JENA ECONOMIC RESEARCH PAPERS

2014 – 009

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www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

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D-07743 Jena
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Financing Higher Education when Students and Graduates are Internationally Mobile

Marcel Gérard and Silke Uebelmesser[1]

Abstract

This paper aims at linking cross border mobility of students and graduates with the financing of higher education. Against the background of institutional features and empirical evidence of the European Union and Northern America, a theoretical framework is developed. This allows analyzing the optimal financing regimes for different migration scenarios, comparing them with the regimes in place and discussing possible remedies. In particular, the (optimal) sharing of education costs between students / graduates and tax-payers is studied as well as the (optimal) sharing of the tax-payers' part between the various countries involved: the country which provides higher education (the host country), the country of previous education (the origin country) and possibly the countries which benefit from the improved skills of the workers. Alternative designs exhibiting potentially desirable properties are developed and policy recommendations derived.

Key words: Mobility of students; Mobility of graduates; Financing of higher education

JEL: F22, H52, I23.

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1. Introduction and background

Globalization and student and graduate mobility have important consequences for fiscal policy. The scope to generate public revenues becomes more limited while the need for public expenditure does not necessarily decrease (see in particular Wildasin, 2014). In this paper, we focus on the consequences of international mobility of students and graduates for one specific aspect of fiscal policy, the financing of higher education.

The point of view adopted might be regarded as typically European. The European features highlighted, however, simply reinforce the more general argument developed below. Those features are the following: First, in the European Union (EU) mobility of students and graduates is not only a fact that we have to live with, but it is also something desirable for the building of the EU. Second, and for that latter reason, two key instruments to favor mobility of students have been set up and deserve further examination. Finally the EU legislative framework introduces legal constraints as to the education policy in EU member states.

Let us provide some details about those three features which are relevant for understanding the European higher education system and related issues, especially those which differ from the United States (US).

1.1. Politically desirable mobility

Sharing a common set of values, a common culture and a common *lingua franca*, being related to each other through cross border networks, and visiting each other beyond the barriers of psychological, linguistic and historical distances, are all powerful instruments for turning a set of separated people and territories into a unified entity of peace, efficiency and fairness. This is true for both sides of the Atlantic Ocean.

However, in the US, that process was facilitated by the fact that, say, people of Irish and Italian descent settled in the same cities on the East coast and moved to the West coast progressively, but together. This is different in Europe where Italian and Irish people are linked to different territories separated by seas and some fifteen hundred kilometers; and they have nearly no common history. Moreover, while the goal of the founders of the US was the creation of a country, today's objective of the EU is definitely much less ambitious: creating a union, a poorly defined concept, the upper bound of which is a true country and the lower bound an efficient and fair single market. Let us adopt that latter option, though it is just a minimal position. As a consequence we assume that the goal of EU leaders is to build a single market for highly qualified EU-wide mobile workers and that mobility of students deserves EU incentives because it feeds further mobility of graduates and

workers with researchers as a particular segment among the highly skilled people. Mobility of labor, and thus a single market for labor, facilitates the functioning of a monetary union.[2] However, compared with the US, the EU experiences a lack of mobility of its workforce. As pointed out by the EU commission, "People in the US are much more likely to move to a different US state than people in the EU are to move to another EU region. In the EU, those of working age who changed their region of residence in 2008 amounted to only 1.2% of total working age population as against 2.8% in the US." (European Commission, 2010, p.11).

Another objective of the EU is to make that area the most advanced one in research, development and innovation – see the Lisbon Agenda (European Council, 2000), the Sapir Report (Sapir et al., 2003) and more recently the Europe 2020 Strategy (European Commission, 2010a), especially the flagship program "Youth on the move". That objective can serve as a justification for the European Commission to stimulate the mobility of researchers.

1.2. Two instruments to support mobility within the EU

It is impossible to deal with the mobility of students in Europe without mentioning the two main instruments which were launched and/or supported by the EU Commission to foster that mobility: the Erasmus program on the one hand and the Bologna process on the other hand.

1.2.1. Erasmus students

The Erasmus Program, launched in 1987, is probably the best known instrument to facilitate students' mobility within the EU (and a series of partner countries). Over 25 years, the program has enabled more than 2,300,000 students to spend at least one semester studying at the tertiary level in a country different from the one where they will receive their degree. For example, a German or an Austrian student enrolled in an Austrian university with the aim of obtaining a degree from that university might spend a term or a year as an Erasmus student at a Polish university.

This program is an exchange program. The student enrolls in the university which will grant the degree, pays her tuition fee to that university and visits, at no additional tuition cost, the other country's university where she will receive credits for courses and exams to be recognized in her own university curriculum. There is no transfer of money between the universities or countries in that process. However, a double agreement lies at the basis. The first agreement is between the universities to set up the general framework of the exchange. The second one is between the

[2] When the exchange rate can no longer be adapted in order to absorb asymmetric shocks, which is the case when a series of countries decide to join together within a monetary union such as the US or the Eurozone, and, further, wages are rigid and especially not permitted to vary much across the area, then mobility of labor is needed to face the shocks.

student and her own country's university which has to approve the content of the curriculum that she will follow abroad. For the stay abroad, the students may receive a grant from their own university, financed by the EU, to cover the cost of living abroad.

Though extremely successful, this program is unbalanced. For the academic year 2010-2011, Spain sent about 31,500 students abroad[3], which represents 2% of that country's student population, and received nearly 30,600 foreign students in the framework of the Erasmus program. In contrast, the United Kingdom (UK) sent only around 8,600 students abroad, a figure which is about half a per cent of the UK student population, and received 17,500 foreign students in the framework of the program. Even though the numbers of outgoing and incoming UK students are much smaller (relatively and absolutely) than for Spain, the UK's in- and outflows are much more unbalanced as that country receives twice as many students as it sends abroad.

Leaving aside the obvious attraction of the Spanish sun and ambience, there are at least two other reasons that explain this discrepancy. On the one hand, unlike other EU citizens, UK students are probably less motivated in going abroad: they have no need to learn another language since they speak the *lingua franca* of Europe and the world, and they also have access to the best European universities; as a consequence there is little room for exchange. On the other hand, UK universities, and especially universities located in England, have no interest in welcoming European students for free when they can easily attract non-EU students and charge them high tuition fees.

That peculiarity of England is further examined by Murphy (2014), where he states that "the total number of overseas students in UK universities has increased by 91% from 2000/2001 to 2008/2009 and by 170% since 1994/1995. The postgraduate sector has seen the highest growth in overseas students in terms of proportions and absolute numbers. There are now quintuple the number of overseas taught postgraduates than there were in 1995, increasing from 15,000 to 77,000. These overseas students are also typically paying higher tuition fees than domestic students, approximately £10k for non-laboratory subjects on average. Thus, overseas students are now a major source of income for the HE sector, currently contributing 8.6% of the total income of the sector."

Note that since England has made itself less attractive for European exchange students, and since learning English is one of the motivations for student exchange, non-UK universities have deliberately decided to propose substitute programs entirely taught in English, as is the case in Poland and the Czech Republic.

[3] Statistics mentioned in this section come from http://ec.europa.eu/education/erasmus/statistics_en.htm

The fact that the EU budget – which is small compared to the US Federal one – amounting to around one percent of EU – wide GDP, finances Erasmus fellowships to foster mobility of students, and to a smaller extent, of professors and clerical staff, illustrates the differences in the advancement of the integration process between the two sides of the Atlantic Ocean. There is no such federal program in the USA. For an observer from the EU, putting together students from different US states no longer seems to be a policy goal since the process has become natural in a geographically integrated nation; though possibly putting together students from different socio-economic backgrounds or ethnic origins is the true challenge for the US. In contrast, in Europe, the challenge is still to mix students from different nations and, thus, to set up a peaceful entity through, among other things, a single labor market for skilled people.

1.2.2. Bologna students

Unlike in the Erasmus program, within the Bologna framework, a student enrolls in the school where she actually attends classes for a term or a year or more, pays the tuition fee for that institution and is permitted to have the credits obtained abroad – the so-called ECTS (European Credit Transfer System) – recognized in the program that she follows in her original country.[4]

The Bologna Process was not an initiative of the EU itself when launched in 1999; its initial goal was to build up a European educational space by 2010. Although it was signed in the Italian city of Bologna by the Ministers in charge of higher education in 46 European countries, this process does not rest on an intergovernmental arrangement. Its philosophy is well summarized in the Bologna's Declaration (Bologna Declaration, 1999). That declaration states that "A Europe of Knowledge is now widely recognized as an irreplaceable factor for social and human growth and as an indispensable component to consolidate and enrich the European citizenship, capable of giving its citizens the necessary competences to face the challenges of the new millennium, together with an awareness of shared values and belonging to a common social and cultural space".

It further recognizes the "Importance of education and educational cooperation in the development and strengthening of stable, peaceful and democratic societies" and the "Universities' central role in developing European cultural dimensions"; and calls for the "creation of the European area of higher education as a key way to promote citizens' mobility and employability and the Continent's overall development". In line with this philosophy six main goals were to be implemented, (1) adoption of a system of easily readable and comparable degrees in order to promote European citizens employability and the international competitiveness of the European higher education system; (2)

[4] The content of this section is based on Gérard (2012, 732-33)

adoption of a system essentially based on two main cycles – undergraduate studies leading to a bachelor degree and graduate studies leading to a master degree; (3) establishment of a system of credits as a proper means of promoting the most widespread student mobility; (4) promotion of mobility by overcoming obstacles to the effective exercise of free movement; (5) promotion of European co-operation in quality assurance; and (6) promotion of the necessary European dimensions in higher education.

The promotion of those six main goals might seem obvious to a US reader, again since the organization of higher education has become homogenous across the whole nation over time and without central government intervention or agreements between states.[5] The Bologna goals have been turned into action lines, work plans and objectives which have evolved with time, as well as into legislative acts. We present evidence related to Bologna students' movements and the ensuing imbalances in Section 2.3 below.

1.3. EU principles of non-discrimination and subsidiarity

In most EU countries, with the noticeable exception of England, higher education tuition fees are low, if not zero, for domestic and EU students.[6] Moreover, two principles at the roots of the EU construction are at work. On the one hand, EU principles forbid a member state to discriminate against citizens of another member state.[7] This implies that a Spanish university has to charge the same fee to non-Spanish EU residents as to Spanish ones. In contrast, though a university located in Scotland needs to accept a Belgian applicant under the same conditions as a Scottish one, including the tuition fees, the Scottish university may discriminate against English students because they come from the same EU member state, namely the UK. In other words, a situation where the University of California charges a higher tuition fee to students from Nevada than from California could not occur in the EU: it would be against EU law provided we compare the US and the EU and consider Nevada and California as different member states of the US.[8]

Note that recently Belgium and Austria have departed from the non-discrimination principle, imposing quotas on foreign students in medical and paramedical studies on the basis that the number of applicants from abroad, expected to return home after completion of their studies, was a threat for the future of public health in those two countries. The European Court of Justice permitted

[5] For a short description of the US system, see, e.g., http://www.fulbright.be/study-in-the-us/undergraduate-studies/us-higher-education-info/

[6] See http://www.studyineurope.eu/tuition-fees.

[7] Notice that this is also the case between France and Québec.

[8] See http://registrar.berkeley.edu/Default.aspx?PageID=feesched.html; the undergraduate tuition costs per semester amount to almost $ 7,500 for residents of California against almost $ 19,000 for non-residents of California.

the use of such quotas provided the governments prove that such measures are necessary for the protection of public health in the future and that they are proportionated (European Court of Justice, 2010).

On the other hand, the principle of subsidiarity (Pelkmans, 2005) permits to transfer a competence from the level of the member states to that of the EU if and only if that competence might be better performed at that upper level. Education raises questions in that respect. If the education system is considered globally, from nursing school to university, there are serious arguments for keeping education a national – e.g., in France – or a sub-national – e.g., in Belgium, Germany or the UK – competence. If one focuses on tertiary education, the case is less clear, as will be elaborated on in the remainder of this paper. But all in all, the opinion of the majority of EU citizens is still to keep that competence at the national or sub-national level. In such a context a challenge for economists and designers of higher education systems is to portray a decentralized system which exhibits the same properties as a centralized one.

Note that (largely) publicly funded higher education does not mean that university studies are free goods. Indeed, graduates are expected to earn higher wages than less skilled people and, therefore, to pay higher taxes, especially in those countries where labor income tax is progressive. In that sense, students receive implicit loans from the government during the time of their studies that they later repay, possibly with interest, contingent upon the income generated with skills acquired through their studies. One could conclude from that reasoning that the current system of financing higher education is close to a contingent loan mechanism[9], namely, a system where the students receive money covering the cost of studies and sometimes the cost of living, and pay back that amount after their graduation, in line with their income.

That reasoning holds in a world where the graduates pay their tax in the country where they graduated, and on which they have imposed a sacrifice in terms of GDP – the opportunity cost of studies. This is what we name later in this paper the old paradigm. However, it no longer holds in a setting where people coming from a first jurisdiction (their jurisdiction of origin), graduate in a second jurisdiction (their jurisdiction of studies), and then spend their career in one or several other ones (their jurisdiction of work). This is the new paradigm. In such a setting, the first two countries have contributed to the cost of studies and the other ones benefit from the skill of the graduate, as well as from the contribution to the local GDP and tax revenue, if no correction mechanism is introduced.

[9] Economic issues associated to contingent loans are dealt with, e.g., by Barr (2014) and Del Rey and Racionero (2014).

In today's European Union we are in some sense moving from the first to the second setting, or from the old to the new paradigm, even if the first one still clearly dominates. However, the second setting may no longer be ignored; on the one hand, it corresponds to an emerging single market for high – skill labor, and on the other hand, it creates spillover effects or externalities which call for internalization if one wants to improve the efficiency of the higher education system in Europe. However, the issue related to those spillover effects is only of importance if mobility is unbalanced. This will be further elaborated on in the next section.

The implications of the above mentioned spillover effects are addressed here from two perspectives. Our research question can be stated as "who is to pay for mobile students?" By "who" we mean, on the one hand, which jurisdiction – the country of origin (also called the "origin country"), that of studies (also called the "host country" since it hosts the students during her studies) or that of work (the "destination country"). On the other hand, we are interested in who in each jurisdiction contributes to the financing, i.e., the individual (the student or the graduate) or the local society. That latter distinction raises the question of social costs and benefits versus private ones.

Let us add that, although in higher education the competencies are basically limited to the issue of norms, the EU Commission has real competencies in research with financial means and important framework projects. Especially, the European Research Council (ERC) plays a role quite similar to that of the National Science Foundation (NSF) in the United States, though in the EU, each country also has its own research foundation, such as the CNRS in France and the DFG in Germany (see Gérard, Gilson and Ruiz, 2012).

The rest of the paper is organized as follows. In Section 2 we set forth evidence of mobility of students and graduates, referring to the literature and current research: first that mobility of labor increases with the skill level of the worker; second that the mobility of graduates is incentivized by the mobility before and during tertiary education; and finally that the mobility for the purposes of study is unbalanced. That imbalance, however, is not homogeneous, at least in Europe. In Section 3, we address a first issue related to the imbalance of the mobility of students: the distribution of (social) benefits and costs of higher education between the society as a whole and the students, or their families, or later the graduates. Finally in Section 4, we focus on the move from the old to the new paradigm and investigate how a decentralized design of higher education financing may replicate an outcome generated centrally, i.e., designed at the level of the mobility area. A short conclusion follows in Section 5.

2. Mobility of students and graduates: challenge for (public) financing?

In this section we provide evidence on the mobility of students and graduates, referring to the literature and new pieces of research.

2.1. Mobility of labor increases with the skill of the workers

That mobility increases with the skill level is well established, going back to Sjaastad (1962) - see also Borjas (1987, 1991), Ehrenberg and Smith (1994), and Uebelmesser (2006).[10] Here we highlight it using Canadian data collected on the occasions of the 2001 and 2006 censuses.[11] The interest in using Canadian data for this illustrative computation resides in their homogeneity: we have comparable figures for a series of jurisdictions belonging to the same union or federation.[12]

If we consider the entire Canadian population, we observe that the fraction of the population living in one province in 2001, but in another province in 2006 amounts to 2.7% of the whole Canadian 2001 population. But if we compute similar statistics for the holders of a bachelor degree, the fraction goes up to 4.4% and similarly for holders of a master degree while the figure is even slightly higher for Ph.D. holders. If we include in the computation people who were not living in Canada in 2001 but migrated to that country between 2001 and 2006, the figures, respectively, are 6.4% for the entire population, 12.4% for holders of a bachelor degree, 17.4% for holders of a master degree and 18.2% for Ph.D. holders.

Though this evidence justifies the frequently issued hypothesis that high-skill workers are more mobile than low-skill workers (see Wildasin, 2014) , it also deserves at least two *caveats*: some high-skill people, such as doctors who spend many years acquiring a set of patients, or auditors bound to residence by their customer base, can face a very high cost of migration; and conversely many low-skill people can face a rather low migration cost when economic conditions are especially bad in their origin country, increasing therefore the expected gain from migration.

In line with the notion that mobility increases with skill level, Gagliardi (2014) sets forth the role of highly skilled immigrants in the economic development of UK areas.

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[10] See also, as one of the early contributions, Greenwood (1972).

[11] For this section, and particularly in regard to the Canadian data, we acknowledge useful comments from François Vaillancourt and the valuable assistance of Véronique Laramée, both from the University of Montreal.

[12] Studies on migration in other national contexts are, e.g., Faggian, McCannand Sheppard (2007) who focus on Scottish and Welsh students and Venhorst, van Dijk and van Wissen (2011)for an analysis of Dutch graduates. Backman and Bjerke (2010) study mobility of individuals with different educational backgrounds for Sweden and Waldorf (2011) looks at related issues for the US. See also some of the contributions in Poot, Waldorf and van Wissen (2009) and Varga (2009).

2.2. Mobility of graduates is incentivized by mobility before and during tertiary education

The second observation, that graduate mobility can be positively linked to mobility before and during the studies, is well supported by the analysis of Felbermayr and Reczkowski (2014). Van Bouwel and Veugelers (2014) complement this by studying the migration pattern of Europeans who received their PhD from a US university. Around 70% decide to stay in the US for their first job and that stay rate is a good predictor of the location of those researchers ten years later. This is also confirmed by, e.g., Di Pietro (2012), Dreher and Poutvaara (2011), King and Ruiz-Gelices (2003), Oosterbeek and Webbink (2011), Parey and Waldinger (2011) and Voin and Gérard (2013).

In particular, Voin and Gérard (2013) conducted a questionnaire survey on the alumni of a series of Belgian French-speaking universities. They ended up with more than 500 respondents, including mainly graduates from economic departments and business schools, providing them with data about the graduates themselves, their personal history and their family profile excluding personal and parents' income. The analyses aimed at answering the following two questions: First, "what drives the expatriation of graduates?" in particular, "have stays abroad during tertiary education influenced careers abroad?" i.e., "is mobility of graduates driven by mobility during tertiary education?" and second, "what determines students' mobility?" The answer to the first question is especially important in justifying the spending of European public money. Results were obtained through a probit model with average marginal effects (AME) calculated.

Among the plausible determinants of graduates' expatriation, two emerged as statistically significant: studies abroad without Erasmus support, and participation in the Erasmus program. There is, thus, evidence of the contribution of studies abroad, and especially of the Erasmus program, to the mobility of graduates and the construction of the single EU-wide market for high skill workers. Obviously, however, this doesnot mean that the Erasmus program is causal tograduates' mobility; but at least it has accompanied and facilitated that mobility.

Regarding the second question on determinants of students' mobility, the level of education of the mother dominates the other determinants.This is not a surprise knowing that many studies in education economics report that the education of the mother is the first driver of education of the children. Itis, however, surprising, at first glance, to find the same also with respect to the mobility of the students. Education of the father is significant as well. Taken together, those variables also are a proxy for family income. One can argue that the Erasmus program is not a redistributive one, facilitating studies abroad especially by those who are most favored by their family environment.

But experience abroad prior to entering university is also significant, either as such, or further specified as stays abroad for the purpose of learning a foreign language or to repeat the last year of

secondary education.[13] Those students are already "internationally minded" when entering at university and it is no surprise that they are more likely to study abroad. In contrast, living abroad at the time of childhood is not significant.

To sum up, one is more likely to expatriate if onehas stayed abroad during one's university studies, has some experience abroad between secondary and tertiary education, and is an economist or management scientist by which it is meant that one has a degree in a field whose expertise is least country-specific.

Let us add that among the many contributions devoted to students' mobility,[14] the work of Parey and Waldinger (2011) seems to be especially in line with the findings above. Their first conclusion is that additional subsidies involve larger student mobility and increasing professional mobility. Then, using a large database of German students, they investigate the causality between student mobility and professional mobility; they show that studying abroad increases the probability of working abroad by about 15-20%. Moreover, it seems that students tend to migrate to the countries where they resided during their studies.

2.3. Mobility is unbalanced

Although it is an increasing phenomenon, the mobility of students is unbalanced, as illustrated in Table 1. The figures reported document the fraction of students coming from abroad.The balance of mobility is obtained by taking the number of outgoing students minus the number of incoming students, divided by the total number of students. The number of outgoing students does not include the Erasmus students, but only those who enroll in a foreign university. Incoming students taken into account are those coming from other member states of the EU, also excluding Erasmus students. A negative sign means that the country is a net importer of young people – or raw human capital – and a net exporter of graduates – or enriched human capital since in today's non-Anglo-Saxon Europe most intra - EU migrant students return home after their studies. Another interpretation of that negative sign is that those countriesare net exporters of higher education services.

[13] It is a long established tradition that some students, after completion of their secondary education, devote a year to repeat their last year of study, e.g., in the US being hosted by a US family or working as an *au pair* in such a family, or to serve in a humanitarian project.

[14] See also the literature mentioned in Footnote 12 above.

Table 1 – Unbalanced mobility of students, European Union					
Countries	Foreign students (%)	Balance of mobility (%)	Countries	Foreign students (%)	Balance of mobility (%)
Austria	11.36	-8.02	Hungary	1.20	0.36
Belgium	6.98	-4.62	Italy	0.54	1.06
United Kingdom	4.06	-3.63	Finland	0.74	1.37
Czech Rep.	5.21	-3.01	Poland	0.11	1.43
Netherlands	4.17	-2.41	Portugal	0.68	2.50
Denmark	2.70	-1.18	Greece	0.15	4.06
Sweden	2.03	0.11	Ireland	1.92	7.47
Germany	2.61	0.26	Slovak Rep.	1.59	9.73
Spain	0.75	0.30	Luxembourg	37.00	232.70
France	1.60	0.33			
Source: Gérard (2012) based on Eurostat and own calculation.					

When examining those negatively signed countries, three groups need to be distinguished. The first one consists of Austria, Belgium, the Czech Republic and the Netherlands; the second one consists of the United Kingdom alone, and the last one of includes only Denmark.

The members of the first group have in common large neighboring countries – France for Belgium, Germany for the other countries – which are quite selective regarding admissions to medical and paramedical studies. Then, students who fail at the entrance examination level in their own country, either France or Germany, enroll in the equivalent programs of their small neighboring countries where language is the same or similar, access to studies is formally easier – no entrance examination, and tuition fees are generally low – they are nil in Austria and in the Czech Republic (in the Czech Republic, a 1,000 euro per term extra fee is charged to students following courses taught in another language than Czech), they amount to 830 euro per year in Belgium and up to about 2,500 euro in the Netherlands.[15] And as a consequence of the EU laws the nationality of the degree does not preclude practice in another country. Therefore, one may conclude that France and Germany free-ride on their small attractive neighbors; and that the foreign students attracted by those small countries are not the best students in their field and cohort.

That conclusion is reinforced by the fact that, according to Felbermayr and Reczkowski (2014), the retention rate in countries like Austria or Belgium does not reach 5%. Using the terminology of the previous section, France - to take that case - is both the country of origin of the students and that of work once they have graduated, supporting the opportunity cost and getting all the benefits, while

[15] See http://www.studyineurope.eu/tuition-fees.

Belgium, the host country during the studies, bears the cost of the studies of those foreign students. That reality reduces Belgium's enthusiasm to welcome EU students, a reason why that country – and Austria also – introduced quota in some fields of studies, which is *per se* inefficient.

The second group comprises the UK alone. In that country, the language is country-specific but used in the entire world as *lingua franca*, access to studies is intellectually demanding – admission is very selective and based on documented files, and tuition fees are very high by European standards – up to £9,000 a year for residents of England and of the EU (Murphy, 2014). Moreover, again according to Felbermayr and Reczkowski (2014), the retention rate amounts to more than 35%. And using again the terminology of the previous section, the cost of the studies is supported by the country of origin while a larger part of benefits go to the host country during the studies, which is also that of work for 35% of the graduates. Here the externality benefits UK.

Finally the case of Denmark, another singleton, deserves particular interest. Its attractiveness as a place to work is probably limited, as for other non-Anglo-Saxon countries. However, Denmark welcomes many students from Nordic countries. These countries partially compensate Denmark for the provision of higher education. We come back to that mechanism in Section 4 of this contribution.

We can conclude from the stylized facts presented in this sub-section that, among skilled people, studies abroad and thus, mobility during higher education, is an important driver of expatriation and thus of mobility during their career. The former mobility, in turn, is incentivized by an international experience between secondary and tertiary education as well as by the level of education of the parents, especially of the mother. Nevertheless, the cross border flows of students are unbalanced. Therefore in a decentralized world like the EU, where higher education is extensively financed by the government of the jurisdictions which host the students, and tuition fees must not discriminate between EU residents on the basis of their country of origin, unbalanced transfers, and thus externalities, undermine the efficient functioning of that otherwise appealing system called the Bologna process.

This is *per se* an argument to allocate the responsibility of higher education to the level of the EU, something which is already the case when it comes to the definition of cursus norms but which seems to be impossible for the financing. One can say that the challenge is to find a decentralized system of financing tertiary education such that its outcome is as close as possible to that of a centralized one. That will be precisely the topic of Section 4. Note that the problem is different for research where some funding has been already set at the level of the EU and complements funding by national and sub-national authorities.

Imbalance in student migration is not a characteristic of the EU alone. If we look at US figures we may notice that 90%, 68% and 59% of freshman university students in Washington DC, Vermont and Rhode Island, respectively, are from out of state, while those figures amount to 9%, 11% and 12%for Michigan, California and Alaska, respectively.[16] However, the first group consists of very small jurisidctions whose universities might be oversized with respect to the resident population so that interpretation of these figures is difficult.

Also, we may replicate Table 1 for interprovincial students' migration in Canada – see Table 2. Nova Scotia is historically a net exporter of university services (an importer of students) due to the large number of undergraduate-oriented student-friendly campuses. English speaking universities attract numerous Canadians and foreigners to the attractive city of Montreal; and the University of Prince Edward Island offers a limited range of programs so that many students have to study in other provinces.

Table 2 – Interprovincial migration for higher education purposes in Canada

Provinces	Out of Province students (%)	Balance of mobility (%)	Provinces	Out of Province students (%)	Balance of mobility (%)
Nova Scotia	29.3	-17.2	Manitoba	4.3	2.7
Quebec	7.8	-4.1	Saskatchewan	4.6	4.1
N-Brunswick	23.0	-1.9	Newfoundland	8.2	8.1
Alberta	7.7	0.4	British. Co.	3.4	11.3
Ontario	5.0	0.5	Prince Edward	18.7	31.4

Source: Own calculation based on Junor and Usher (2008) using data from the Association of Universities and Colleges of Canada for the year 2003-2004. Those authors notice that the number of students currently labeled as having home residence of "unknown" or "not applicable" is quite high. The problem is particularly noticeable in the provinces of Alberta and British Columbia, where the University of Alberta and Simon Fraser University report significant segments of data under these categories in 2003-2004.

3. How should the costs of education be shared between the individual and the government?

With unbalanced mobility, the financing system is thus very important. In this section and the following one, we will discuss the question of which party should contribute to the financing of higher education. Is there a convincing argument for pure tax-financing by the government of the country who provides higher education or, more precisely, by all tax-payers no matter whether they

[16] See Junor and Usher (2008) based on data for the year 2003-2004 from the National Center for Education Statistics.

(or their children) have obtained a university education? Or should governments of other countries – and for that matter tax-payers – also contribute, notably governments of countries where the graduates then work? Or are there, on the contrary, reasons why higher education should be purely fee-financed, possibly with the support of contingent loans, by those who study? In this section, we focus on the distribution of the cost of studies between the student, through tuition fees, and the government, via the state budget. The question of the payment of that cost by the country of origin, by that of studies or by that of work after graduation, either through the public budget directly or via students or graduates, is left for Section 4.

3.1 Some observations

On average, private returns amount to 64% of total returns when the latter is measured by summing up private and public returns (see Table 3). We observe that private and public benefits from higher education are significant in all countries with private ones ranging from 82,000 euro in Denmark to 320,000 euro in Portugal and public ones from being as low as 26,000 euro (Estonia) and amounting up to 215,000 euro (Hungary). With the exception of Belgium and Hungary, private benefits exceed public benefits in all countries.

Comparing public and private benefits could provide a first indication about the relative contributions to the financing of higher education by the public and the student. The observations deserve, however, two remarks. First, one should note that among other limitations the public benefits as displayed in the table only comprise the additional tax revenues from individuals with tertiary education relative to those with non-tertiary education as well as saved transfer payments. Indeed, tertiary education graduates are less likely to be unemployed or sick. So, the positive effects of a more educated population for, e.g., economic growth, would have to be added to the public return.[17] Second, we implicitly assume here the absence of any market failure. Governmental interventions, however, are called for independently of benefit considerations when there are market imperfections, e.g., related to borrowing constraints (see the next section as well as Barr, 2014).

In a closed economy, we would expect the fee-tax ratio to roughly reflect the ratio of total benefits as they accrue to the individual and to the public, respectively. The question is then whether these conclusions have to be adjusted in an open economy, by which is meant, in our context, mobility of students and / or of graduates.

[17] Many other positive (causal) effects of education have been established, e.g., a reduction of crime (Lochner, Moretti, 2004) and an improvement of the health status (Webbink, Martin, Visscher, 2010).

Table 3 – Private and public benefits in 2008 (or latest available year) in net-present value in equivalent USD converted using PPPs for GDP (mean of men and women)

Country	Private Benefits	Public Benefits	Private Index*	Public Index*	(Private – Public) / Total	Private / Total
Australia	166171	93958	87.0	83.5	27.8 %	63.9 %
Austria	236476	159110	123.8	141.4	19.6 %	59.8 %
Belgium	140903	177439	73.8	157.7	-11.5 %	44.3 %
Canada	183575	86318	96.1	76.7	36.0 %	68.0 %
Czech Republic	222826	107484	116.7	95.5	34.9 %	67.5 %
Denmark	106617	89239	55.8	79.3	8.9 %	54.4 %
Estonia	90610	26723	47.5	23.8	54.5 %	77.2 %
Finland	173811	113999	91.0	101.3	20.8 %	60.4 %
France	196484	101687	102.9	90.4	31.8 %	65.9 %
Germany	184918	177091	96.8	157.4	2.2 %	51.1 %
Hungary	174960	215674	91.6	191.7	-10.4 %	44.8 %
Ireland	263123	162856	137.8	144.7	23.5 %	61.8 %
Israel	168558	88638	88.3	78.8	31.1 %	65.5 %
Italy	173002	148338	90.6	131.8	7.7 %	53.8 %
Japan	219138	75263	114.8	66.9	48.9 %	74.4 %
Korea	239529	47196	125.4	41.9	67.1 %	83.5 %
Netherlands	226635	177804	118.7	158.0	12.1 %	56.0 %
New Zealand	99297	50303	52.0	44.7	32.8 %	66.4 %
Norway	149158	92805	78.1	82.5	23.3 %	61.6 %
Poland	210093	106521	110.0	94.7	32.7 %	66.4 %
Portugal	320627	117196	167.9	104.2	46.5 %	73.2 %
Slovak Republic	187571	70037	98.2	62.2	45.6 %	72.8 %
Slovenia	222633	165223	116.6	146.8	14.8 %	57.4 %
Spain	167788	72709	87.9	64.6	39.5 %	69.8 %
Sweden	114866	69956	60.2	62.2	24.3 %	62.2 %
Turkey	82176	38000	43.0	33.8	36.8 %	68.4 %
United Kingdom	260237	115103	136.3	102.3	38.7 %	69.3 %
United States	365591	204132	191.4	181.4	28.3 %	64.2 %
Average	190978	112529	100.0	100.0	27.4 %	63.7 %

Source: OECD (2012, Tables A9.3 and A9.4). *The private (public) index relates the private (public) benefits compared to their respective average over countries. Private and public benefits refer to the difference between people who attained a tertiary education compared with those who attained an upper secondary or post-secondary non-tertiary education. Private benefits include differences (positive or negative) in net earnings, transfers and grants; public benefits comprise differences in income tax and social contribution payments, transfers and grants.

Without going into the analytical details, it is obvious that a financial regime which relies very much on taxes is not sustainable in the presence of significant mobility of graduates, i.e., high-skilled and high-wage tax-payers (Wildasin, 2014). With tax-financing, students receive their education free of charge at the time of studying as it is financed by tax revenues from those working at that time. Implicit in this is, however, the understanding that in the next period those former-students-and-

now-workers finance the next student generation with their tax-payments. But this requires that those graduates – or for that matter, other graduates – be present in sufficient numbers.

Taking all this into consideration, it is interesting to see to what extent the financing-mix of higher education reflects these observations. What can be said is that the systems differ in a significant way across countries as to the relative importance of public and private financing – see Table 4.

Table 4 – Relative proportions of public and private expenditure for higher education

Country	Public Sources	Private Sources	Country	Public Sources	Private Sources
Australia	45	55	Japan	35	65
Austria	88	12	Korea	26	74
Belgium	90	10	Mexico	69	31
Canada	63	37	Netherlands	72	28
Chile	23	77	New Zealand	68	32
Czech Republic	80	20	Norway	96	4
Denmark	95	5	Poland	70	30
Estonia	80	20	Portugal	71	29
Finland	96	4	Slovak Republic	70	30
France	83	17	Slovenia	85	15
Germany	84	16	Spain	79	21
Iceland	92	8	Sweden	90	10
Ireland	84	16	United Kingdom	30	70
Israel	58	42	United States	38	62
Italy	69	31			

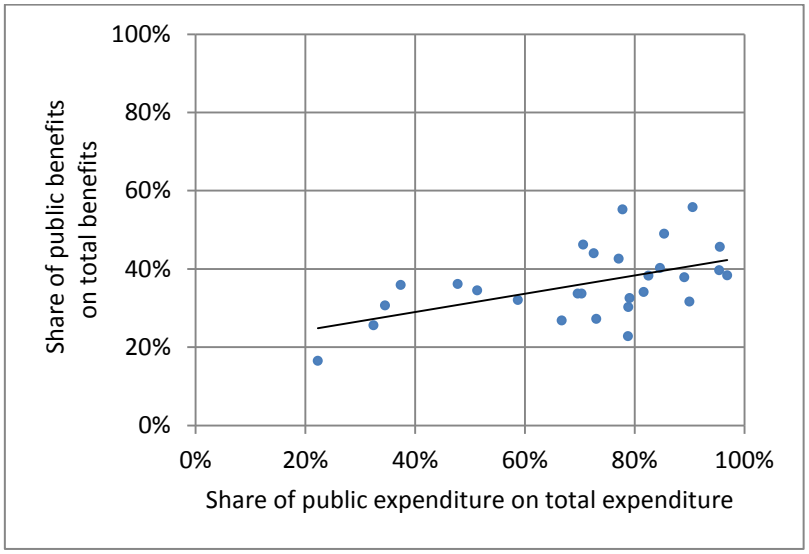
Source: OECD (2012, Table B3.2b). Private sources refer mostly to tuition fees paid by private households; public sources are subsidies. Data are after transfers from public sources, i.e., subsidies attributable to payments to educational institutions received from public sources are included as private sources.

At one end of the spectrum, we find the Nordic countries with a public share of close to 90% and above. In Germany, the share is 84% and in France 83%. At the other end, there are the UK, Korea and Chile each with a public share of less than 30% followed by Japan with 35% and the US with 38%. Comparing public expenditure for higher education as a share of total expenditure between 2000 and 2009, a trend towards more private contributions can be identified (OECD, 2012, Table B3.3). This holds, in particular, for the UK where the public share in 2009 is less than half of what it was in 2000. Exceptions are the US, Ireland and Spain where the private share decreased by more than 5 percentage points.[18]

[18] Of course, nothing is said here about the relevance of special schemes, scholarships, etc. deemed to alleviate the burden and guarantee equality of chances independent from individual financial resources.

So, the financing schemes differ across countries, but do they also differ in a systematic way? We have discussed above that we would expect a positive association between the tax-fee mix and the ratio of public and private benefits on the one hand and a negative association between the tax-fee mix and graduate mobility on the other hand. Of course, there are many additional relevant factors which we do not take into account here. The correlations below are, therefore, mainly intended to highlight some basic relations which can be observed in a cross-country perspective.

Figure 1 – Relation of public benefits to public expenditure
(as shares of respective totals)



Source: OECD (2012, Tables B3.2b, A9.3 and A9.4). Note for the regression results: constant 0.197 (t-value 3.357), slope coefficient 0.233 (t-value 3.122)

Considering first the relation of public benefits from and public expenditure for higher education (both as shares of the respective totals), we find a positive and highly significant association (Figure 1). So, a larger share of public benefits goes hand in hand with a larger share of public expenditure. Despite this, the shares are only (roughly) balanced for Korea where the public benefit share amounts to 16% and the public expenditure share to 22%, Japan (26% and 32%), the UK (31% and 35%) and the US (36% and 37%). Larger shares of public expenditure do not translate, however, into proportionally larger shares of public benefits and vice versa.[19] In Germany, e.g., the public benefit share is 49% and the public

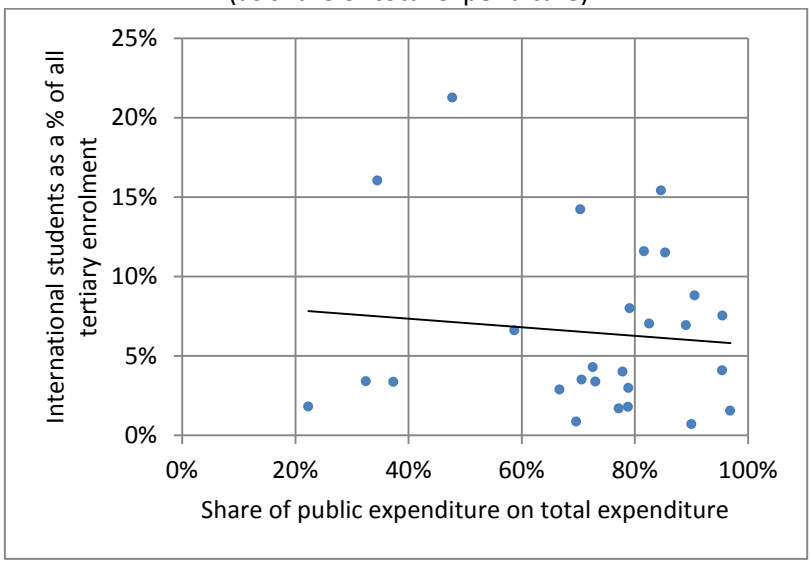
[19] Remember that public benefits do not include (positive) externalities and are, therefore, underestimated.

expenditure share almost twice as large with 85% and in France, the difference is even greater with a public benefit share of 34% and a public expenditure share of 81%.

Turning to the relation between student mobility and the share of public expenditure, we find a negative association which is, however, not significant (Figure 2). So, a country with a larger share of international students does not have a regime which relies more heavily on private contributions via tuition fees. This is in contrast to what one would expect: as outlined above there is a positive relationship between student mobility and the migration decision after graduation. So, more mobile students and thus more mobile graduate tax-payers might put some pressure on the public budget for higher education. One would then expect the government or the voters, respectively, to react by increasing the private contributions. At least this would be the conclusion when one pursues a causal interpretation from student mobility to the decisions about the financing regime.

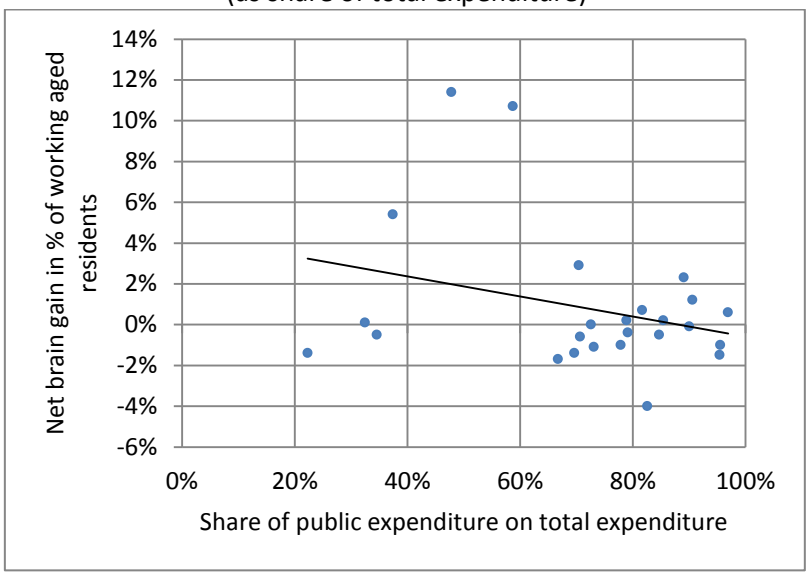
A more direct way would be to relate graduate mobility to the public share of total expenditure for higher education. As data about graduate mobility are not available, we make use of data about the net brain gain (see Docquier and Marfouk, 2005). Figure 6.3 confirms our previous insights: there is a negative, but insignificant relation. A negative brain gain, i.e., a net outflow of highly educated workers is not associated, on average, with a larger share of private expenditure on total expenditure for higher education. Countries with comparable net outflows of between 0.4% and 0.6% have very different financing regimes with only the UK relying much on private contributions (public share of 35%), while Italy, the Czech Republic and Austria have large public shares of, respectively, 70%, 79% and 85%. On the other hand, the importance of public expenditure in immigration countries is relatively modest. Australia with a net brain gain of 11.4% relies on private and public financing in a very balanced way (public share of 48%). The public contributions to the financing of higher education are slightly larger for Canada with 59% and a net inflow of highly educated migrants of 10.7% while the US with a net inflow of 5.4% have the smallest public expenditure share of these three immigration countries with 37%.

Figure 2 – Relation of student mobility to public expenditure (as share of total expenditure)



Source: OECD (2012, Tables B3.2b and C4.1). Note that for the Czech Republic (8.0), France (11.6), Greece (4.2), Italy (3.5), Korea (1.8) and Turkey (0.7), the data refer to non-native students as defined on the basis of their country of citizenship ("foreign student"). Note for the regression results: constant 8.416 (t-value 2.166) and slope coefficient -2.687 (t-value -0.516) and – when foreign students are excluded – constant 11.624 (t-value 2.401) and slope coefficient -6.159 (t-value -0.984).

Figure 3 – Relation of graduate mobility to public expenditure (as share of total expenditure)



Source: OECD (2012, Tables B3.2b), Docquier and Marfouk (2005, Tables 5.1). Note for the regression results: constant 4.321 (t-value 1.747), slope coefficient -4.901 (t-value -1.474).

3.2 Theoretical considerations

Looking at the data presented in the last section, several points stand out. Let us comment just on one, which is particularly illustrative for the following exposition: Some small countries, in particular Austria and Belgium, face a large number of students from their large neighbors, i.e., Germany and France, respectively, where the majority of these students returns after their graduation. At the same time, higher education in Austria and Belgium is primarily tax-financed. So these students, who come for their degree and leave afterwards, do not contribute in any significant way to the financing of higher education.

Taking these observations as a starting point, we want to look more closely at the question of how higher education should be financed and how the financing regime is chosen by the government. For the sake of the argument, we assume here that the quality level of education is given.[20] The choice of the financing regime is the policy variable, i.e., the mix between private financing via tuition fees and public financing via taxes.

We start with a closed economy setting to derive the optimal mix which can then serve as a benchmark when considering an open economy.

We consider a two-period general-equilibrium model with two ex-ante identical countries.[21] Individuals differ in their innate abilities, which are not observable. At the first stage, governments choose the educational policy. At the second stage, individuals make their education decision and – if the economy is open – their migration decision given the education policy as implemented by the government. Unskilled individuals are assumed to be immobile throughout.

So, in the first period, individuals decide whether or not – and where, if borders are open – to acquire higher education, which will affect labor supply in the second period. For this, they compare the lifetime income with higher education to the lifetime income when uneducated. If individuals choose not to study, they work and receive the wage income of an unskilled worker in both periods in their home country. If individuals decide to acquire higher education at home or abroad, they receive no wage income in the first period. In the second period, if they are mobile, they decide in

[20] Justman and Thisse (1997, 2000), Mechtenberg and Strausz (2008) and Kemnitz (2010) are examples of papers which focus on the quality level, while Thum and Uebelmesser (2003) and Poutvaara (2004, 2008) study the structure, i.e. the relative importance of internationally and domestically applicable contents of higher education. Other papers analyze the financing-side of educational policy in the presence of fiscal competition. In the general-equilibrium setting of Wildasin (2000), e.g., tax level and tax structure are the choice variables while the simultaneous competition in the tax rate and a further fiscal instrument is central in Andersson and Konrad (2003), Haupt and Janeba (2009) and Krieger and Lange (2010).

[21] This part is based on Demange, Fenge, Uebelmesser (2014).

which country to work and earn the wage income of a skilled worker there.[22] Fees are paid according to the financial regime in place in the country that provides education, while taxes are paid in the country where the graduates work. In a closed economy, both countries trivially are the same while this will no longer necessarily be the case in an open economy with mobile graduates. For simplicity, the population is assumed to be constant. We only concentrate on steady state situations.

For production, labor supplied by individuals with and without higher education, i.e., skilled and unskilled labor, is needed. Production takes place according to a neoclassical production function with constant returns to scale where both types of labor enter as complements. So, importantly, we abstract for the time being from any externalities apart from these technology-related interpersonal links. We will comment later on this. Furthermore, we assume competitive labor markets. So, the optimal demand for labor is such that productivities of skilled and unskilled workers are equal to their respective wage rates, which are endogenously determined.

Due to individual-specific ability levels, it will turn out that only some individuals of a generation with high enough abilities decide to study while the rest starts working as unskilled. This decision is obviously affected by the financing regime in place which changes the costs borne by the individuals and thus the attractivity of the education investment. In general, quite intuitively, the higher the share of education costs financed by taxes, the more attractive it is to study. This allows on the one hand escaping the tax duties during the first period when studying, and above all it implies a reduced total financial burden as part of the costs are co-financed by the unskilled via their tax payments.

3.2.1 Closed economy

In the absence of any market imperfections, in particular with a perfect credit market, and abstracting from any social or public benefits, it is straightforward that there is no justification for public intervention: higher education should be financed via tuition fees only. On the contrary, if there was partial or full tax financing, this would lead to too many individuals who would decide to study and who would possess too low an ability level at the margin.

It is certainly more appropriate, however, to allow for some market imperfections. In the following, credit market imperfections are considered. There is a mark-up to the interest rate which reflects, e.g., the moral hazard problems (see von Weizsäcker and Wigger, 2001, and Jacobs and van der Ploeg, 2006) or the riskiness of the human capital investment. What would then be the optimal financial regime? If the distortions on the credit market are not too large, there is still a positive fee level (albeit smaller than the total costs of higher education), which induces the optimal number of

[22] This approach has been introduced by Borjas (1987) where the prospective migrant compares wage abroad with wage at home plus migration cost.

individuals with the optimal ability levels to study. Only if the distortions are very important is it possible that a pure tax-financing regime results. So, distortions on the credit market justify a (partial) intervention of the government via tax-financing. In this case, a pure fee-regime would lead to too few students.

Of course, when, in addition, benefits of higher education arising for society are taken into account (see Table 6.3 above for the relation of private and public benefits), a larger optimal tax-share would result. Still, a financing policy where higher education is (almost) totally financed by taxes appears to be hard to justify.

So, in a general equilibrium framework we establish that the optimal solution as to the number of students (and their ability) can be reached with the right financing-mix (if credit market imperfections are not too large) – even if ability cannot be observed by the government.

3.2.2 Open borders

With open borders, however, it is no longer clear that this policy can be implemented. As the next step, therefore, we study in which direction and to what extent the results (financing mix and number of students) deviate from the optimal levels when governments take migration into account. For this, we consider two symmetric countries. It turns out that it matters who is mobile or, respectively, who is relatively more mobile: graduates, i.e., tax-payers, or students. The question is how the policy of one country changes when taking the policy of the other country into account.

Let us first look at the scenario where only graduates are mobile at no cost. In our framework, this leads to an equalization of net wages across countries. The place of study, which is the place of birth in this scenario, does not affect the earnings opportunities in the second period. So, if countries choose a different tax-fee mix to finance higher education (for a given quality level), this will lead to migration from the high-tax to the low-tax country until marginal productivities and thus gross wages have adjusted sufficiently such that net wages are equal again. As a consequence, countries have an incentive to lower taxes and to increase fees starting from the closed-economy optimal tax-fee mix. A too high fee level, however, discourages some individuals from studying. In this sense, open borders with mobile students lead to an under-provision of education.[23]

If not only graduates but also students are mobile at no cost, the situation is different. A marginal deviation of the optimal tax-fee mix leads now to a non-marginal reaction of the student population. If a country contemplates increasing its fee level without changing the quality level of education, this reduces the attractiveness of this country as a place to study compared to the other country. It

[23] See in particular Justman and Thisse (2000).

follows that all individuals will study in the country with the lower fee if they decide to study. These changes are far from marginal. On the contrary, as a result of the large inflow of students, the destination country has to change its financing policy: the tax rate or the fee level has to be raised. In particular, when the tax rate is already rather high, the country has to increase fees up to the same level as in the country which first raised its fee level. So, this would result in the same financing policy with the same number of students in both countries. But one should note that the financing-mix would again be sub-optimal and so would be the number of students. If countries anticipate the respective reaction of the other country, they should abstain from increasing the level of fees in the first place. A symmetric situation would thus emerge with no migration. Taking this into account, the countries would optimize as if in a closed economy and the optimal finance mix of the closed economy could be sustained.

The scenario with full and costless migration of students and graduates is, admittedly, not very realistic in the short-run – also in the light of the data provided in the previous section. Still, if one takes the Erasmus-Program or the Bologna Process, which are intended to foster stays abroad for students by facilitating the recognition of qualifications and periods of study (see Section 1.2 above), they can all be seen as promoting migration by reducing migration costs in the medium- to long-run.

So, what can be said when we look at the more realistic scenario with positive migration cost for both students and graduates? Can we then again talk about marginal reactions? There will be no longer a full net-of-tax wage arbitrage. This implies that the decision of where to study also becomes (to some extent) a decision on where to work as there are cost advantages when one stays in the country of education after graduation. It then becomes harder to attract graduates by (marginally) lowering taxes. At the same time, students are more valuable as future tax-payers. So, the relative mobility of students and graduates matters (see Lange, 2009). If graduates are relatively more mobile, there is still a tendency towards underprovision of higher education, i.e., towards too high fees and too few students. If students' mobility is, however, relatively high, it is even possible that an overprovision of higher education results.

Finally, if we bring the different scenarios together, there seems to be a possible U-shaped relation between the migration costs of students and graduates and the intensity of the tax-fee competition: a closed economy without migration and an open economy with costless migration of both students and graduates both result in the optimal (closed-economy) financing regime and the optimal number of students. An open economy with limited migration, on the contrary, leads to incentives for the countries to underprovide higher education and to free-ride on the higher education provided by other countries – at least when the (return) migration of graduates dominates students' migration.

This at least holds for the financing system considered so far where the costs of higher education are (possibly) shared between the students and the (host) country which provides higher education. The country of previous education, or alternatively the country of work – if not identical to the country of higher education, is left out of the picture.

So, a two-step procedure is called for to arrive at the optimal financing regime with open borders. In a first step, the private and social benefits and the corresponding share of costs borne via fees and taxes have to be determined. Then, in a second step, the specific implementation of the regime has to be considered. This involves the private part and the question of whether tuition fees should be levied at the time of studying or after graduation (as graduate taxes or income-contingent loans). The contributions by Barr (2014) and Del Rey and Racionero (2014) explicitly analyze this. This also concerns the public cost share and how it has to be allocated between the country of education and the country where indeed the social benefits arise. In fact, with migration, the financing would have to be split up among four parties: the graduates, according to their private returns, the country of higher education, that of previous education (possibly identical to that of birth), and the working-country (or countries), according to the respective social returns which those countries benefit from. This will be analyzed in detail in Section 4.

3.2.3. Asymmetric countries

Before moving on, we want to briefly comment on two of our assumptions: symmetric countries and the given (and identical) quality level of higher education. Within this framework, we have considered the options a country B has if it faces a policy change by another country A. At least with rather low mobility costs, we have argued that it is plausible to expect that country B matches this policy. But what happens when country B is not able to adjust its policy accordingly - or more precisely, when country B cannot introduce fees even if it faces positive tuition fees in country A?[24]

If A increases the fee level and B cannot match this because it continues to face constraints which restrict the financing instruments to pure tax-financing, B might contemplate changing the quality level of education. A migration equilibrium in the presence of different taxes and fees in the two countries can only exist, however, if the quality levels of education differ such that the quality is higher in country A (with high fees) than in country B (with low fees). Otherwise, why should students go, e.g., to the UK or the US despite the higher fees charged there by some (prestigious) universities? Country A, i.e., the UK or the US, then specializes in attracting high-ability students while country B focuses on the low-ability ones and an asymmetric equilibrium (possibly) results.

[24] See e.g. Austria where fees were ruled out in September 2008.

Otherwise, all students would go to country B where the given educational quality is provided most cheaply (for zero fees).[25]

Whether this constitutes an equilibrium when general equilibrium effects are taken into account depends on the specific functional forms. The relative importance of student and graduate mobility will be essential for the financial regime as well as the quality level of education and the cost function.[26]

4. How should the costs of higher education be shared between the affected countries?

We may now discuss the current system of financing higher education of cross border students in the EU and investigate alternative avenues which fit aspects of the challenges mentioned above. Comparisons with alternative devices, like the Bhagwati tax and the instrument of Contingent Loans will be conducted including a discussion of US policies.[27] As basic setting for this section we use the old and new paradigms already mentioned and depicted in Section 1.

4.1. The old paradigm

In that setting the resident is born in one country, she studies in that country and after graduation she works in that country, too. Therefore the countries of origin, studies and work are identical. That corresponds to a closed economy but also to an open one; let us call it a union, provided that education policy, especially tertiary education, is centrally designed.

The objective of the country is to maximize a Social Welfare Function based on its own benefits and costs. Benefits are basically the contribution of graduates to GDP. However those benefits might be split in two sets: one consists of private benefits like a better pay, better working conditions, smaller risk of unemployment, and better health; the other conveys social benefits which include spillover effects on the quality of the working force in the area, taxes paid on higher wages, possibly levied in a progressive way, larger contributions to social security, and simultaneously fewer costs in terms of social benefits like unemployment benefits and health-related expenditure.

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[25] Another, related example of an intentional differentiation strategy within countries concerns the Russell Group in the UK. This association of 20 major research-intensive universities strives at maintaining the highest standards of research, education and knowledge transfer. By doing so, the universities which belong to this group clearly want to differentiate themselves with respect to other British and possibly European and North-American universities in terms of quality and in terms of tuition fees. Fees are limited to formerly £3,000 and now £9,000 per year for full-time British and EU undergraduates, whereas there is no limit for fees for students coming from outside the European Union (Murphy, 2014).

[26] See Demange and Fenge (2009) for a model which deals with this question - albeit in a simplified version of the model presented here.

[27] The setting below is based on a simple model initially introduced in Gérard (2007).

Costs basically include the cost of providing students with higher education, and the opportunity cost of no contribution to GDP during the period of studies. Those costs may also be split into private and social costs.

Taking into account all these benefits and costs the country or the union decides on an optimal amount of tertiary education. A formal value for that amount is provided by equation (3) below. However, even though the centralized outcome makes sense in a country, it does not at the level of a union like the EU where provision and financing of higher education is a competence that countries or subdivisions of countries are not ready to transfer to the center. Therefore, at that level, one may seek for a decentralized design which reproduces the centralized outcome.

4.2. The new paradigm

Let us now introduce the distinction between the country of origin, that which hosts the students and the country of work or the destination country, respectively – Table 5. In that framework, we investigate a series of education policy devices in order to assess their respective capacity of approximating the centralized one, i.e.to assess their efficiency in terms of internalization of cross border spillover effects.

Table 5 – Benefit and cost for the origin, host and destination countries

Country	*j* (origin)	*i* (host of higher education)	*k* (third destination for working purposes)
Host Country Pr.	Benefit = returning graduates Cost = Opportunity	Benefit = remaining graduates Cost = Studies	Benefit = attracted graduates No cost
Origin Country Pr.	Benefit = returning graduates All costs	Benefit = remaining graduates No cost	Benefit = attracted graduates No cost
Origin Country + Bhagwati tax (BT) or Contingent loan	Benefit = returning graduates Cost = All - BT	Benefit = remaining graduates Cost = BT on remaining	Benefit = attracted graduates Cost = BT on attracted

Benefits of a country primarily consist of the contribution to domestic GDP of graduates who, after their graduation, decide to settle there. In addition, benefits also consist of the net local expenditures by foreign students during their stay in that (host) country and possibly of the money they bring from home to finance their tuition fees. Finally, the last component of the benefits is not the least: it relates to the opportunity cost. Indeed, during their period of tertiary education, students do not belong to the workforce of their origin country and they do not contribute to the GDP of that country; that creates an opportunity cost. When a country keeps or attracts a foreign student after her graduation, it not only gets the contribution of that person to GDP, but also avoids

the burden of the opportunity cost, which is actually supported by her (origin) country of previous education; therefore the (host or destination) country enjoys an externality.

Costs basically include the cost of providing students with higher education, and possibly the compensations to be paid to the country of origin of the graduates.

All in all the fact that the Social Welfare Function only considers students who, when they graduate, will contribute to local GDP, and does not internalize corresponding opportunity cost, makes the number of cross border students inefficient and involves free riding by at least one country.

In the following, we first consider a system ruled by the Host Country Principle, which is mostly applied in the European Union, with the noticeable exception of England. We will complete the section with a brief comparison between EU and Anglo-Saxon practices. Then we will turn to alternative designs and discuss their properties, especially from a cross-border efficiency point of view.

4.2.1. The current Host Country Principle

Currently, in most EU member states except England, higher education for native and other EU-students is mainly publicly funded by the local government of the host or higher education country, and thus by the taxpayers of that country, that we have named *i* above (see Table 6.5). Moreover the tuition fees *v* are either zero or equal to a very moderate amount compared to those charged in England or the US, or in the EU to non-EU residents – see the contribution of Murphy (2014). These features characterize what is named here the Host Country Principle. Formally – see Gerard (2007) – we may depict the social welfare and objective function of host country *i*, as

$$W^i = \rho_{ji}^i \theta f\left(n_{ji}\right) + v_{ji} n_{ji} + \gamma q_{ji} n_{ji} - c n_{ji} - \rho_{ji}^i \tau_{ji}^{ij} n_{ji} \qquad (1)$$

where we assume for the sake of simplicity that people working in *i* have received their pre-tertiary education in *j* but their tertiary education in *i*. We abstract from any third country *k* here.

That equation deserves some comments. First, $\rho_{ji}^i \theta f\left(n_{ji}\right)$ is the social value of the discounted flow of future contributions to GDP in *i* by the fraction ρ_{ji}^i of the n_{ji} students, whose country of origin is *j* and whose country of tertiary education is *i,* and who decide to stay in *i* after graduation; θ is a parameter which reflects the social value of that contribution.

Two questions, at least, then arise. First, what is the size of ρ_{ji}^i ? Van Bouwel and Veugelers (2014) suggest a figure around 70% for young Europeans who have obtained their PhD in the US. A similar figure of about 70% is set forth for OECD countries by Felbermayr and Reczkowski (2014). However,

they say that the average effect is entirely driven by Anglo-Saxon countries. For the EU they arrive at a retention rate of about one third, but with a very high dispersion: retention or stay rate is larger than 30% in Ireland and the UK but around 3 to 5% in continental European countries like Austria, Belgium, France or Germany.

This difference is important. In our opinion, it reflects the fact that, in the EU, there are clearly two different types of student mobility, already illustrated in Section 2 – see Table 1. On the one hand, there is the migration of the most talented students who primarily go to Anglo-Saxon countries where they are likely to stay. On the other hand, there is that of students who fail at entrance examination level in their country and attempt to get an equivalent degree abroad, almost all of whom return home after graduation. See the case of French or German students enrolling in neighboring countries.

The second question is about the value of θ, in particular, whether the social value – by which is meant the combination of the private and public values or benefits – of the contribution to local GDP by foreign graduates remaining in their education country exceeds the private value or benefit of their degree? That question is to some extent highlighted in Gagliardi (2014).

The second comment related to equation (1) is on γq_{ji} where γ captures a multiplier effect and q_{ji} reflects the net amount of expenditures by foreign students. The size of those expenditures is not discussed here but it is extensively documented in the literature as recalled by Gérard (2012).

Finally, we do not comment on the cost of studies c and the tuition fee v_{ji}, except that we suppose $c - v_{ji} \geq 0$; and we leave transfers τ_{ji}^{ij} aside for the time being. In that context, the number of foreign students that the higher education country *i* will want to host will be, assuming a log specification for the $f\left(n_{ji}\right)$ function,

$$n_{ji}^{H} = \frac{\rho_{ji}^{i}\theta}{c - v_{ji} - \gamma q_{ji}} \tag{2}$$

where the superscript *H* indicates that the Host Country Principle applies.[28] That number increases with the probability of staying in the country after graduation, with the social value of foreign graduates' contribution to domestic GDP, with the height of the tuition fee they pay and with their net effect on local expenditures; and it decreases with the cost of studies, supported by the host

[28] The number of students derived from this equation might be considered as an optimal quota of foreign students such as the one determined by Austria and Belgium in some paramedical programs; see European Court of Justice (2010).

country. That number however is not efficient since, as explained above, country *i* does not include externalities in its calculation. If one takes those spillover effects into account, the expression above becomes

$$n_{ji}^{E} = \frac{\theta}{c+w} \tag{3}$$

It is different from the previous one in three respects. First, the effect on the total GDP of the various countries affected is counted. Second, the opportunity cost of higher education, w, is embodied; that latter cost is supported by country *j*, the country of origin of the students. And finally transfers between countries cancel out – though that point might be debated. Comparing (2) and (3), the application of the Host Country Principle leads to an inefficient outcome: too few foreign students are admitted if the probability to stay abroad after graduation is low,

$$\rho_{ji}^{i} < \frac{c - v_{ji} - \gamma q_{ji}}{c+w} < 1 \tag{4}$$

In contrast too many foreign students are admitted if that probability is high.

We know that in most EU countries today the staying rate of foreign students, ρ_{ji}^{i}, is low – if one uses the figures suggested by Felbermayr and Reczkowski (2014) – and tuition fees, v_{ji}, are close to zero. If we further assume that the net effect q_{ji} vanishes, then it is very likely that we observe too few mobile foreign students. In contrast, in the Anglo-Saxon world where ρ_{ji}^{i} is high and v_{ji} close to *c*, there will be too many foreign students attending classes in universities. That large supply of seats for foreigners in Anglo-Saxon aula, especially in Canada, New-Zealand, the US and Australia, means that those countries may attract, or want to attract, foreign students without supporting the opportunity costs of studies – see above for the explanation of that cost.

To sum up, under the assumptions above, we find

$$\begin{aligned} n^{H} &= \frac{\rho_{ji}^{i}\theta}{c - v_{ji} - \gamma q_{ji}} \to 0 < n^{E} \text{ , } \rho_{ji}^{i}, v_{ji}, q_{ji} \to 0 \text{ , EU Case} \\ n^{H} &= \frac{\rho_{ji}^{i}\theta}{c - v_{ji} - \gamma q_{ji}} \to \infty > n^{E} \text{ , } v_{ji} \to c \text{ , } q_{ji} \to 0 \text{ , Anglo-Saxon Case} \end{aligned} \tag{5}$$

The Anglo-Saxon view where $v_{ji} \to c$ actually characterizes the first alternative examined below.

4.2.2. The Origin Country Principle

A first alternative to the Host Country Principle is the Origin Country Principle. According to that mechanism, the country of origin of a student, say her country of secondary education, is responsible for her higher education irrespective of whether the latter takes place at home or abroad. In both cases, it is up to the origin country to pay; it does not matter whether it is through a direct transfer from country to country or through a fellowship – a voucher – given to the student herself. Accordingly, that jurisdiction will decide on the number of students it sends abroad. Then the relevant Social Welfare Function is that of country *j* and may be written, under similar simplifying assumptions as before, as

$$W^j = \rho_{ji}^j \theta f\left(n_{ji}\right) - \gamma q_{ji} n_{ji} - c n_{ji} - w n_{ji} + \rho_{ji}^i \tau_{ji}^{ij} n_{ji} \tag{6}$$

where, in the following, the τ-terms will again be set to zero. Notice that, here, the term $-cn_{ji}$ illustrates that the origin country *j* pays to the higher education country *i* the true cost of studies, i.e. $v_{ji} = c$. Moreover $-wn_{ji}$ refers to the opportunity cost mentioned earlier, that students, during their tertiary education period, do not contribute to the GDP, here in their country of origin, *j*.

Then the equilibrium number of students sent abroad amounts to

$$n_{ji}^O = \frac{\rho_{ji}^j \theta}{\gamma q_{ji} + c + w} = \frac{\left(1 - \rho_{ji}^i\right)\theta}{\gamma q_{ji} + c + w} \tag{7}$$

where the superscript *O* indicates that the Origin Country Principle applies. That number is again inefficient since spillover effects are not taken into account, now by the government of country *j*.

Compared to the Host Country Principle, the number of foreign students will be larger, however, under the Origin Country Principle if

$$\rho_{ji}^i < \frac{c - v_{ji}}{c + w} \rho_{ji}^j \tag{8}$$

Where we assume as before that $q_{ji} = 0$. It turns out that in the typical EU case where ρ_{ji}^i and v_{ji} are small (see above), shifting from the Host to the Origin Country Principle might be a Pareto improvement, since it increases the number of cross border students, while it may not be the case for Anglo-Saxon countries. Indeed, under the assumptions of this simple model, we find that

$$n^H = \frac{\rho_{ji}^i \theta}{c - v_{ji} - q_{ji}} \to 0 < n^O = \frac{\left(1-\rho_{ji}^i\right)\theta}{c+w} \to \frac{\theta}{c+w} = n^E \text{ , } \rho_{ji}^i, v_{ji}, q_{ji} \to 0 \text{ , EU Case}$$
$$n^H = \frac{\rho_{ji}^i \theta}{c - v_{ji} - q_{ji}} \to \infty > n^E > n^O = \frac{\left(1-\rho_{ji}^i\right)\theta}{c+w} \text{, } v_{ji} \to c \text{ , } q_{ji} \to 0 \text{ , Anglo-Saxon Case} \quad (9)$$

Let us now investigate how to implement the Origin Country Principle and have a look at two actual examples where such a device is applied: Switzerland and the Nordic countries.

The system described above can be implemented through the provision of vouchers by the government of a given country to potential students who are residents of that country. Those vouchers may be used for, say, one year of studies in a particular field in a university located at home or abroad, provided it is recognized as an institution of high quality by the issuer of the voucher. Those vouchers should either cover the actual cost of studies or a standardized one. It is up to the issuer of the voucher to decide whether the vouchers are distributed upon request or are allocated through a competition, and whether they are made available for free or subject to a present or future (re)payment.

In the case of competition, and provided that other countries commit to not admitting students without a voucher, that device expands the geographical area of sovereignty to the set of those countries, e.g., the Bologna area or the European Union. As an example, let's imagine that Germany limits the number of students admitted to the first year of medicine in German universities in order to optimize the supply of medical services in the future; those young Germans who go to Austria and enroll in the schools of medicine there try to bypass the German numerus clausus – at least when they plan to go back to Germany after they have obtained their MD degree (according to the EU law they will be permitted to practice medicine, at least in hospitals). If we move to the Origin Country Principle, only those young Germans with a voucher issued by the German authorities will be admitted to Austrian schools of medicine. Thus the decision to admit those students for studies in medicine, even outside Germany, is in the hand of the German authorities who are then in a position to expand the application of their numerus clausus rules and thus their area of sovereignty. And similarly, Austria has the opportunity to sell the quality of its medicine schools while being in accordance with German public health policy.

Though the vouchers depicted above channel the transfer implied by the Origin Country Principle through students, that transfer may alternatively be directly operated by governments. This is already the case in Switzerland and in the Nordic Countries. In Switzerland, cantons that do not have universities pay for the studies of their residents in universities located in other cantons. Similarly, among Nordic countries, if, say, a Norwegian student enrolls in a university in Denmark, Norway will

partially compensate Denmark. To illustrate that system, based on a four country agreement, notice that "the previous agreement was signed in 1996, and the new agreement will be effective from 1 January 2013 for Denmark, Finland, Norway and Sweden (…) The new agreement means that the yearly compensation per student for Denmark will be DKK 22,000 (US$ 3,800) in 2013 – the same as it was in 2012 – rising to DKK 30,000 (US$ 5,200) in 2014. The compensation will be regulated according to the consumption index calculated each year by Statistics Denmark.

Under European Union (EU) regulations, Denmark is obliged to treat citizens of the EU and the European Economic Area the same as Danish citizens, which means that European students are entitled to free higher education in Denmark. The compensation agreement has been concluded despite this, with the cost to be carried by governments rather than by individual students".[29] It seems from that quotation that direct transfers between governments are a way to bypass EU legislation. In the same line, Switzerland plans to demand compensatory transfers for German students who study in Switzerland. Switzerland is also willing to pay something to Germany for Swiss students in Germany. But as the numbers are unbalanced (many more Germans study in Switzerland than vice versa), Germany would transfer much more money.[30]

4.2.3. Bhagwati Tax and Contingent Loans

In an increasingly integrated world, graduates are most likely to work in a country different from both their country of origin and their country of higher education. That third country, denoted by *k* and referred to as the destination country, benefits from a high skilled worker without supporting the cost of her education – in country *I* – and the corresponding opportunity cost – in country *j*. Country *k,* in other words, free rides on its two partners, which constitutes an important source of inefficiency. Can we find a remedy for that inefficiency?

A new application of the Baghwati Tax as proposed by Bhagwati (1976) and again in Wilson (2008) is one such remedy. In this application, those who have studied at the expenses of one country and currently work in another country have to compensate the former for the cost of their tertiary education. In practice that may take the form of a transfer by the government of the latter country to the government of the former within an agreement similar to the Nordic one – see above. If the Host Country Principle applies for the financing of the studies the transfer is due to that country; but then the opportunity cost supported by the country of origin is not offset. Under the Origin Country

[29] See University World News, 03 November 2012, http://www.universityworldnews.com/article.php?story=20121031163939447#.UJOYFr7pNiM.email.

[30] See Neue Züricher Zeitung, 21 October 2012.

Principle the transfer is due to the origin country and may include the compensation of the opportunity cost.

That latter solution combining the Bhagwati Tax with the Origin Country Principle might be superior since then a transfer from the third destination country may offset both the opportunity cost and the cost of studies. The objective of the origin country is then to maximize the Social Welfare Function (6) where the transfer τ funded by the Bhagwati Tax is no longer zero. Assuming that after completion of their studies in country *i*, graduates whose origin country is *j* distribute between the three countries involved, the number of students sent abroad by their country of origin amounts to,

$$n_{ji}^{BT} = \frac{\rho_{ji}^{j}\theta}{\gamma q_{ji} + c + w - \rho_{ji}^{i}\tau_{ji}^{ij} - \rho_{ji}^{k}\tau_{ji}^{kj}} \tag{10}$$

If the discounted flow of tax liabilities matches the costs supported by the origin country, the number of students becomes,

$$n_{ji}^{BT} = \frac{\theta}{\left(\gamma q_{ji} / \rho_{ji}^{j}\right) + c + w} \tag{11}$$

which only differs from the efficient one – see equation (3) above – by the $\gamma q_{ji} / \rho_{ji}^{j}$ term in the denominator with q_{ji} as defined above (and assumed to vanish in the computation of mobile students suggested in equations (5) and (9)).

Another instrument to remedy the inefficiency set forth above is to turn vouchers into contingent loans, a well-known mechanism investigated a.o. by Barr (2014) and Del Rey and Racionero (2014). If payments associated to the contingent loans are deductible against the personal income tax liabilities – imagine a tax credit – in the country of residence, this mechanism is similar to the Bhagwati Tax, except possibly for its timing. Alternatively, when the graduate stays abroad, the charge of the loan might be isolated by the local tax administration and transferred to the country of origin deemed to have made the loan, creating a compensation of the origin country by the destination one. In both cases, equation (11) holds.

4.2.4. Foreign students in US postgraduate education: a mix of Origin and Host Country Principles

Especially interesting is the case of foreign students in US universities. During their first – and sometimes second – year of graduate studies the Origin Country Principle usually applies. They are pre-selected by, and in, their country of origin, and sent to the US with a fellowship from their origin country intended to cover the cost of the studies and the cost of living during those years, a precondition to get a student visa. US universities then make their choice among the pre-selected

applicants. Usually again, if they succeed at the end of that period and decide to go ahead with a US graduate program, they receive support from the US university, and thus the Host Country Principle applies.

After graduation they are likely to remain in the US, as pointed out by Van Bouwel and Veugelers (2014) where a retention rate of around 70 % for PhD holders is set forth.

4.2.5. …and a way to unveil the missing characters

One may easily understand the behavior of US universities or of the US in general. Given the high probability that the best students remain in the country after their graduation, a probability that presumably increases with the length of the stay in the US, the Host Country Principle is more likely to be more efficient than the Origin Country Principle. Arguing that the probability goes up with the length of the stay is a way to explicitly re-introduce a first missing character, the cost of migration, and thus to relate this discussion with the seminal approach suggested by Borjas (1987).

Understanding the behavior of the countries which pay for their best students going to the US, thus applying the Origin Country Principle, is more demanding. A first argument to justify such a policy is that more money is available for studies in the US than for studies in other countries, partly because that money comes from budgets and foundations co-funded by the US and the origin country, such as the Fulbright and Fulbright-Schuman grants.

Leaving aside that argument one may question why the money is not preferably used to send students to other countries, whose retention rate is lower or who require smaller investment.

Most importantly that issue allows us to introduce the second missing character in the reasoning: quality, or at least, perceived quality. By that term we mean academic and scientific quality as testified by reviews and rankings, but also quality in terms of networking opportunities and fluency in the *lingua franca*, i.e., English.[31] The parameter θ which brings into the model the gain from studies abroad might incorporate quality and quality differences. Suppose you have the choice between sending a bright student to country *a* and sending her to country *b*. The probability of her return is $1-\rho^a$ if she goes to country *a* and $1-\rho^b$ if she enrolls in country *b*, with $1-\rho^a < 1-\rho^b$. Values of θ are θ^a and θ^b, respectively, with $\theta^a > \theta^b$ and costs are c^a and c^b with $c^a > c^b$. According to the model used so far, especially equation (6), the student will be sent to *a* rather than to *b* if,

[31] On networking and especially the Taiwan-Silicon Valley relation, see Hsu and Saxenian, (2001). On the premium granted to the knowledge of English see, e.g., Vaillancourt, Lemary and Vaillancourt (2007).

$$\theta^a > \frac{\left(1-\rho^b\right)\theta^b\left(1/n\right)+\left(c^a-c^b\right)}{\left(1-\rho^a\right)\left(1/n\right)} - \frac{\left(\rho^a\tau^a-\rho^b\tau^b\right)}{\left(1-\rho^a\right)\left(1/n\right)} \quad (12)$$

The last term on the right hand side of the inequality shows that the introduction of a Bhagwati tax or of a contingent loan of the kind described above increases the likelihood for the inequality to be fulfilled. More generally the inequality shows that the return on the investment measured by θ^a should exceed a threshold which depends on a series of variables.

Therefore one may conjecture that, even now, the qualitative and quantitative return on a US degree, despite the few students who come back, outweighs any alternative destinations for studies. This approach might be compared with that of Haupt, Krieger and Lange (2014). Those authors argue that "a higher permanent migration probability, i.e., a higher probability that international students continue to stay in their host country after graduation, incentivizes the host country to improve its education quality. A higher education quality in turn raises the human capital of all students, including returning students. As long as the permanent migration probability is not too large, this positive quality effect increases human capital and welfare in both the less developed country (LDC – the sending country) and the developed host country. Thus, a brain gain to the LDC occurs."

A third missing character is asymmetry between countries beyond the difference pointed out so far.

5. Conclusion

Features specific to the European Union exacerbate the issues raised by international mobility of students and graduates there. Among those features we have set forth the political desirability of students mobility viewed as a building block for Europe, the existence of powerful instruments like the Erasmus program and the Bologna process, low tuition fees in most EU member states, and the principles of non-discrimination and subsidiarity. In such an environment, mobility of students is especially a challenge for public provision and financing of tertiary education: indeed mobility increases with the level of education, mobility of students incentivizes mobility of graduates and, above all, mobility of students is unbalanced, creating different subsets of countries within the EU. Among them a distinction has to be made between countries which are net importers and net exporters of students. Within the former group one has, in addition, to distinguish between countries which finance the studies of their neighboring fellows with a limited retention rate of graduates, countries which have a limited retention rate but have the studies of the neighboring fellows financed partially or totally by their respective countries of origin, and finally countries where foreign students support the cost of their studies but are likely to stay after their graduation.

Those features raise the two questions that we have coped with in Sections 3 and 4, respectively. First, how should the costs of education be shared between the individual and the government? And second, how should the costs of higher education be shared between the affected countries?

For the first question the relative shares of private and public or social returns play an important role as well as market imperfections such as credit constraints and externalities. While a financing scheme which only relies on tuition fees will not turn out to be optimal, this also holds for pure tax-financing of higher education. In an open economy, in addition, the conclusions depend on the relative intensity of student and graduate mobility as well as – and this already refers to the second question – on the absence or presence of intergovernmental transfer systems.

The second question allows us to make a distinction between the old paradigm, when a resident of a country was born, studied and worked in the same country, and the more and more relevant new paradigm where the country of origin of a students is no longer the one where she will study, or the one where she will work after completion of her studies. In such a setting, decentralized education policy leads to inefficiently low or high public provision and financing of tertiary education, depending on the retention rate after graduation due to externalities. As a centralized device internalizing those externalities is not feasible, at least in a union like today's EU, the question then is to find a decentralized device which comes closest to the outcome of the efficient centralized one. With that objective in mind, we have investigated the properties of some avenues, like substituting the host country principle with the origin country one, through vouchers or intergovernmental transfers, with possible compensation of the origin country by the destination country; expanding the use of contingent loans; or introducing a Bhagwati tax. All that paves the way for further research and more focused work on these issues.

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