
(robust s.e.)	*** p<0.01,	** p<0.05,	* p<0.1					

Figure A17. This extra table demonstrates the issue of time-in-sample bias. Different sample periods alter enlargement effect, especially under PPML approach. Nevertheless, coefficients are still strongly significant except column 4, which treats only 3 years period under PPML.

	FE	FE PPML	RE	FE	FE PPML	RE	HT
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	ln(IS flows+1)	IS flows	ln(IS flows+1)	ln(IS flows+1)	IS flows	ln(IS flows+1)	ln(IS flows+1)
Total enlargement	0.600***	0.452***	0.565***				0.580***
	(0.0748)	(0.0913)	(0.0694)				(0.0338)
(**H**) enlargement				0.383***	0.379***	0.359***	
				(0.0807)	(0.142)	(0.0730)	
(**S**) enlargement				0.167**	0.382***	0.213***	
				(0.0735)	(0.0908)	(0.0599)	
(**H**) ln(stud. pop)	-0.902***	0.440	0.718***	-0.885***	0.474	0.721***	-0.333***
	(0.319)	(0.540)	(0.0521)	(0.333)	(0.534)	(0.0535)	(0.121)
(**H**) ln(income)	2.027***	0.887	1.849***	1.947***	0.394	1.833***	2.026***
	(0.339)	(0.677)	(0.203)	(0.362)	(0.799)	(0.209)	(0.181)
(**H**) ln(unempl)	0.102	0.170	0.0530	0.0973	0.140	0.0569	0.0475
	(0.0745)	(0.112)	(0.0704)	(0.0782)	(0.113)	(0.0722)	(0.0471)
(**H**) ln(fin. support)	-0.00575	-0.0118	-0.0229	-0.00459	-0.0151	-0.0225	-0.0195
	(0.0211)	(0.0347)	(0.0208)	(0.0223)	(0.0365)	(0.0218)	(0.0125)
(**H**) ln(VA)	2.107***	3.285***	2.210***	2.145***	3.261***	2.280***	2.003***
	(0.515)	(0.804)	(0.440)	(0.537)	(0.799)	(0.477)	(0.279)
(**H**) ln(RL)	-0.582	0.111	-0.688*	-0.602	0.255	-0.718*	-0.871***
	(0.454)	(0.707)	(0.417)	(0.468)	(0.693)	(0.435)	(0.240)
(**H**) ln(CC)	-1.189***	-0.579	-0.904***	-1.184***	-0.631	-0.901***	-0.966***
	(0.307)	(0.491)	(0.280)	(0.310)	(0.504)	(0.285)	(0.165)
(**H**) Int. exposure	0.284***	0.790***	0.415***	0.283***	0.754***	0.418***	0.291***
	(0.0768)	(0.188)	(0.0511)	(0.0799)	(0.188)	(0.0534)	(0.0333)
(**H**) HE quality	0.151***	-0.00565	0.166***	0.151***	0.000588	0.166***	0.205***
	(0.0495)	(0.0484)	(0.0280)	(0.0527)	(0.0504)	(0.0293)	(0.0214)
(**S**) ln(stud. pop)	0.355	0.882**	0.589***	0.482	0.977**	0.579***	0.0503
	(0.338)	(0.420)	(0.0444)	(0.351)	(0.416)	(0.0455)	(0.134)
(**S**) ln(income)	0.172	1.187**	-0.107	0.601	1.150**	-0.0214	0.149
	(0.355)	(0.558)	(0.196)	(0.386)	(0.573)	(0.198)	(0.190)
(**S**) ln(unempl)	0.0308	0.0444	-0.0119	0.0281	0.0353	-0.0410	0.0194
	(0.0845)	(0.101)	(0.0730)	(0.0865)	(0.0980)	(0.0741)	(0.0474)
(**S**) ln(fin. support)	0.117***	0.145***	0.110***	0.0877***	0.138***	0.0870***	0.0962***
	(0.0242)	(0.0474)	(0.0206)	(0.0263)	(0.0456)	(0.0215)	(0.0125)
(**S**) ln(VA)	0.738	0.751*	0.462	0.711	0.686	0.246	0.428
	(0.470)	(0.438)	(0.440)	(0.479)	(0.426)	(0.456)	(0.283)
(**S**) ln(RL)	-0.803*	-0.522	-0.870**	-0.799*	-0.503	-0.748*	-0.779***
	(0.427)	(0.431)	(0.367)	(0.444)	(0.441)	(0.389)	(0.243)
(**S**) ln(CC)	0.715***	1.129***	0.725***	0.631**	1.054***	0.680***	0.598***
	(0.276)	(0.286)	(0.245)	(0.287)	(0.291)	(0.252)	(0.153)
(**S**) ln(edu.opport)	-0.248**	-0.171	-0.116	-0.203	-0.139	-0.0829	-0.305***
	(0.124)	(0.192)	(0.104)	(0.129)	(0.198)	(0.107)	(0.0643)
ln(distance)			-0.744***			-0.737***	-5.101**
			(0.115)			(0.116)	(2.258)
contiguity			1.278***			1.243***	-2.850
			(0.270)			(0.270)	(2.614)
common language			0.775*			0.753*	-0.259
			(0.429)			(0.431)	(0.918)
colonial link			0.567			0.621	-0.342
			(0.449)			(0.450)	(0.969)
Constant	-15.73*	-52.32***	-29.53***	-20.80**	-48.29***	-29.61***	20.65
	(8.641)	(14.77)	(2.690)	(9.155)	(15.30)	(2.764)	(17.25)
Country-pair effects	YES	YES	YES	YES	YES	YES	YES
Country effects							
Year effects	YES	YES	YES	YES	YES	YES	YES
Observations	6,294	6,294	6,294	6,294	6,294	6,294	7150
(robust s.e.)	*** p<0.01	** p<0.05,	* p<0.1				

Figure A18. This extra table considers subset of only positive-valued IS flows (1-6), whose results do not differ substantially from Table 2 results, thus implying robustness of Table 2 results to exclusion of zero IS flows. Also, specification 7 considers one of the variants of Hausman-Taylor estimation, which gives significant negative coefficient on distance.