

Financing Bologna: which country will pay for foreign students?*

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Abstract

In an integrated set of jurisdictions, where residents of one country may obtain higher education in another country and later return home (with some probability), the question arises of which country has to pay for higher education abroad, the country of origin of the student, which is likely to benefit from the education acquired abroad, or the country which has produced the extra human capital? This paper, nested in the philosophy of the Bologna process and the reality of today European Union - where such issue is hot for countries like Belgium and Austria, which host numerous students from France and Germany - investigates under which conditions it can be recommended to set up a network of bilateral treaties or a multilateral arrangement, in some sense similar to what exists for taxation, social security or health expenditures, which imposes the country of origin to pay for studies of its resident students either at home or abroad, provided it is in a certified institution.

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1 Introduction

The Bologna process is now well known at least among Europeans. It was launched in that Italian city on June 19, 1999 when the representatives of the Ministers of Higher Education of Thirty-one European countries or subnational jurisdictions signed a common declaration, which intended to achieve the following objectives within the first decade of the new millennium:

- Adoption of a system of easily readable and comparable degrees, also through the implementation of the Diploma Supplement, in order to promote European citizens employability and the international competitiveness of the European higher education system.

- Adoption of a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years. The degree awarded after the first cycle shall also be relevant to the European labour market as an appropriate level of qualification. The second cycle should lead to the master and/or doctorate degree as in many European countries.

- Establishment of a system of credits - such as in the ECTS system¹ - as a proper means of promoting the most widespread student mobility. Credits could also be acquired in non-higher education contexts, including lifelong learning, provided they are recognized by receiving Universities concerned.

- Promotion of mobility by overcoming obstacles to the effective exercise of free movement with particular attention to: (i) for students, access to study and training opportunities and to related services; (ii) for teachers, researchers and administrative staff, recognition and valorization of periods spent in a European context researching, teaching and training, without prejudicing their statutory rights.

- Promotion of European cooperation in quality assurance with a view to developing comparable criteria and methodologies.

- Promotion of the necessary European dimensions in higher education, particularly with regards to curricular development, interinstitutional cooperation, mobility schemes and integrated programmes of study, training and research.

¹ECTS is an acronym for European Credit Transfer System; those credits measure time spent by students and 60 credits are more or less equivalent to a one-year-full-time study.

Beyond that however, the various jurisdictions used Bologna to pass a series of reforms not directly related to the original process.² Though the Bologna process concerns a geographic area larger than the territory of the European Union, one can say that, together with the Sapir Report and the Lisbon Agenda, it generates a large debate around higher education in Europe - see Bache (2006), Sapir et al. (2003), van der Ploeg and Veugelers (2007).

In this paper, we focus on students who are mobile across borders. As long as European students are concerned, two different situations need to be distinguished. On the one hand, students go abroad to get some of the credits, called ECTS, for European Credit Transfer System, needed to obtain a degree - e.g. a master degree can need 120 credits out of them 30 or 60 may be obtained outside the country of the university which gives the degree; let us add that a full time year of studies usually corresponds to 60 credits; those students are known as Erasmus or Socrates students after the names of the EU program which stimulates those exchanges of students. On the other hand some students already go abroad to get a degree; that category of students is expected to increase in the future since the Bologna process should encourage students to get a first degree at home and a more advanced one abroad; by extension, some students will interrupt their studies at home, go abroad for a semester or a full year and enroll there in a local university in order to get a number of credits that they will further validate on a cursus in their original institution, where they will enroll again when returning home; let us call those students, the Bologna students.³

In the former case, the school or university of the country of residence of the students - the origin country - receives the whole subsidy or fee and the host institution in no case receives money, the system being based on reciprocity. In the latter case, the country which hosts the students - the higher education production country - supports the cost of their education,

²As an example, let us mention the attempts made in French-speaking Belgium to change the university landscape by gathering the various university institutions into three so called academies, set up around the three main universities of that jurisdiction. For another example, the case of France, see Ahues (2005).

³A example of what may be produce the Bologna process in the future, and which rise an issue motivating this paper, is provided by the following observation: during the academic year 2005-2006, in some classrooms of Higher Education Schools of the French speaking part of Belgium a large majority of students were coming from France; most were students who failed entrance competition in their own country. They were expected returning home after completion of their degree and some even return home during their period of studies for field training; they were therefore not expected to contribute to Belgian GDP in the future so that they were actually a cost for Belgium, and represented a typical free riding opportunity for France. Similar features may be observed between Germany and Austria, or between Luxemburg and neighboring countries.

except if it is permitted to charge them a fee.

In most EU countries the fee charged to students, if any, is rather symbolic and in no case it covers the true cost of studies. Moreover charging a fee different to student resident of the country and to students non-resident of the country violates the non-discrimination principle at the root of the EU process (del Rey (2001))⁴. This is a key difference between the EU and The US where a State University usually charges a different fee to residents and non-residents of the State. UK departs from the standard EU system by charging larger fees to students; accordingly UK universities are rationally more interested by attracting non EU exchange students.

Thereafter, we disregard the case of Erasmus or Socrates exchange students as well as the case of students from the South coming to study in schools of the North. Rather, we focus on Bologna students. Indeed, by increasing the transparency of diplomas and organizing portable credits, the Bologna process is in itself an incentive for students either to acquire credits abroad, that they can further use to fulfill degree requirements at home, or to get a foreign degree.

Although it greatly facilitates studying abroad, the Bologna process however remains silent about the way those studies will be financed. In particular nothing has been decided as to which country will be responsible for organizing the financing of the studies abroad: the country of origin of the student, or the country where the studies take place. In the former case, in the sequel of the paper, we say that the Origin Principle applies, in the latter case, we say that the Production Principle applies. Especially, this paper aims to show under which conditions it can be recommended to set up a network of bilateral treaties or a multilateral arrangement, in some sense similar to what exists for taxation, social security or health expenditures, which imposes the country of origin to be responsible for the payment of the studies abroad of its resident students (Gérard 2006a,b,c).

Notice that, when we write that a country is "responsible for", we do not mean that this country needs to pay using public funds. It may require that the students contributes partly or totally, or organize a system of contingent loans; that issue is beyond the scope of this paper. For the ease of the exposition, in the sequel of the paper, we do "as if" the payment comes from the authorities of the country, using public funds.

Thereafter we first consider the current system where the cost of studies is supported by the country of production of higher education, and we call that the Production Principle. We show that under that system the number

⁴For a justification see <http://ec.europa.eu/youreurope/nav/en/citizens/education-study/eu-legislation/index.html>

of students studying abroad - actually the number of credits got abroad - is too small, compared to a number decided in a centralized way. Then we turn to the alternative principle, called the Origin Principle, where the cost of the studies is supported by the country the students are residents of before temporarily migrating for studying purposes. Under that system, the number of credits obtained abroad is still inefficiently low, but less inefficiently low than under the Production Principle. We then conclude that a reform substituting the latter principle for the former is a Pareto improvement. Translated into a feasible design, the exercise is favorable to a system of portable vouchers that the student may use either at home or abroad in higher education institutions recognized by their country of origin. At the moment we write this paper, we know that such a system of cross border portable vouchers exists, directly or indirectly, at least in Switzerland (for studies across the borders of the Canton) and in The Netherlands (for studies across the borders of the country).

Notice that this reform considered in this paper concerns exclusively students of developed countries belonging to the Bologna area.

The organization of the sequel of the paper is the following. In section 2 we propose a short survey of literature emphasizing the contribution by Mechtenberg and Strausz (2006) which inspired part of the formal analysis that we conduct below. Then in section 3 we conduct our analysis under the currently applying Production Principle, showing in particular the free riding issue appearing in that context. In section 4 we compare the outcome under the Production Principle with the Centralized Efficient equilibrium. In section 5 we introduce the Origin Principle and also compare its outcome with the centralized or cooperative efficient equilibrium. Finally, in section 6 we compare the outcomes obtained under the Production Principle, the Centralized Efficient equilibrium and the Origin Principle, and show under which conditions the move from the currently applied Production Principle to the Origin Principle is a Pareto improvement and should be recommended as a model solution for the European Union or other interjurisdictional entity; some avenues for further research are also provided in that section.

2 Literature

As Mechtenberg and Strausz (2006) says "the relation between mobility and human capital has for long been on the agenda of economic research". According to them, relevant literature indeed first refers to the contributions on the brain drain - see Grubel and Scott (1966) or Bhagwati and Hamada (1974). In a similar context, Justman and Thisse (1997) points out

the link between mobility and underprovision of publicly provided education. By contrast Stark, Helmenstein and Prskawetz (1997), Beine, Docquier and Rapoport (2001), and Stark and Wang (2002) also consider private investment in education. More recently, both forms of financing education are taken into account by Poutvara (2004a,b). Quoting Mechtenberg and Strausz, "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) produces a similar result while, next to free rider effect, Kemnitz (2005) also considers the competition effect for governments providing education to mobile students.

The present paper has some features in common with Mechtenberg and Strausz, especially it introduces the opportunity to become *international* and to acquire *multicultural skill*, and the probability of returning home after completing studies abroad. However it departs from that contribution by focusing on the issue of which country should be responsible for financing foreign students, regarded from the point of view of efficiency and fiscal federalism.

3 The Production Principle

According to the Production Principle, studies are financed by the host jurisdiction. This is the most popular system among jurisdictions where Higher Education is publicly funded. Elaborating in that context we first examine the demand for credits by resident students, then the supply of credits by jurisdictions and the effective numbers of credits assuming that the countries behave non-cooperatively in a decentralized setting.

3.1 The demand for credits

Suppose a representative student of a jurisdiction i . He decides of the credits he wants to obtain at home, n_{ii} , by comparing the private return on those credits, $f(n_{ii})$ such that $f' > 0$ and $f'' < 0$, with their opportunity cost, the wage that he can obtain if he remains, say, unskilled, w_i and, with the other extra costs related to those credits, including possible tuition fee and on or off campus boarding costs, p_{ii} ; such an approach is standard in the literature. Alternatively, he may want to obtain some credits abroad, say n_{ij} , because those credits provide him with a higher return $(1 + ma) f(n_{ij})$, $0 < a < 1$,

since he becomes *international* or acquires *multicultural skill*⁵; however those credits have an extra cost $p_{ij} > p_{ii}$ that the student has to support by himself, including transportation cost and extra costs related to living abroad; m is a variable between 0 and 1 reflecting the capacity of the foreign university to actually providing the multicultural skill or of the student himself to take profit of his stay abroad to become international.

His demand for credits is then such that

$$f'_{ii} = w_i + p_{ii} \quad (1)$$

and

$$(1 + ma) f'_{ij} = w_i + p_{ij} \quad (2)$$

If we specify $f(x)$ as $\ln x$, those equations provide us with the demand for credit functions, assuming $w_i = w$ in both countries and $\gamma_{ij} = \gamma$ as well - that latter means that the extra costs of studying abroad, related to say transportation and accommodation, are symmetric -

$$\begin{aligned} n_{ii}^d &= 1 / (w + p_{ii}) \\ n_{ij}^d &= (1 + ma) / (w + p_{ij}) \end{aligned} \quad (3)$$

We do not elaborate more on the decision of either studying at home or abroad.⁶

⁵One can imagine that the value of a is determined by the labor market, especially by its demand side.

⁶One approach is to assume that the decision as to study at home or abroad depends on the surplus generated by each opportunity. If he studies at home his surplus will amount to

$$\begin{aligned} S_{ii} &= \ln(n_{ii}) - (w_i + p_{ii}) n_{ii} \\ &= -[\ln(w_i + p_{ii}) + 1] \end{aligned}$$

while if he studies abroad,

$$\begin{aligned} S_{ij} &= (1 + ma) [\ln(1 + ma) - \ln(w_i + p_{ij}) - 1] \\ &\simeq -(1 + ma) [\ln(w_i + p_{ij}) + 1] + (1 + ma) ma \end{aligned}$$

It turns out that, admitting the second interpretation for the m variable, the student not able to adapt to a foreign environment, thus such that $m = 0$, will never decide to study abroad. Unlike that, the student such that $m > \hat{m}(a, w_i, p_{ii}, p_{ij})$ will study abroad, with $\hat{m}(a, w_i, p_{ii}, p_{ij})$ such that $S_{ii} = S_{ij}$.

Then, if the population of domestic student is characterized by a variable m uniformly distributed between 0 and M , one can compute the demand for credits at home and abroad. Alternatively we can assume, and compute accordingly, that the type of the representative is unknown or that one representative student is of the $m < \hat{m}$ type and one of the $m > \hat{m}$ type.

Let us add that, in line with Mechtenberg and Strausz (2006), if someone studies abroad, he has a probability R of returning home after completing his program and a probability $1 - R$ to remain in the foreign country; we call the decision to stay abroad a *sweet heart effect*.

We don't elaborate more on those issues now and we immediately turn to the supply of credits by the jurisdiction, deliberately confusing the government, the higher education authority and the university.

3.2 The supply for credits

Let us now turn to the government of jurisdiction i . It maximizes a Social Welfare Function defined on the future contribution to GDP of students educated at home or abroad that will be resident of jurisdiction i , net of the sacrifice in terms of immediate contribution to GDP involved by the studies of the residents and of the cost of the public funds levied to finance the production of credits; those public funds are deemed to be levied through a lump sum tax turned into a subsidy to universities, implying a cost $\lambda > 0$ per credit - on those costs in general, see Laffont and Tirole (1993).⁷ Finally, let us notice p_{ji} the tuition fee possibly asked from non resident students, per unit of credit, if permitted. A variable $\theta \geq 1$ indicates that the social return on credits might be larger than the private one justifying the public good aspect of Higher Education by social externalities.

As a consequence, the Social Welfare Function of country i may be written

$$W_i = \theta f(n_{ii}^s) + R(1 + ma)\theta f(n_{ij}) + (1 - R)(1 + ma)\theta f(n_{ji}^s) - \lambda(n_{ii}^s + n_{ji}^s) - p_{ij}n_{ij} - w(n_{ii}^s + n_{ij}) + p_{ji}n_{ji}^s \quad (4)$$

where a superscript s indicates an amount supplied; other variables refer to effective amounts i.e. possibly the minimum of supply and demand. The social planner of that jurisdiction will decide on the credits supplied to its resident students studying at home and to the foreign students it hosts

$$\theta f'_{ii} - \lambda - w = 0 \quad (5)$$

and

$$(1 - R)(1 + ma)\theta f'_{ji} - \lambda + p_{ji} = 0 \quad (6)$$

For illustrative purposes, suppose again that $f(x) = \ln(x)$. Then,

$$\begin{aligned} n_{ii}^s &= \theta / (\lambda + w) \\ n_{ji}^s &= (1 - R)(1 + ma)\theta / (\lambda - p_{ji}) \end{aligned} \quad (7)$$

⁷Notice that we can easily enlarge the application of the model to partly privately funded Higher Education; then λ includes the social cost of the imperfection of the capital market.

3.3 The effective number of credits

Let us first consider students deciding for studies at home, then for studies abroad.

3.3.1 Purely domestic students

The effective number of credits provided to the representative student deciding to study at home is, omitting unnecessary subscripts and setting $p_{ii} = p_{jj} = p$,

$$n_{ii}^P = n_{jj}^P = \min [1 / (w + p), \theta / (\lambda + w)] \quad (8)$$

Two cases then arise. On the one hand, the equality between supply and demand can be realized if a tuition is imposed which amounts to

$$p = \frac{\lambda - (\theta - 1) w}{\theta} \quad (9)$$

Especially, if there is no social externality ($\theta = 1$), $p = \lambda$ so that the equilibrium tuition fee required from local students exactly offsets the cost implied by a subsidy to the university financed through a lump sum tax, or by other system involving inefficiencies. If a social positive externality exists, $\theta > 1$ and $p < \lambda$ since

$$\frac{dp}{d\theta} = -\frac{\lambda + w}{\theta^2} < 0 \quad (10)$$

That expression shows that part of the cost is offset by the positive externality. Alternatively we can say that the cost λ decreases when either the tuition fee or the externality goes up, or if both increase.

On the other hand, if the tuition fee needs to vanish, an extreme case for a publicly funded university, $p = 0$ and there is an excess demand or an excess supply depending on

$$\theta \lessgtr (\lambda + w) / w \quad (11)$$

In the sequel we realistically suppose θ and λ such that there is an excess demand. That will be the case for sure if $\theta = 1$. As a consequence the effective number of credits served to local students amounts to $\theta / (\lambda + w)$.

3.3.2 Foreign students

Similarly the effective number of credits provided to students deciding for studies abroad amounts to, omitting again unnecessary subscripts and setting $p_{ij} = p_{ji} = p_f + \gamma$.

$$n_{ij}^P = n_{ji}^P = \min [(1 + ma) / (w + p_f + \gamma), (1 - R) (1 + ma) \theta / (\lambda - p_f - \gamma)] \quad (12)$$

Again, two cases arise. On the one hand, the equality between supply and demand can be realized if a tuition is imposed to foreign students which amounts to

$$p_f = \frac{(\lambda - \gamma) - (1 - R) \theta (w + \gamma)}{(1 - R) \theta + 1} \quad (13)$$

Especially, if there is no social externality ($\theta = 1$), foreign students go back home after completing their studies ($R = 1$) and $\gamma = 0$, then again $p = \lambda$ so that the equilibrium tuition fee required from foreign students also exactly offsets the cost implied by the financing of the provision of the credit by the publicly funded university. Unlike for domestic students, in case of positive social externality the tuition fee rebate only appears when the probability that foreign students go back home departs from unity, and is proportional to $1 - R$. Thus, for $\gamma = 0$,

$$\frac{dp_f}{d\theta} = - \frac{1 - R}{[(1 - R) \theta + 1]^2} \frac{\lambda + w}{\theta^2} < 0 \quad (14)$$

and the decline of the equilibrium tuition fee with respect to the size of the externality is smaller. As a consequence, the equilibrium tuition fee to be charged to foreign students, if permitted, should be larger. Then,

Proposition 1 *When students are mobile across borders, jurisdictions are symmetric and decisions are taken in a decentralized way, if the cost of higher education is supported by the production jurisdiction exclusively, the efficient equilibrium tuition fee charged to foreign students should be larger than that charged to local students, the discrepancy depending a.o. on the probability of foreign students returning home after completing their studies abroad.*

That proposition highlights e.g. the behavior of US States or some Canadian provinces charging a larger fee to non State or Province residents in State or Province funded universities.

On the other hand, if the tuition fee needs to vanish for foreign students as well as to domestic students, an extreme case for non-discrimination between resident and non-resident students⁸, $p_f = 0$ and there is an excess demand

⁸Notice that if price discrimination is not allowed within the EU with respect to citizen from other EU Member States, some jurisdictions discriminate using quantity rationing., e.g. in French-speaking Belgium by a drawing among the numerous foreign students - especially from France - who want to study in that part of Belgium. That kind of discrimination has been recently regarded by the EU Commission as not compatible with EU treaties principles.

or an excess supply depending on

$$(1 - R)(w + \gamma)\theta \leq \lambda - \gamma \quad (15)$$

In the sequel we suppose θ , R and λ such that there is an excess demand. That will be the case if $\theta = 1$, $\gamma = 0$ and R close to unity.⁹ As a consequence the effective number of credits served to foreign students amounts to $(1 - R)(1 + ma)\theta / (\lambda - p_f - \gamma)$.

3.4 Free riding its neighbor

Let us still investigate what happens if a jurisdiction exports a student and re-imports him after he has completed his curriculum¹⁰. Therefore consider again equation (4), then the effect on the Social Welfare of his jurisdiction of origin is given by

$$dW_i = R(1 + ma)\theta f'_{ij} - \theta f'_{ii} + \lambda - p_{ij} \quad (16)$$

The right hand side of that expression might be positive. In particular it is more likely to be positive when the probability R of the students to return home after completing their studies is high - which is consistent with observation in the EU - , when the valuation a of studies abroad and the capacity m of the students to take profit of that value increase - which is *per se* an incentive for local university to be of bad quality, a logically going up with the difference in quality, and when the cost of studying abroad decreases - especially if the tuition fee abroad is small, say p_f is zero, and cost of living abroad is also small, say again γ vanishes. Notice that due to the shape of the return function, as long as less credits are obtained abroad than at home, $f'_{ij} > f'_{ii}$.

It turns out that

Proposition 2 *When students are mobile across borders, jurisdictions are symmetric and decisions are taken in a decentralized way, if the cost of higher education is supported by the production jurisdiction exclusively, no price discrimination against foreign students is permitted and those students are likely to return home after completing their studies abroad, jurisdictions have an incentive to free ride their neighbor and to produce poor quality studies.*

⁹Mansoorian and Myers (1993) write, in the context of their study, that "individuals derive non-pecuniary (psychic) benefit from living in their home". They see that as something "of special interest for systems that consist of culturally diverse regions, such as the EEC and Canada". "In such systems, they add, it would be reasonable to assume that individuals would have a preference for a particular region for cultural (...) reasons".

¹⁰See footnote 3.

4 The centralized solution: efficient number of credits obtained abroad

Suppose now a central planner maximizing the sum of the two social welfare functions. Then the first order conditions imply

$$\theta f'_{ii} - \lambda - w = 0 \quad (17)$$

unchanged, but

$$R(1 + ma)\theta f'_{ji} + (1 - R)(1 + ma)\theta f'_{ji} - \lambda - w = 0 \quad (18)$$

so that, in our illustration

$$\begin{aligned} n_{ii}^C &= n_{jj}^C = \theta / (\lambda + w) \\ n_{ij}^C &= n_{ji}^C = \min [(1 + ma) / (w + p_f + \gamma), (1 + ma)\theta / (\lambda + w)] \end{aligned} \quad (19)$$

and comparing the supply of credits in a centralized setting with that observed above for a decentralized setting when the Production Principle is at work,

$$n_{ij}^C = n_{ji}^C > n_{ij} = n_{ji} \quad (20)$$

Especially, if no (discriminatory) fee may be required from EU foreign students, and given our assumptions on θ , R and λ

$$n_{ij}^C = (1 + ma)\theta / (\lambda + w) > (1 - R)(1 + ma)\theta / (\lambda - \gamma) = n_{ij}^P \quad (21)$$

We summarize that discussion by issuing

Proposition 3 *When students are mobile across borders, jurisdictions are symmetric and decisions are taken in a decentralized way, if the cost of higher education is supported by the production jurisdiction exclusively, no price discrimination is allowed among students and those students are much likely to return home after completing their studies, the number of credits obtained abroad is inefficiently low.*

The reason is the following: when the social planner of jurisdiction i increases the number of students it hosts, it generates a positive externality in the other jurisdiction. That positive externality is taken into account by the central planner.

5 The Origin Principle

Now the country of residence or origin of the student - in this context we can use those terms indifferently though the use of the latter is probably better: in the US a student originated from one state who studies in another state may be considered as a resident of that other state after completing his first year of studies and then only charged with the reduced fee for residents of the state - needs to pay for their studies abroad, through e.g. the provision of portable vouchers.

For that purposes, let v_i stand for the voucher per credit provided to his resident students by the government of country i and similarly v_j that provided by the government of country j ; for simplicity we assume that $v_i = v_j$.

The demand for studies at home and abroad of resident students of country i is unchanged, still provided by equations (1) and (2); the value of the vouchers does not enter those equations since the student is only the instrument transferring that value from one institution (his home government) to another institution (the university at home or abroad, hold here for simplicity as a branch of the respective governments).

However, the Social Welfare Function of country i now becomes

$$\begin{aligned} W_i = & \theta f(n_{ii}^s) + R(1 + ma) \theta f(n_{ij}^s) + (1 - R)(1 + ma) \theta f(n_{ji}) \\ & - \lambda(n_{ii}^s + n_{ij}^s) - \gamma n_{ij}^s + (\gamma + v) n_{ji} - w(n_{ii}^s + n_{ij}^s) \end{aligned} \quad (22)$$

where the distribution of the superscripts s is now changed. Notice that λ can be reinterpreted as the cost of a portable voucher v granted to students originating in the jurisdiction and financed through a lump sum tax; in other terms, we suppose that the value of the voucher exactly matches the cost of studies in both jurisdictions. The main differences between the two social welfare functions are depicted thereafter.

First, as previously, the local social planner decides of the number of credits that will be supplied at home to its resident students.

$$\theta f'_{ii} - \lambda - w = 0 \quad (23)$$

or, using the same specification as above,

$$n_{ii}^s = \theta / (\lambda + w) \quad (24)$$

so that the effective number of credits obtained at home by residents of i is

$$n_{ii}^O = n_{jj}^O = \min[1/w, \theta / (\lambda + w)] = \theta / (\lambda + w) \quad (25)$$

Second, unlike previously, the government of country i now no longer decides on the number of credits that it supplies to foreign students - it will supply any number since it does not support the cost -, but it decides on the number of credits obtainable abroad by its residents that it finances, n_{ij}^s

$$R(1 + ma)\theta f'_{ij} - \lambda - w - \gamma = 0 \quad (26)$$

or

$$n_{ij}^s = R(1 + ma)\theta / (\lambda + w_i + \gamma + v) \quad (27)$$

so that

$$\begin{aligned} n_{ij}^O = n_{ji}^O &= \min [(1 + ma) / (w + \gamma), R(1 + ma)\theta / (\lambda + w + \gamma)] \\ &= R(1 + ma)\theta / (\lambda + w + \gamma) \end{aligned} \quad (28)$$

Since $R < 1$, when the Origin Principle applies in a decentralized setting, the number of credits obtained abroad is still smaller than its efficient level, given by equation (21).

Therefore,

Proposition 4 *When students are mobile across borders, jurisdictions are symmetric and decisions are taken in a decentralized way, if the cost of higher education is supported by the origin of the students jurisdiction exclusively, no price discrimination is allowed among students and those students are much likely to return home after completing their studies, the number of credits obtained abroad is inefficiently low.*

Again the economic intuition is simple: when jurisdiction i decides to send an additional student abroad it generates a sweet heart effect in the other jurisdiction, which amounts to $(1 - R)(1 + ma)\theta f'$.

However now, this effect is accompanied by a tax effects $-\lambda$ in its own jurisdiction due to the transfer to the university of the other jurisdiction. And notice that the counterpart of equation (16) is now

$$dW_i^O = (1 + ma)\theta Rf'_{ij} - \gamma - \theta f'_{ii} < (1 + ma)\theta Rf'_{ij} - \gamma - \theta f'_{ii} + \lambda = dW_i^P \quad (29)$$

so that country i has less incentive to free ride its neighbor.

6 Tentative conclusion and proposition

Comparing all these situations for the case of entirely publicly funded Higher Education, we have that

$$n_{ii}^P = n_{ii}^O = n_{ii}^C = \theta / (\lambda + w) \quad (30)$$

and

$$\begin{aligned}
n_{ij}^P &= (1 - R) (1 + ma) \theta / (\lambda - \gamma) \\
&< n_{ij}^O = R (1 + ma) \theta / (\lambda + w + \gamma) \\
&< n_{ij}^C = (1 + ma) \theta / (w + \lambda)
\end{aligned} \tag{31}$$

and similarly for country j , again ignoring p . The first part of the above ranking holds if

$$\frac{R}{1 - R} > \frac{\lambda + w + \gamma}{\lambda - \gamma} \tag{32}$$

which requires that the probability of returning home after getting his degree be large enough.

We then conclude that

Proposition 5 *When students are mobile across borders, jurisdictions are symmetric, decisions are taken in a decentralized way, no price discrimination is allowed among students and those students are much likely to return home after completing their studies, moving from a system where the cost of higher education is supported by the production jurisdiction exclusively, to a system where that cost is supported by the origin of students jurisdiction, also exclusively, is a Pareto improvement.*

From a policy point of view, it turns out that charging the country of origin of the students to be responsible for organizing the payment for their studies abroad, through e.g. portable vouchers, is a second best solution, being the less inefficient between the two solutions considered so far. Nevertheless it is less efficient than the centralized outcome, the difference being the price to pay for the respect of subsidiarity principle at the root of e.g. the European Union.

Though the result stressed in this paper, in our opinion, deserves discussion among policy makers, further research might be needed as to the best way of financing Higher Education in an area like the European Union. Especially the model used in this paper should be expanded in order to explicitly take into account a larger contribution by the students themselves, including through contingent loans, or by the private sector. Another issue to be investigated is that of the consequences of the fact that, in a progressively integrating area like the European Union, it is likely that some mobile students - even if for most of them the probability to return home after completing their studies will remain large, still for a long time - will stay in a jurisdiction other than their country of origin and their country of Higher Education; for those students, the social positive externality generated by

their education will benefit a third country and the issue arise of how to have that third country contributing to the financing of the human capital it benefits from. There is room for a specific design which should be close to the centralized solution but compatible with the subsidiarity principle. In that respect empirical investigation of the functioning of Higher Education in various modern federations could be helpful.

Let us add two final remarks. First, links should be investigated with incentives to specific kinds of studies and *numerus clausus* which may be desirable in some professions. Actually the institutional design investigated above is especially designed for enlarging the field of application of that latter issue: through deciding on the allocation of study specific vouchers to students from its territory, a government may rule the local entry in specific professions in a more efficient way than with barriers to the access to the sole local schools; indeed it also limits access to similar studies abroad.

Second, we should come back to the relation with quality since the system designed above requires that portable vouchers financed by a given government should only be used in universities and other higher education institutions whose quality has been recognized, e.g. by a certification.

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