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Financing Bologna Students' Mobility.

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Abstract

The current system for financing cross-border students, based on the host country, is neither sustainable nor efficient: it produces too little cross-border education. On that background, and motivated as well by a recent decision of the European Court of Justice, we explore two alternative solutions. The first one substitutes to the financing by the host country, a financing by the country of origin, through vouchers that the student may use at home or abroad provided it is in a recognized institution. The second one, potentially an efficient design, combines that substitution with a reimbursement of education costs through interjurisdictional transfers or the change of vouchers into contingent loans.

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1 Introduction

More and more students are crossing national borders to get either credits or full degrees abroad. This is especially true within the European Union (EU). Actually two different reasons at least motivate those cross border flows of students. On the one hand, students may consider that an international experience makes them bi- or multi-cultural and provides them with additional capabilities when entering the labor market: they may play in European Liga, no longer in the sole domestic one; they belong to an international elite also called a common pool of talents - the term is used by Haupt, Krieger and Lange (2010) for mobile students -, and contribute to the creation of a single EU market for high skill graduates.[1] The EU national and supra-national authorities themselves seem to be convinced that such a creation is desirable. They have launched the Erasmus program which finances studies abroad on an exchange basis. They also support the Bologna process which, by creating well defined transferable credits, makes diplomas more transparent and comparable; and insisting on the quality of Higher Education, that process favors international mobility of students.

On the other hand, students try to get a degree abroad because they fail at entrance examination in Higher Education (HE) institutions in their country of origin. Then they move to a neighboring country where HE is of good quality, cheap and provided in their mother tongue. The Bologna process and the free circulation of workers within the EU make such behavior easier today than previously. This is typically the case in medical and paramedical fields of study, or still in veterinary medicine, where a huge number of French and German students, failing at entrance test in their origin country, find a substitute in the French speaking part of Belgium or in Austria and return home after obtaining their degree; in that sense France and Germany free-ride their neighbor. According to OECD (2010), there are 16,650 French students in tertiary education in Belgium against 2,768 Belgian students in France; similatly there are 17,464 German students in Austrian tertiary education against 6,419 Austrian in Germany (see also Table 1 infra).

Those in- and out-flows of students do not raise specific issues for public finance as long as they are balanced. This was the reasoning at the root of the Erasmus program: a student of a given university in a given country spends a term or a full academic year in a university of another country and a student of that latter university goes to the former. Consequently, students are exchanged, not money: each student enrolls in the university of the country where she comes from. However that system becomes problematic when some destinations are more valued than other countries, for various reasons like teaching language or quality of life.

[1] Few empirical works however investigate the wage effect of mobility; that effect may differ quite importantly from +20 to -5 pro cent according to Ball and Chik (2001), Bracht et al. (2006), Palifka (2003). The link between students and graduates mobility is documented by Parey and Waldinger (2008). Mechtenberg and Strausz, although they are among the first (2008) to set forth the advantage of being bi-cultural, qualifies that advantage in their (2009, 2010) papers.

However this paper does not focus on those exchange students, so called Erasmus students. It rather focuses on those who enroll in a HE institution abroad in order to get credits[2] that they will impute on the amount of credits needed to get a degree in their country of origin; or in order to get a full degree that they will use on the labor market either at home or abroad. Those students are called Bologna students in this paper; they may have decided to study abroad to become multicultural or because there was no room for them in domestic HE institutions. In any case not only students circulate across borders, but also (claims for) money.

That latter circulation deserves explanation. In most EU countries – UK is a noticeable exception – two features characterize the financing of HE, very small, or even zero, tuition fee on the one hand, quasi fully public funding by domestic authorities on the other hand.[3] Moreover EU rules prohibit discrimination between domestic and other EU residents. As a consequence a student of a given country A who gets her degree in country B and then never works in, and never pays tax to, that country, generates an externality: country B provides country A (supposed to be the country where career is spent) with enriched human capital for free. Thus there is a transfer from B to A and potentially a claim for money from country B. In US public universities where state and non-state residents are classmates, that problem has been solved through a differentiated tuition fee at least for the first year of studies. In UK, where that externality is large – see Table 1 – it has been internalized through a high tuition fee charged identically to both UK and non-UK but EU residents. In Belgium and similarly in Austria, where that externality is still larger than in UK – see again Table 1 – the problem has been solved through imposing a quota of no more than 30 per cent of EU non-Belgium residents in sensitive fields of studies.

That quota however has been considered by the European Court of Justice, the ultimate custodian of EU principles, as not compatible with EU Law. For the Court indeed "Articles 18 and 21 TFEU (the Treaty founding the EU) preclude national legislation, such as that at issue in the main proceedings, which limits the number of students not regarded as resident in Belgium who may enroll for the first time in medical and paramedical courses at Higher Education establishments, unless the referring court, having assessed all the relevant evidence submitted by the competent authorities, finds that that legislation is justified in the light of the objective of protection of public health."Moreover, although "the Belgian Government, supported by the Austrian Government, confirms that the legislation at issue in the main proceedings is necessary to attain the objective of ensuring the quality and continuing provision of medical and paramedical care within the French Community", the Court adds that "it follows from the case-law that a difference in treatment based indirectly on nationality may be justified by the objective of maintaining a balanced high-quality medical service open to all, in so far as it contributes to achieving a high level of protection of health. Thus, it must be determined whether the legisla-

[2] Known as ECTS, an acronym for European Credit Transfer System.

[3] See Aghion et al. (2008, 2010), Justmann and Thisse (1997, 2000), Andersson and Konrad (2003), Barr (1998), Poutvaara and Kanniainen (2000).

tion at issue in the main proceedings is appropriate for securing the attainment of that legitimate objective and whether it goes beyond what is necessary to attain it (...) That being the case, it is for the competent national authorities to show that such risks actually exist. According to settled case-law, it is for those authorities, where they adopt a measure derogating from a principle enshrined by European Union Law, to show in each individual case that that measure is appropriate for securing the attainment of the objective relied upon and does not go beyond what is necessary to attain it. The reasons invoked by a Member State by way of justification must thus be accompanied by an analysis of the appropriateness and proportionality of the measure adopted by that State and by specific evidence substantiating its arguments".[4]

That decision of the ECJ provides us with an additional and increased motivation for this paper. It aims not only at putting forward the inefficiency of the current principle of financing HE students mobility but also at investigating alternatives to quotas which may be more "appropriate for securing the attainment of the objective relied upon and does not go beyond what is necessary to attain it".

Table 1 – Profile of students' mobility in various EU Member States[5]

Country	Foreign students (%)	Balance of mobility (%)
Belgium	6.46	-4.69
Austria	8.07	-4.42
United Kingdom	4.04	-3.56
Sweden	3.57	-2.65
Germany	3.01	-1.82
Ireland	2.34	-1.52
Check Republic	2.66	-1.09
The Netherlands	2.03	-0.75
Denmark	1.59	-0.47
France	1.63	-0.39
Spain	0.51	0.29
Hungary	0.91	0.49
Italy	0.62	0.65
Poland	0.04	1.13
Portugal	0.65	1.34
Finland	0.63	1.47
Greece	0.04	3.15
Slovakia	0.36	8.35
Luxembourg	0.00	187.77
Source : Gérard et Vandenberghe (2007), based on Oecd and Unesco figures from 2006 or 2007.		

[4] See European Court of Justice (2010).

[5] The second column of the Table shows the percentage of foreign students from EU Member states in the total number of students in local institutions of Higher Education; the third column gives the ratio between the difference between the number of outgoing local students

Thereafter, section 2 presents and discusses the model used to conduct the analysis; it also shows the benchmark efficient equilibrium it may generate. Then section 3 set forth the inefficiency of the current system of financing HE mobile students, called the Host Country Principle. Section 4 suggests using another principle, called the Origin Country Principle, to design a system operating through two vouchers, and discusses under which circumstances such device is more efficient. Then, at section 5, we expand the model in order to take into account the possibility for the graduate from a country to spend her career in a country which is neither her country of origin nor her country of HE; contingent loans and the use of a Bhagwati tax[6] are then investigated. Some remarks and avenues for further studies are issued at section 6. Section 7 concludes.

Interested reader will usefully read Mechtenberg and Strausz (2008, 2009, 2010) and their references. For those authors "the most stable result established by this kind of literature is that although increasing mobility [...] will lead to higher private investment in education, public provision will decrease. The government will tend to free ride on the education system of other country". Buettner and Schwager (2004) obtains similar results while, next to the free rider effect, Kemnitz (2005) sets forth competition between governments to provide education to mobile students.

2 The Model

Let us assume a simple world, say a rudimentary European Union, consisting of two local jurisdictions or Member States denoted by i and j respectively. Each of them wants to maximize the social welfare of its own residents. Therefore it decides on the degree of international openness of its future workers; that degree is measured by the number of credits, or European Credits Transfer System (ECTS), that it commits to provide to incoming foreign students or to outgoing residents depending on the institutional environment at work.

The tuition fee requested from students is zero and then the cost of providing Higher Education is totally supported by the jurisdiction budget, what is close to the actual funding system in the EU. Also there is no difference between the costs of providing Higher Education to foreign and domestic students; indeed, such difference, if any, is small as reported by Throsby (1999). For the jurisdiction whose the students are residents, the cost of studies also include the opportunity costs of studying, i.e. the cost of not participating to the labor market during the studies. The cost of studies, fully socialized and supported by the local budget, might include a student's salary and it is eventually financed by taxes; however graduates will pay taxes in the country where they will work, not in that they are coming from.

– to EU countries – and that of incoming students – from EU countries – on the one hand, and the total number of Higher Education students in the country on the other hand.

[6] That tax has been suggested by economist Bhagwati in order to offset developing countries whose students, after completing their education in developed countries, decided to stay and work there rather than to return home; see Bhagwati (1976) and Wilson (2008).

The objective function of the government of country i might be written as an intertemporal Social Welfare Function

$$W_i = f\left(e_{ii}, r\beta e_{ij} + (1-r)\,\beta e_{ji}\right) - c\left(e_{ii} + e_{ji}\right) - w\left(e_{ii} + e_{ij}\right) \qquad (1)$$

In that equation, $f(x,z)$ is the local production function of wealth; it is characterized by a technology using locally and internationally educated graduates. The former have been educated only at home, in the domestic establishments of Higher Education. The latter have been educated abroad: either they are natives of the country who come back home after the completion of their studies abroad - what they do with a probability r - or they are foreigners who come to the country for getting credits or a degree and who then decide to remain in the country after their studies - what they do with probability $1-r$. Both groups of internationally educated graduates are said to be bi-cultural and have an extra, identical or smaller ability to contribute to wealth production characterized by $\beta \geqslant 1$.[7] Moreover, e represents the number of ECTS: among the two subscripts associated to that variable, the first one denotes the country of origin of the student, and the second one indicates the country where she studies; $c(x)$ is the cost of producing ECTS and w stands for the opportunity cost of dedicating time to getting an ECTS rather than contributing to current production of local wealth. The equation shows that a country benefits from ECTS obtained abroad by its own residents who return home after their studies.

The first order condition of the maximization of the objective function with respect to the decision variables under control of the local government, e_{ii} and either e_{ji} or e_{ij} allows us to derive the optimal behavior of the government. Especially it enables to write the reaction function of government i to government j decisions regarding the number of foreign students (or ECTS) that it decides to host or the number of resident students that it wants to send abroad. Nash equilibrium might then be computed.

Under the Host Country Principle equilibrium gives the number of ECTS that each jurisdiction will provide to foreign students; those numbers may be regarded as the quotas applied by Austria and Belgium. In contrast, under the Origin Country Principle, those numbers refer to the students sent abroad by the jurisdiction at its own expenses. In both cases however those numbers are inefficient. In the former case indeed the government of i deciding in its own best interest will base its decision on the sole fraction $1-r$ of hosted foreign students who will stay in the country after their studies and contribute to the production of local wealth; the fraction r of those students returning home after completing their studies will be disregarded. On the contrary, in the latter case, only students returning home after their studies matter for the government which finances them, those remaining in the host country being disregarded.

The lack of efficiency of those situations has to be appreciated with respect to an efficient benchmark provided by the joint maximization of $W_i + W_j$ w.r.t. e_{ii}, e_{jj}, e_{ij} and e_{ji}. Assuming the right concavity of the production function,

[7] See above the two reasons why basically students are going abroad for studies; see also Mechtenberg and Strausz (2008, 2009, 2010).

that c and w are linear in ECTS and that countries are symmetric, it turns out that,

$$\begin{aligned} f_d^i &= f_d^j = f_d = c + w \\ f_m^i r\beta + f_m^j \beta(1-r) &= f_m^j r\beta + f_m^i \beta(1-r) = \beta f_m = c + w \end{aligned} \tag{2}$$

where a subscript d refers to purely domestic students and a subscript m to internationally mobile ones. An efficient equilibrium is then characterized by

$$\begin{aligned} e_d^E &\propto \frac{1}{c+w} \\ e_m^E &\propto \frac{\beta}{c+w} \end{aligned} \tag{3}$$

where a superscript E refers to efficiency.[8] We observe that neither r nor $1-r$ appear in that equation.

In section 5 we will try to find out institutional arrangements which replicate those values without implying a centralized process.

That model however deserves at least two comments. On the one hand it considers only the supply of ECTS by the HE authorities of each country; students' wishes do not play any role unlike in many papers. The justification we give is that demand for ECTS is constrained by supply in a world where the price is zero.[9] On the other hand, HE institutions and governments are not distinguished from one another. That may correspond to a world where HE is publicly funded and provided. However even in such a world, HE establishments may have a behavior which does not fit exactly the wishes of public authorities whose they are the agents; it will be however up to a further development of this research to cope with that issue.

3 The Host Country Principle

As documented in the introductory section, in most EU Member States ECTS provided to foreign students are financed by the host country which thus imports post secondary students and some months or years later exports an enriched human capital which will contribute to the wealth and revenue of its country of enrichment in proportion $1-r$ only. In that setting it is up to that country to decide on the number of foreign students it will host and thus on the maximal number of credits it will provide to foreign students. That number might be regarded as a quota.

Then the first order condition of the maximization of equation (1) w.r.t. e_{ii} and e_{ji} is

$$\begin{aligned} f_{ii}^i - c'_{ii} - w_{ii} &= 0 \\ (1-r)\,\beta f_{ji}^i - c'_{ji} &= 0 \end{aligned} \tag{4}$$

[8] To easily understand the derivation of e_d and e_m assume that the production technology is specified by $f(x,z) = \alpha \ln x + \alpha\beta \ln z$ where $x = e_{ii}$ or e_{jj} and $z = re_{ij} + (1-r)e_{ji}$ or $re_{ji} + (1-r)e_{ij}$.

[9] See Gérard (2007).

and similarly for the other jurisdiction. Under the same assumptions as in the previous section, the equilibrium numbers of ECTS now are

$$\begin{aligned} e_d^H &\propto \frac{1}{c+w} \\ e_m^H &\propto (1-r)\frac{\beta}{c} \end{aligned} \tag{5}$$

where e_m^H is the outcome at Nash equilibrium of the non-cooperative simultaneous game between the two governments.

Comparing the second line of equation (5) with that of equation (3) we denote two main differences, the presence of $1-r$ and the absence of w in the denominator. The former illustrates that only students expected to remain in the country have been taken into account, the latter that the host country does not support the lack of production suffered by the country of origin of those students. Therefore the externality, which is measured by

$$E^H = e_m^E - e_m^H = \left[1-(1-r)\frac{c+w}{c}\right]\frac{\beta}{c+w} \tag{6}$$

and might be either positive or negative, will involve an underprovision of mobile students if

$$r > r^H = \frac{c}{c+w} \tag{7}$$

In the opposite case an overprovision occurs. For illustrative purpose, one may suppose an opportunity cost of 12,000 Euros a year and a cost of studies of 7,000 Euros as it is the case in paramedical studies (Gérard and Vandenberghe, 2007), then the threshold value for r amounts to .63 which is certainly compatible with today European situation so that we can suggest that the quotas implied by the current system of financing mobile HE produce too few cross border Higher Education. Notice that, based on the second line of (5),

$$\frac{de_m^H}{dr} < 0, \frac{de_m^H}{dc} < 0, \frac{de_m^H}{d\beta} > 0$$

so that foreign students are more likely to be welcome when their probability to return home after their studies goes down, when the cost of those studies for the host country is smaller and when their potential contribution to the production of wealth is larger. In other terms best welcome are those with a high probability to stay and a high return on investment β/c.

4 The Origin Country Principle

According to that principle, it is up to the country of origin of the student, understood as that where she completed her previous studies – like that where she got her high school degree –, to fund her HE regardless the country where those studies are performed, but provided it is in a school whose good quality

has been certified and recognized by the paying authority. That system is quite similar to that used for health care. For Higher Education, it is used by Swiss cantons (Gérard, 2008b) and most often in the case of students sent abroad with a fellowship from her origin country.

Let us first set forth the main lessons which arise from the use of that principle; then we will discuss its properties and its feasibility.

4.1 The Principle

So far the government of country i decided on the number of ECTS e_{ji} that it provided to foreign students and maximized equation (1) with respect to that variable. Now it determines the number of ECTS e_{ij} that it allocates to students from its own jurisdiction that it sends abroad and whose it will finance the cost of studies. Therefore it now maximizes equation (1) with respect to that latter variable. Proceeding as previously we get now the equilibrium values

$$\begin{aligned} e_d^O &\propto \frac{1}{c+w} \\ e_m^O &\propto r\frac{\beta}{c+w} \end{aligned} \tag{8}$$

and again an externality arises

$$E^O = e_m^E - e_m^O = (1-r)\frac{\beta}{c+w} \tag{9}$$

Those results are driven by the fact that the origin country only takes into account the fraction r of students who will come back after their studies abroad; the externality, which is positive anyway now, is the "gift" made by the origin country to the host country and consists in a fraction $1-r$ of the students whose it finances the studies but who will remain in the host country and be productive in that latter jurisdiction.

Although it is still inefficient, moving from the Host Country Principle to the Origin Country Principle may increase efficiency. Indeed,

$$e_m^E > e_m^O > e_m^H \tag{10}$$

if

$$r > r^{HO} = \frac{c+w}{2c+w} \tag{11}$$

Using the same figures for c and w as in the previous section we get $r^{HO} = .73$. Since actually the probability of returning home is high and might be supposed larger than that threshold, we may conclude that moving from the Home to the Origin Country Principle is welfare enhancing.

4.2 Properties and Feasibility

Equation (10) shows that, under the realistic condition (11), moving from the Host Country Principle to the Origin Country Principle makes us closer to the

efficient solution. Beyond that economic property, funding of students by the origin country allows the authorities of that country to expand the geographical area in which its policy is applied. However that system needs some cooperation between partner countries: that cooperation may take the form of bilateral treaties or be organized through a EU directive. In that latter case the mechanism set forth should be consistent with the subsidiarity principle. According to that principle and the subsidiarity test suggested by Pelkmans (2005) and expanded by Ederveen, Gelauff and Pelkmans (2008), you start with all the competencies exerted at the lower level, say the Member States - which is the case according to the currently applied Host Country Principle. Then, you test for the presence of externalities and compare the gain from reducing those externalities (moving from Host to Origin given a high value of r) with the cost from departing from local social preferences (here we assume preference homogeneity between jurisdictions). If the outcome of that benefit - cost analysis is positive, you have arguments to act in common on the competency at stake. Acting in common may however take various forms. The most consistent with subsidiarity is to have an intergovernmental agreement - say a network of bilateral treaties or a multilateral arrangement. Only if that device is not credible, set up an institution like a special agency or a directorate-general of the EU Commission in charge of that competency. In that latter case however that agency may still simply issue rules e.g. through a EU directive - again the most consistent organization from the point of view of subsidiarity -, or it may take care for the regulation and the financing of the competency, or it may also levy the money needed for exerting that competency, through a tax levied at that upper level.

We have that in mind when suggesting the following device for the financing mechanism based on the Origin Country Principle,

- The origin country first decides on the total number of students who are permitted to follow a given field of studies and who are financed therefore wherever they attend courses – at home or abroad – but provided it is in an agreed institution.

- To those students, the origin country gives a voucher dedicated to cover the corresponding tuition fee, and possibly another voucher to finance the cost of living during the studies and to stimulate Higher Education attendance by socially targeted groups or in targeted fields of studies and careers.

- In line with bi- or multilateral arrangements like bilateral treaties or EU directives, HE institutions at home or abroad only enroll students able to show up a voucher.

That institutional device thus locates either at the level of a credible intergovernmental arrangement or at that of an agency issuing rules; we can term it a coordinated decentralized device. It turns out that the Higher Education policy of the origin country – e.g. regarding enrolment in veterinary medicine – is no longer applied by the sole domestic schools of that jurisdiction but by the partner countries' HE institutions as well. That feature might be regarded as an improvement with respect to the current situation where a student who fails admission tests in a given field in her country of origin migrates to the country next door for the purpose of studying that field, and returns home af-

ter completing her education, with a degree fully recognized by her country of origin.

Two remarks still deserve consideration at this moment. First, the cost of studies is assumed to be identical across countries for any given field. That makes the valuation of the voucher easier; beyond that, it implies that the partner countries are able to jointly determine the cost of getting a set of ECTS or a degree in a given field of studies. Gérard and Vandenberghe (2007) provides figures based on public funds allocated to the French speaking Belgian Higher Education institutions for the academic year 2005-2006: around 7,000 Euros per student per year in paramedical non-university Higher Education institutions like schools for nurses; 11,000 or 17,000 Euros per student per year in medicine and veterinary medicine (the former for the first two years and the latter for the subsequent years).

Second, the requirement that vouchers be solely used in institutions agreed by the issuing country relates the mechanism described above to the criterion of quality at work in the Bologna process. Actually that requirement might be satisfied either through a process of mutual recognition – each Member State recognizes as an institution of good quality a school regarded as such by the authorities of the jurisdiction where it is located – or through a label granted by certifying agencies – e.g. the Equis label for management schools.

Finally, notice that a centralized solution, according to which an agency operated at upper level of government, is in charge of deciding, for each lower level jurisdiction, on the number of students who will study at home and the number of students who will study abroad, might replicate the efficiency outcome described in section 2. That solution however is not very consistent with the subsidiarity principle. That is however not a reason to disregard it. In some federal countries, although HE is a state, regional or provincial competence, like Canada, federal fellowships exist.

In the section below we show that efficiency might be reached through the application of a decentralized device. And we show that in a more general framework.

5 Bhagwati tax and contingent loan or efficiency restored

So far we have considered the sole mobility of students and assumed that, when mobile across borders, after completing their studies abroad, they either return home - with probability r - and spend their entire career in their home country, or they remain abroad - with probability $1-r$ - and decide for a career in that latter jurisdiction. Now suppose that after graduating abroad, those individuals belong to a pool of internationally mobile talented workers. For the ease of the exposition we continue to assume two countries. Suppose first that the Origin Country Principle is still at work but see $1-r$ as the fraction of the career span spent abroad, actually in this model in the foreign country of HE. Then

revise the model and reintroduce the Host Country Principle interpreting r as the fraction of the career span spent at home. In both cases, during the fraction of time spent in a country other than the one which has financed the studies, the graduate has to compensate that latter country for the investment in her education which she does not repay through local tax payments.

That compensation may take two forms. First it may take the form of a Bhagwati tax. For the years she does not pay regular tax to the jurisdiction which invested in her HE, the graduate will pay a special tax to that jurisdiction, which is a form of Bhagwati tax. That tax might be paid toward the tax system of the country where she works and an international clearing system; that devices may require a minimum of international coordination but it is feasible in the context of the EU, *a priori* no more no less than the Origin Country Principle of the previous section. If necessary, when the coordinated system may not work, one can imagine international assistance in debt payments being operated or even - if the Origin Country applies - that relatives are made responsible for those tax payments in case of the default of the debtor, as it may be the case for contingent loans.

Alternatively the grant associated to the financing of studies, possibly including a student's salary, might be turned into a contingent loan *pro rata* the years spent outside the country which has financed the studies. The financing country may get its money back through the tax system of the country where the graduate works and the operation of a clearing system. Contingent loans mechanism is such operated domestically in e.g. Australia.

Let us denote by θ the payment due by the graduate not working in the country which has financed her studies - actually that payment is either $(1-r)\,\theta$ or $r\theta$. Under the Origin Country Principle, θ is such that equation (1) is now rewritten

$$\begin{aligned} W_i &= f\left(e_{ii}, r\beta e_{ij} + (1-r)\,\beta e_{ji}\right) - c\left(e_{ii} + e_{ij}\right) - w\left(e_{ii} + e_{ij}\right) \\ &\quad + (1-r)\,\theta e_{ij} - (1-r)\,\theta e_{ji} \end{aligned} \tag{12}$$

is maximized with respect to e_{ij}. It turns out that, proceeding as previously,

$$\begin{aligned} e_d^{BO} &\propto \frac{1}{c+w} \\ e_m^{BO} &\propto \frac{r\beta}{c+w-(1-r)\,\theta} \end{aligned} \tag{13}$$

Comparing the second line of equation (13) with that of equation (3) we can compute the value θ^O of θ which replicates the efficiency outcome. Then

$$\theta^O = c + w \tag{14}$$

That the Bhagwati tax is equal to the sum of the marginal cost of studies and the opportunity cost of those studies is obviously not a surprise. Then $e_m^{BO} = e_m^E$. In other terms the revenue of imposing a Bhagwati tax or of turning the grant into a *pro rata temporis* contingent loan is

$$(1-r)\,\theta^O = (1-r)\,(c+w) \tag{15}$$

Under the Host Principle Country, the corresponding payment comes from the maximization of

$$\begin{aligned} W_i &= f\left(e_{ii}, r\beta e_{ij} + (1-r)\,\beta e_{ji}\right) - c\left(e_{ii} + e_{ji}\right) - w\left(e_{ii} + e_{ij}\right) \\ &\quad +\theta r e_{ji} - \theta r \beta e_{ij} \end{aligned} \tag{16}$$

w.r.t. e_{ji}. It turns out that

$$\begin{aligned} e_d^{BH} &\propto \frac{1}{c+w} \\ e_m^{BH} &\propto \frac{(1-r)\,\beta}{c+w-r\theta} \end{aligned} \tag{17}$$

and efficiency is restored if

$$\theta^H = c - \frac{1-r}{r} w \tag{18}$$

so that the revenue for the studies financing host country actually is

$$r\theta^H = rc - (1-r)\,w \tag{19}$$

Here the optimal Bhagwati tax corresponds to an optimal differentiated tuition fee covering the cost of studies minus a term related to the probability of remaining in the host country. Especially the tax decreases with that probability.

6 Remarks and avenues for further research

Let us issue three remarks which are as many avenues for further research. In this paper, unlike in - but as a consequence of - Gérard (2007) we have disregarded student's decision assuming that demand for ECTS is constrained by supply due to a zero tuition fee. In the framework of the present paper we may imagine that in the case where, say, the Origin Country Principle applies, the government decides that the best students deserve HE abroad and that another number of students, comprised between the lower threshold of capability to be sent abroad and a further lower threshold are confined to HE at home; this is typically consistent with $\beta > 1$. Or we can consider that the government decides of educating at home the best students and to provide them with country specific capabilities, including a useful social network, while second class students have to be educated abroad; this is consistent with $\beta < 1$. In both cases there is room for introducing differences in the capacity of the students to access HE. Similar discussion might be related to the Host Country Principle. Then HE institutions of the host country, supported by their own government, either compete with those of the origin country to get the most talented students - a competition in quality if not in price -, or they accept those who have failed at entrance examination in their origin country, maybe because accumulation of students means accumulation of budget. In any case there is room for (re)introducing in

the model such items as the behavior of students and the respective quality of HE institutions.

Not unrelated to that first remark, especially to its penultimate sentence, is the relation between HE institutions and governments. In the paper we have supposed that the objectives of the governments and those of the schools are identical. That may not be the case. If the HE institutions are autonomous enough they may pursue objectives different from those of their government. Though that latter may be social welfare maximizing, schools may intend to have as many students as possible in order to have a larger share of the HE budget and so to be in better capacity to conduct research programs and to become more prestigious. The relation between governments and HE institutions should be usefully further developed and captured in a Principal-Agent model.[10] That raises several related questions as to the incentive to institutions and their governance.

Finally, the model used in that paper assumes symmetric jurisdictions. However, as mentioned in the introduction, one of the real issues at the origin of this paper is the free riding of two small countries by their respective large neighbor. More generally there is room for introducing asymmetry in the model. Two typical asymmetries are in terms of size and in terms of social preferences. Indeed the move from the Host to the Origin Country Principle, either or not completed by a Bhagwati tax or contingent loan, even if it increases aggregate social welfare, it may not increase large country welfare. Further, if the reform has a negative effect on the welfare of the large country it may have a negative aggregate welfare effect although the small country actually gains. That raises the issue of the feasibility and credibility of a bilateral agreement, and of the decision making process in a larger Union like the EU. Asymmetry in social preferences may also impact the solutions discussed here especially the need for coordination.

7 Conclusion

Today funding of cross border Higher Education students based on the Host Country Principle is neither sustainable nor efficient. Against that background the paper has investigated two alternative solutions both compatible with the principles of functioning of the European Union.

The first solution substitutes to the financing by the host country a funding by the country of origin of the student. Based on vouchers permitted to be used either domestically or abroad provided it is in Higher Education institutions whose quality has been recognized by the issuing country, that system is more efficient than the current one if the probability to return home after the completion of the studies is higher than a given threshold. That mechanism obeys the following characteristics,

[10] The issue mentioned in that paragraph seems to be especially relevant in a country like Belgium where institutions have to share a given budget coming from the public authorities.

- The origin country first decides on the total number of students who are permitted to follow a given field of studies and who are financed therefore wherever they attend courses – at home or abroad – but provided it is in an agreed institution.

- To those students, the origin country gives a voucher dedicated to cover the corresponding tuition fee, and possibly another voucher to finance the cost of living during the studies and to stimulate Higher Education attendance by socially targeted groups or in targeted fields of studies and careers.

- In line with bi- or multilateral arrangements like bilateral treaties or EU directives, Higher Education institutions at home or abroad only enroll students able to show up a voucher.

The second solution introduces the refund by the graduate of the investment in Higher Education made by either the origin or the host country *pro rata* the years of her career spent outside the country which has financed her studies. That refund might take the form of a transfer payment between countries – a Bhagwati tax. It may also take the form of turning vouchers into contingent loans the charge of them being due for the sole years of the career spent outside the paying country. That second solution might be designed in such a way that it makes it an efficient device: the amount of cross border education generated by that process is then identical to that produced by a centralized mechanism aiming at maximizing aggregate social welfare.

At the end of the paper remarks are formulated which are as many avenues for further research; they refer to the behavior of students and the quality of institutions, to the Principal-Agent relation which may exist between the government and the Higher Education institutions, and to possible interjurisdictional asymmetries in size and social preferences. A final remark usefully takes place at this moment: the alternative solutions presented and discussed in this paper only apply to students coming from developed countries.

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