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Mobility of Students and Quality of Higher Education:

An Empirical Analysis of the "Unified Brain Drain" Model

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Abstract

Globalization has led to a vast flow of migration of workers but also of students. The purpose of this paper is to analyze the migration of individuals encompassing decisions already at the level of education. We present a "unified brain" drain model that incorporates the decisions of an individual related to migration vis-à-vis both education and work. In the empirical part, this paper addresses international flows of migration within the Bologna Process and presents strong evidence of concentration of students in countries with high-quality education.

Keywords: Brain drain; Globalization, Higher education; Human capital; Migration, Mobility, Bologna process.

JEL: F22, I23, J24.

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I. Introduction

In the past decade, mobility of young people has grown rapidly, and interestingly this flow is not homogenous. On one hand is the flow of individuals who are already skilled and who emigrate to work. On the other hand, are young individuals migrating to acquire education, and this flow is growing rapidly this last decade. In 2010, the flow of individuals who obtain education outside their country of citizenship was nearly five times what it was in 1980. Moreover, according to OECD data, the mobility of students has significantly increased in the past four decades, from 250,000 in 1965 to approximately 3.7 million in 2011. This last decade, the growth rate of student flow to the OECD countries was twice that of flows for the purpose of finding employment.[1]

The analysis of migration should therefore focus not only on the decision on where to work but also on the decision where to study. Indeed, globalization permits a more general set of decision choices. First, the individual decides where to learn, and afterwards he decides where to work.

The purpose of this paper is to analyze the migration of individuals encompassing decisions already at the level of education. We suggest building a "unified brain-drain" model. We combine the two migration decisions into a unique model, and develop a simple two-step model that describes the decisions of an individual vis-à-vis education and migration. In the first step, individuals decide where to study (i.e., in country of origin or in a foreign country); and in the second step, they decide where to work.

This paper presents succinctly the structure of the model and focuses mainly on the empirical analysis of it. The main reason for having a unified model is that costs of migration are different at the different stages of life, as we emphasize in the section presenting the model.

We show that, due to the fact that psychological costs increase with age, and costs of moving are greater after graduation, then under plausible assumptions, the usual brain drain strategy is sub-optimal. In the past, migration of students was not a possibility and students were learning in their own country. Globalization today is opening this type of migration at least for students from OECD countries, and in the future, probably from the whole world. Therefore it is important to notice that brain drain which was (and is) the optimal solution for individuals of countries without the door open to higher education abroad, will give place to the strategy we stress in our model.

[1] See OECD (2011) and Unesco (2006). During the decade, the flow of workers has increased by 27% while that of students by 52%.

This model will also allow us to pinpoint the optimal decision of young individuals, as well as to analyze the effects of wages and quality of education on the decision making of students. We show that one of the main variables affecting the decision about the country of migration is its quality of education, a variable which has not been stressed enough in the literature.

The second part of the paper is empirical. This paper will analyze the pattern of flows between countries, and will identify the reasons why students migrate. Our empirical work will have two main results: the first is that, indeed, quality of higher education affects the probability of migration. The second main result is that there is a concentration effect. We find that not only does high education quality affect migration, but the movement of students is concentrated towards the top five countries.

This fact has strong redistribution effect, as the usual brain drain. On one hand, the students who move to countries with good universities have a better chance to go up the ladder to success, if they come back to their country of origin. On the other hand, if they don't return, the country has lost its young individuals, which leads to lower economic growth.

This paper is organized as follows: In the next section, we present a short overview of the literature. In section III we develop the model of migration. In the forth section we present the data, and explain the methodology. In the fifth section, we present the empirical results, and section six concludes.

II. Facts and Related Literature

In the model, we present below, we discuss the decision of young individuals to migrate abroad and attend a foreign university. This decision cannot be disentangled from the decision regarding work. Therefore, we will present in brief the literature on student migration, as well as that related to migration of skilled workers. We begin with the literature focusing on student migration.

1. Migration of Students

The literature on student flow is not large, and is mainly empirical. The studies in this field mainly outline the elements affecting the costs and benefits of students' migration (see Kyung, 1996; Bessey, 2006; and Agasisti and Dal Bianco, 2007). Heaton and Throsby (1998) focuses on the determinants of flows of students, using also a cost-benefits framework.[2]

The literature has stressed that wage level is one of the main elements affecting the decision to migrate as a student. On one hand, Mac and Moncur (2001) found

[2] See also Altbach, 1998.

that higher wages in the country of origin positively affect the rate of out-migration. It is so, because agents with higher income can bear the costs of migration more easily and have better possibilities to invest in high quality of education.

On the other hand, wage differences between the host country and the country of origin are also used to explain the patterns of migration. These studies show that flows of students are from low-wage to high-wage countries because students are motivated by the wish to exploit the opportunity to acquire employment in the country wherein they acquired their education (see Rosenzweig, 2006).

There is also a literature which focuses on the macro effects of migration. Papatisba (2005) argued that studying overseas enhance the social and cultural development of migrants and therefore leads to human capital gains. Moreover, she stresses that migration could be a political means to foster technological transfers and economic integration of Europe.

Some scholars emphasize also the negative effects of migration on the stock of human capital. Poutvaara (2004) argued that while migration fosters private investment in human capital, it will lead to a reduction of public investment in education, due to free riding.

Following this line of reasoning, Mectenberg and Strausz (2008) underlined the tradeoff facing government, i.e., competition versus free riding. On one hand, a central planner may decide to invest in quality of higher education in order to attract foreign students, and due to more competition, increases the amount of investment. On the other hand, the central planner might encourage local students to obtain education overseas free of charge. This free-riding on the account of another country reduces the total amount of investment in higher education.

The literature regarding mixing decisions of working and learning is seldom. Kwok and Leland (1982), develop a multiple equilibria model of migration based on asymmetric information, wherein students prefer to remain in the country where they attended university, due to a lack of information on the "value" of their degrees. So due to signaling, good students find it more valuable to remain in the host study countries to work. In consequence, students with less "internal information", i.e., those with lower abilities, will bet those who decide to return to their countries of origin.[3]

There are also studies on the effects of migration on the social environment as more migration will lead to a reduction in cultural differences over time (see Putvaara, 2004 and Mechtenberg and Strausz, 2008). We now turn to the literature on the migration of workers.

[3] Nowadays, there are some models with multiple equilibria. See De laCroix and Docquier (2012) and Benassy and Brezis (2013).

2. Migration of workers

In contrast to the literature on student migration, the literature on workers' migration is vast. From Sjaastad (1962) on, the optimal behavior of migrants has been found to be a function of income differences and migration costs.[4] The main elements that have been emphasized are those affecting migration costs, as for instance, geographical distance, family size, and previous migration.[5] This literature did not focus on skilled workers.

The literature on the migration of skilled workers is coined the "brain drain" literature, and it emphasizes the negative effects of the flight of skilled workers on the country of origin. These studies claim that the flight of skilled workers towards countries with higher standards of living lead to impoverishment of developing countries, due to increasing returns and externalities in the level of human capital. These papers conclude that migration of skilled labor has negative effects on human capital and economic growth of the country of origin.[6]

Lately, a number of authors have shown that the possibility of migration might create some positive effects on the country of origin, termed the "brain gain" effect. This line of research has been engaged in by Mountford (1997), Stark, et al. (1997, 1998) and Stark (2004). An overview of this literature can be found in Docquier and Rapoport, (2008, 2012) and Gibson and McKenzie, (2011). They focus on the fact that the incentive to migrate could increase the investment in education, and on average would increase the level of human capital. Beine, et al. (2001) and Easterly and Nyarko (2008) both derive the theoretical effects of migration on human capital creation, and test these effects empirically.

This paper will not draw a dichotomy between decisions on education and those on employment. Instead, it will combine these two into one model, presented in the next section.

III. The Model

In this study, we develop a simple model that allows us to develop a cost-benefit analysis of migration decisions and to perform empirical analysis. The model combines the decisions related to migration of students and workers into a single

[4] See Borjas (1987, 1989) and Chiswick (1999). The seminal work of Harris and Todaro (1970) adds to previous work the possibility of unemployment, and therefore focuses on the net expected present value as the element that explains migration.

[5] The main empirical papers in this literature are those of Greenwood (1969), Bowles (1970), Kaluzny (1975), Lee and Roseman (1999), and Ahn et al. (1999). The variables on which they focus are mainly income, age, and distance unemployment.

[6] See Hacque and Kim, (1995) and Docquier, (2006). Early articles in this direction are notably Grubel and Scott (1966) and Bhagwati and Hamada (1974). A summary of this literature can be found in Docquier and Rapoport (2012).

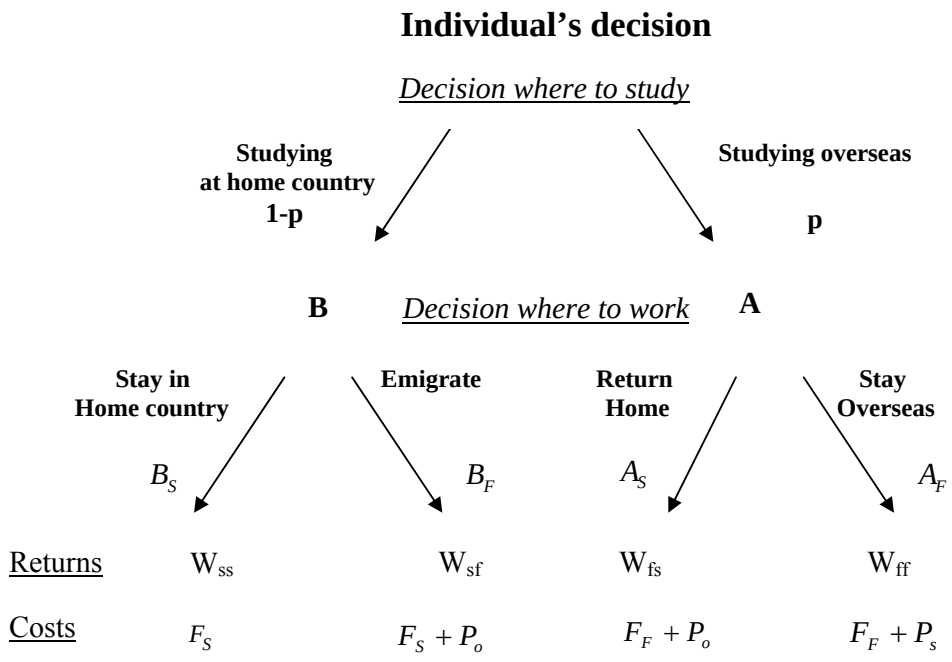
model. It will show that under specific conditions, the usual brain drain strategy is sub-optimal and therefore in countries where globalization is such that young individuals can already travel for education, it is optimal to do so.

The model we develop is the following: In the first step, individuals decide where to study, and in the second step, they decide where to work. Two main elements affect decisions of migration: wages and quality of higher education. Wages affects net income in a direct way, while the quality of education affects the level of human capital.

Indeed, this paper will focus on the quality of higher education as a main element driving migration: students know that their human capital is a function of the quality of the education they have received.[7] In consequence, this paper focuses on the heterogeneity of higher education, and tests its effect on the decision of migration.

The general model takes into account the two stages of decisions. In Chart 1, we show the elements affecting the decisions at each stage of this model.

Chart 1



In the first period, individuals invest in acquiring human capital, H, and decide whether to study overseas in country F, or in his home country, in country S. Their

[7] There are few papers which discuss the notion of quality of higher education, see Aghion et al. (2009) and Brezis (2012). On the relation of quality of secondary education and human capital, see Card and Krueger (1992) and Hanushek and Wossman (2007).

decision is a function of the costs and the returns from acquiring human capital. In the second period, they decide where to work.

The main idea of this two-steps model is that the decision to work is not completely independent of the decision the individual took previously in the first period. The main assumption is that the psychological costs of moving are different when young and when adult. This will drive the main results of the paper. The second assumption is related to the psychological costs of returning, vs. its new "identity" as a student, as we explain later on. Depending on these assumptions, we determine the optimal decision.

The model is presented succinctly, since this paper is mainly empirical. We are cautious to stay general, so that in the empirical part, we can check different variables. Still, this paper mainly focuses on wages and quality of education, and check how the equilibrium will be affected by these two variables, as well as the costs of migration.

1. Returns from Migration

One main element which affects the future income of students is the accumulated human capital. This accumulated human capital is a function of the quality of higher education they have acquired, as we stressed above. Students are aware that quality of higher education is heterogeneous and varies across countries; the higher the quality, the higher the human capital they are acquiring.[8] The second element which influences the future income of students is the wages paid for a given amount of human capital.

So, individual's earning is a function of three factors: (i) the quality of higher education, Q_i which affects the accumulated human capital (where *i* is the index of the country in which he gets an education), (ii) a idiosyncratic factor specific to the individual, λ, and in this section, we take λ constant for all students, assumption which will be removed, when we will develop the macro equation of migration. (iii) The third element is the wage per unit of human capital, w_j where *j* is the index of the country in which the individual decides to work (country S or country F). The income of individuals takes the four possible forms:

(i) Migration as student and staying to work – strategy A_F.

Agents migrate in the first stage to country F in order to obtain education and remain there after graduation.[9] The income in this specific strategy is a function of Q_F and w_F and for sake of simplicity, we adopt this specific functional form:

[8] The assumption is that the choice of the country is based on its best universities, and that students are aware of the aura of the country.

[9] We ignore the whole present value of income, and focus on the earning of a specific year, since discount factor will affect all incomes in the same way.

$$W_{FF} = \lambda\psi(Q_F, w_F) = \lambda w_F Q_F^{\alpha}. \quad (1)$$

where W_{FF} are the earnings of an individual that obtains education and works in country F.[10] The second possible strategy is:

(ii) Temporary migration – strategy A_S.
Individuals migrate as student but later on return to their home country after graduation. The earnings under this strategy is a function of quality of education overseas, Q_F and wages at home, w_S:

$$W_{FS} = \lambda\psi(Q_F, w_S) = \lambda w_S Q_F^{\alpha}. \quad (2)$$

(iii) Permanent migration only as worker – strategy, B_F

The third possible strategy is that an individual will obtain education in his home country and migrate in order to work, following graduation. This is the usual "brain drain" strategy. The value of earnings under this strategy is a function of quality of education at home, Q_S and wages overseas, w_F:

$$W_{SF} = \lambda\psi(Q_S, w_F) = \lambda w_F Q_S^{\alpha}. \quad (3)$$

(iv) No migration – strategy, B_S.

An individual obtains education in his home country and remains to work there following graduation. The present value of earnings over time under this strategy is:

$$W_{SS} = \lambda\psi(Q_S, w_S) = \lambda w_S Q_S^{\alpha}. \quad (4)$$

So all four strategies present different returns depending on where the student learns and where he works. We now turn to the main costs related to learning and migration.

2. Costs of Migration

The literature of migration stresses two main types of costs that individual bears during migration: financial costs and psychological costs.

[10] This model focuses on migration between home and foreign countries, and it does not analyze moving from one foreign country to another.

(i) Financial Costs

When migrating as a student, we assume that the main financial costs of migration are tuition fees. Therefore, if the individual obtains education in his home country, the amount of tuition fees that he pays are F_S and if he obtains education overseas he pays tuition fees which are charged in the host country, F_F .

(ii) Psychological costs

Sjaastad (1962) argued that migrants bear costs which results from separation from family and friends. This definition of costs is known in the literature as psychological costs. The new literature developed by Akerlof and Cranton (2010) also put an emphasis on "identity". This literature takes into account that one of the main element people care about is their identity, or in other word, their culture.

In consequence, when a person leaves home, he has the cost of leaving his own culture and adapting to the new one.[11] These costs are positively affected by the cultural differences between the sending and the receiving countries.

This phenomenon of adapting to a new culture is coined as acculturation (see, Narchal, 2007). Theories of acculturation stress that the interaction between different cultures and adaptation to the majority's culture, lead to a process in which migrants are losing their own cultural identity. Therefore, this process bears psychological cost, which depends on the cultural differences between the origin and the destination countries.

The literature emphasizes that these psychological costs are much bigger for adults than young individuals starting learning. Therefore in this paper, we assume that there are two different costs, one borne by adults migrating, P_o (o for old), and one by students, which are smaller and coined, P_S .

Moreover, we assume that the student feels more integrated in the host country than in his own home country. Since we assume a two-step decisions model, then the psychological costs will also occur when he returns home. Based on the theory of acculturation, the psychological costs are a function of Cu which is the differences between the culture of the migrant and the culture of the majority in the destination country, but also of language, and distance.

In summary, the net incomes under each of the strategies are as follows:

[11] Some psychologist will also emphasize the costs of loneliness and isolation; Others argued that as a result of changes in the identity of the individual, mental illness might appear (see Bhugra, 2004).

A_F $\quad NV_{AF} = \lambda w_F Q_F^{\alpha} - (F_F + P_S)$ (Ci)

A_S $\quad NV_{AS} = \lambda w_S Q_F^{\alpha} - (F_F + P_o)$ (Cii)

B_F $\quad NV_{BF} = \lambda w_F Q_S^{\alpha} - (F_S + P_o)$ (Ciii)

B_S $\quad NV_{BS} = \lambda w_S Q_S^{\alpha} - F_S$ (Civ)

3. Optimization

Individual decides whether to migrate for education purpose or later on as skilled worker, according to the net return under each of these four strategies. The next proposition checks the optimally of these strategies under the specific condition that tuition fees are similar in all countries.

The reason for this specific assumption is that in the empirical section, we analyze the consequences of the Bologna process on migration of students, and tuition fees for students belonging to the EHEA (European Higher Education Area) are quite similar.[12] In consequence, we analyze what happens under this condition. From comparison of the net returns under each of the strategies we get the following Proposition.

Proposition 1:

Under the assumption that tuition fees are similar, the two optimal solutions are either A_F *or* B_S*, given condition I.*

Condition I:

If $w_F > w_S$, $\quad P_o > \lambda Q_S^{\alpha}(w_F - w_S)$.

If $w_S > w_F$, $\quad P_o - P_S > \lambda Q_F^{\alpha}(w_S - w_F)$.

Proof: (see appendix A)

[12] It should be noted that tuition fees are different for students coming from outside the EHEA, since the Bologna Process ensures that tuition fees are equal for all students from this area, while for students from outside this area, tuition fees are higher.

This proposition states that we don't have to analyze four possibilities, but we can focus only on two strategies, A_F and B_S. This will permit us to use the Borjas model (1987), in order to analyze empirically the elements which affect migration.

However before turning to the empirical part, a consequence of Proposition 1 is the following Proposition:

Proposition 2:

Under Condition I, Brain Drain (strategy B_F) is suboptimal and individual will prefer either to leave their country already as a student, or to stay in their home country.

Proof: (see appendix B)

This proposition states that under Condition I, there is always a strategy which will be better that B_F, the usual brain drain. The meaning of Proposition 2 is that when we allow for migration of students, and do not restrain ourselves to the question of migration as adult, then we get that when differences in tuition fees are not big and when psychological cost of adaptation are higher when adult, the strategy of brain drain is sub-optimal. It is always one of the other strategies which is optimal. Moreover, whenever the quality of higher education is higher overseas, then A_F is optimal and is a better solution than the regular brain drain.

Still the brain drain strategy, B_F is commonly used for individuals from poor countries who cannot afford learning abroad, and for whom tuition fees abroad are too high. They move when they have saved enough to travel to the developed world.

This two-steps model is especially important for countries in the border of the developed word, from which students can easily travel to learn. This model shows that they will either stay in their countries, or move when they are still young. For them, the strategy B_F is sub-optimal.

This model encompasses the idea that in the past, when learning overseas was not as easy as today, brain drain was more frequent. In the future, we might face a structure in which young people, with secondary education will leave the country to learn overseas, and will not come back, unless for them, the "previous identity" or family ties are essential elements of their well being.

IV. Empirical analysis

Proposition 1 lead to the conclusion that under some assumptions, the only two optimal strategies are strategy A_F i.e., to migrate as student and remain in the host country; or strategy, B_S, i.e., not to migrate at any stage.

These two optimal strategies will permit to find the equation to be estimated, and which is based on the model of self selection developed by Borjas (1987). In this part, we assume that λ is not anymore constant for all migrants, but it is different among countries. We define λ_F and λ_S the returns on personal characteristics in country F and country S respectively. Following Borjas we also assume that $\ln \lambda_F \sim N(0, {\sigma_F}^2)$ and $\ln \lambda_S \sim N(0, {\sigma_S}^2)$.

Recalling that the net returns under the two optimal strategies are:

$$A_F: \quad NV_{AF} = \lambda w_F Q_F^{\alpha} - F_F - P_S \qquad \text{(Ci)}$$

$$B_S: \quad NV_{BS} = \lambda_S w_S Q_S^{\alpha} - F_S \qquad \text{(Civ)}$$

In consequence, we get that:

- If $I > 0$, then students migrate;
- and if $I < 0$, then individuals do not migrate,

where I is:

$$I = \ln[\frac{A_F}{B_S}] = \ln[\frac{\lambda_F w_F Q_F^{\alpha} - (F_F + P_S)}{\lambda_S w_S Q_S^{\alpha} - F_S}]. \qquad (8)$$

It follows from equation (8) that:

$$I \approx [W + q + E] + X \qquad (9)$$

where

$$W = \ln w_F - \ln w_S \qquad (10)$$

$$q = \ln Q_F^{\alpha} - \ln Q_S^{\alpha} \qquad (11)$$

$$E = \ln F_S - \ln F_F - \ln P_S \qquad (12)$$

$$X = \ln \lambda_F - \ln \lambda_S \qquad (13)$$

Therefore the probability, P, of emigration from country S to country F is:

$$P = \Pr[X > -(W + q + E)] = \Pr\left[\frac{X}{\sigma_X} > \frac{-(W + q + E)}{\sigma_X}\right] = 1 - \phi(Z) \qquad (14)$$

where $Z = -(W + q + E)$, σ_X is the standard deviation of X, and ϕ is the CDF function of the normal distribution. From equation (14) it follows that the emigration equation from country S to country F is therefore:

$$P = 1 - \phi\left[\frac{-[\ln w_F - \ln w_S + \ln Q_F^{\alpha} - \ln Q_S^{\alpha} + \ln F_S - \ln F_F - \ln P_S]}{\sigma_X}\right] \qquad (15)$$

Let us now turn to the regression of equation (15). We start with some clarification on the specification of the empirical model. We then present the data. Note that the elements affecting the psychological costs, P_S are the difference in culture, distance and language. In consequence, in this empirical part, we include these three elements.

1. The specification of the model

In this empirical part, we regress the probability of migration as a function of the elements that appears in equation (15): wages, quality of education, psychological costs and tuition fees. To these variables, we add a variable checking if there is a different behavior when an individual belongs to the EU, and if the education system is similar. In consequence, we estimate the following equation:

$$\begin{aligned} Pmig = {} & \alpha + \beta_1 \Delta Wage + \beta_2 \Delta Cu + \beta_3 \Delta Tuition + \beta_4 \Delta Tuitionsq + \beta_5 EU_F + \beta_6 \Delta Quality \\ & + \beta_7 Distance + \beta_8 Similarity + \beta_9 Language + \beta_{10} Top5 + \beta_{11} Wage5 + u + \varepsilon \end{aligned} \qquad (16)$$

We investigate this equation with a country fixed effect, u and analyze a panel data of students' flow published by the OECD on the years 2001-2006, and we focus on two groups of countries, and will present the data for two samples.

The first sample includes the countries from the EU 27 (without Croatia) including Switzerland and Norway. The second sample includes only the 15 EU countries (which belonged to the EU before 2004), since they were inside the EU for a longer time.

The decision on migration is a qualitative variable, based on macro-data, therefore, we use a logistic transformation when estimating equation (16). Let us recall that in our theoretical model we used, as Borjas, the normal distribution while in this analysis we use the logistic distribution. Since the normal distribution and the logistic distribution are similar in their bell curve and in their practical uses, the results are similar. Let us now describe the variables in equation (16).

2. The variables of the model

Pmig is the dependent variable which is a logistic transformation of the probability to emigrate from country S to country F. The dependent variable is therefore:

$$Pmig = \ln \frac{P_{SF}}{1 - P_{SF}} \tag{17}$$

where P_{SF} is the probability to migrate from country S to country F, calculated by dividing the number of foreign students from country S in country F by the total number of students in country S.

$\Delta Wage$ is the difference in the monthly average wage in manufacturing between country F and country S, based on the ILO database.

$\Delta Quality$ measures the differences in quality of higher education between the sending and the receiving countries. Our quality index defines the quality of higher education in a country according to the number of universities in this country which are ranked among the world's top 100 universities. Therefore the quality of country is higher when it has more universities which are ranked in the top 100. There are two main ranking of universities in the world – the THE and the SJTU-ARWU (Shanghai ranking). We have chosen to use the SJTU ranking since it uses criteria of research quality, research productivity, quality of the faculty and quality of teaching. Some previous work (Mac and Moncur, 2001) uses instead the expenditure on education, but OECD research has shown that the correlation between budgets and quality is weak.[13]

$\Delta Tuition$ is the difference in tuition fees between the origin and host countries. based on the CESifo Dice report. We should note that tuition fees in Europe are very low and in many countries students obtain education free of charge.[14]

$\Delta Tuitionsq$ is the square difference in tuition fees between the sending and the receiving countries.

EU_F is a dummy variable which receives the value 1 if the destination country is a member of the EU 27 countries.

Distance measures the geographical distance between the capital cities of the origin and the destination countries. The series are based on the Gleditsch and Ward (2001) database. This variable is part of the moving costs.

ΔCu is an index of cultural differences between countries. We developed this index based on the World Values Survey.

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[13] It should be noted that our own index has also some weakness, because many countries don't have universities which are ranked in the world top 100. As a result this index provides information on a limited set of countries.

[14] It is important to note that the EU forbids discrimination regarding tuition fees that are charged from EU, EEA citizens and citizens of countries which have special agreements with the EU. Since all the countries in our data are either EU countries or countries which have agreement with the EU, tuition fees are the same for local student as well as for overseas student.

Similarity is a dummy variable which get the value 1 if the structure of higher education in the sending and the receiving countries was similar prior to the adoption of the Bologna process. We divided the countries into two different groups. The first group includes the countries which, prior to Bologna process, had the three cycles of degrees and the second group includes countries with structure similar to the German system. As we will show, this element is important for understanding migration in Europe.

Language is a dummy variable that gets the value 1 if the official language in the origin and the destination country is the same.

Top5 is a dummy variable which gets the value 1 if the destination country is one of the five countries which has the highest quality of education according to top100 index of quality. In fact, we use this variable to measure concentration by quality. The top five countries are France, Germany, UK, Switzerland and Sweden.

Wage5 is a dummy variable which get the value 1 if the destination country is one of the five OECD countries with the highest wage in manufacturing. The top five countries are: Austria, Denmark, Holland, Norway and Switzerland.

Finally, u represent a fixed country effect and ε is the random error.

V. Empirical results

The results of our analysis are presented in Table 1. In all regressions, the dependent variable *Pmig* represents the transformation of the probability to emigrate from country S to country F according to the logistic distribution.

In the first and third columns of Table 1 we present the regression in the overall sample and in the second and forth columns we present the regressions for the EU15 sample.

1. Main results

(i) Wages and Quality of Education

Table 1, columns 1 and 2, present the results when the explanatory variables are quality of university and the gap in wages between the country of origin and the host country.

We find that in both samples (total sample and the EU15), there are significant negative effects of wage differences on migration of students (see columns 1 and 2). This result is interesting because the literature stresses that wages are a positive and significant element in the decision of student migration (see Rosenzweig 2006). Our paper shows that this is not so. This result is puzzling and needs some more research. We return to this question below, and we focus now on the element which is significant and positive: the quality of higher education.

$\Delta Quality$ - Following our theoretical model, positive quality differences between the receiving and the sending countries is expected to encourage students to migrate. Indeed, we find a positive and significant effect of the quality of higher education on the probability of students' migration (see columns 1 and 2).

In conclusion, we find negative and significant effect of wage differences on migration of students and positive and significant positive effect of quality of education on migration.

(ii) Top Wages and Top Quality of education

We check whether quality of higher education or wage lead to some concentration effect. In order to explore this effect, we add two dummy variables in columns 3 and 4 of Table 1. The first one is *Top5-quality*. This variable gets the value 1 if the destination country is one of the top five countries in quality of higher education. This variable measures concentration of students in top quality countries.

Similarly, we add the variable *Wage5* which measures whether the destination country is one of the five countries with the highest wage. In other words, this variable measures concentration of students in high wage countries.

The results show positive and significant effect of the *top5-quality* variable and negative and significant effect of the *wage5* variable. Therefore we find evidence that the pattern of flows is to countries with high quality of universities and not to countries with high wage.

This result is puzzling as we have stressed above. It also leads to think that maybe the unified brain drain model should be refined to take these elements into consideration. Our results seem to show that students study where the higher education is best, but where wages are not the highest. Indeed, in Table 2, we present the correlation between wages and quality of higher education. We find that the correlation between wages in manufacturing in each country and its number of universities in the world's top100, top 200 and top500 universities is around 0.35. Therefore the countries with the highest quality of education are not necessary the countries with high wages. This could be explained by more flexibility in the labor market, which is a positive element for students which just have finished to learn and are without experience.

The concentration effect stressed in Table 1 can be presented in a different manner in Tables 3a and 3b, in which we present the distribution of student flows according to quality of higher education (in Table 3a), and according to wages (in Table 3b).

Table 3a shows that around 67 percents of student flows in the OECD and EU countries concentrated into the top five countries in quality of higher education.[15] Are these flows also concentrated in the top five countries in wage?

In Table 3b, we measures concentration in countries with the highest wage. We show that more than 80 percent of the student flows went to the low wage countries. Therefore, unlike the concentration of students in high quality countries, we don't find concentration in high wage countries.

2. Some more results

The next four variables, *similarity*, *language*, *Distance and culture* are related to the costs, P_S.

Similarity - measures similarity between the structure of higher education in the host and origin countries. When the structure of the systems is more similar the compatibility costs are lower. In our empirical investigation, this variable was not significant.

Language – In all regressions, we find a positive effect of the same language in the host and the origin countries on migration. Note that this positive relation was also found in previous studies.

Distance – Similar to previous studies on migration, we find negative effect of distance between countries on migration.

ΔCu - Table 1, row 3 shows that higher cultural differences, as reflected by the cultural index, reduce significantly the rate of migration in all four regressions.

These results lead us to conclude that students are indeed affected by psychological moving costs. Are the tuition cots affecting migration as emphasized by the literature?

$\Delta Tuition$ - A priori, we expected to find negative effect of tuition fees gap on migration, but we found positive effects. Already Mak and Moncur (2001) found also positive effect of tuition fees on migration of students, while Bessey (2007) found insignificant effect. In this paper we also find a significant and positive effect of tuition fees gap on migration in both samples, meaning that students migrate to countries with higher tuition fees. This positive effect could be due to a signaling effect of the level of tuition fees on the quality of education.

$\Delta Tuitionsq$ - The positive effect of tuition fees on migration led us to check whether there is a non linear relation between tuition fees and migration. The results are not clear cut.

[15] More specifically, around 19 percent of students went from low quality countries to low quality countries. Around 48 percent went from low quality countries to the top five countries, 14 percent from the top five countries to the low quality countries, and 19 percent were between the top five countries.

EU_F - We get a positive and significant effect of the host country being a member of the EU. There is clearly a club effect since migration to the EU area could raise the returns on migration.

VI. Conclusion and Policy Remarks

This past decade, cross-national migration of young people has become an important issue in the policy arena for two main reasons. The first is that the European Union has decided upon establishment of a European Higher Education Area, thereby allowing and even encouraging free movement of students between European Union countries.

The second issue related to migration of students is the increasing global competition on talents. In the past, the elite of most countries were educated in their own countries. Today, an element common to many of the elites is that they share a common education and for many of them, they have attended the same elite universities, which are not in their home countries. In consequence, the issue of social mobility has become linked to the international movement of students. An obvious question is then what determines the direction of student mobility? This is the topic of this paper.

The first contribution of this paper is that it has stressed that to answer these types of questions, we cannot use a conventional model of migration which naturally limits itself either to student migration, or to migration of workers. We developed a "unified brain drain" model, that merges the decision to migrate as a student with the decision to migrate as a worker. Our first result is that the usual brain drain might be sub-optimal. The second result of this paper is that migration is towards the countries with higher quality of education.

This issue might appear redundant, since *a priori*, countries with high wages will also be countries with high education quality. Yet among the empirical regularities exposed herein, we show that this is not the case: The correlation between wages and education quality is only 35%.

The empirical analysis shows that while quality of education affects positively migration, wages do not affect positively migration. Previous researches, which have analyzed the impact of wages, did not include any variable for quality of education: Our paper shows that this is the element driving movement of students.

Moreover, we test whether there is concentration in specific countries. We show that young people travel to the top five countries in terms of education quality. Our indices show a concentration of students in the top-quality education countries, and not into countries with the highest wages, so that students' emigration is motivated by quality of education and not by wages.

Nobel Prize Laureate Robert Lucas raised a famous query in his paper: "Why doesn't capital flow from rich to poor countries?" Paraphrasing Lucas, we could state

that human capital doesn't flow from poor to rich countries, but rather from countries of low-quality education to those of high-quality education.

These are not good news for the Bologna Process. These are even worse news for developing countries in the border of the European Union, especially for the Mediterranean countries. Young people will try to acquire higher education in the top countries in terms of quality of education, and brain drain will increase.

However there are also some good news. In order to develop, countries need bright people at the helm of the political and economic leadership. Countries do not develop if their elite are not well educated. The Bologna Process leads to low tuition fees for all countries in the area. So the bright people from developing countries in which higher education is not of high quality can move and attend the best universities. The question is whether they will return to their home countries.

Some other good news is that the market for education is much more open and competitive than that for labor. Indeed, this paper shows that the Bologna process has succeeded in stimulating mobility. Is this good for Europe? The answer is mitigated. The Bologna process is leading to significant changes, not only in the market for education, but also in the labor market. The effects on the neighborhood countries are not clear. On one hand, it can lead to an increase in the loss of young bright people. On the other hand, it could enable providing a good education to the next generation of leaders. The new literature on migration has emphasized that migration of young people can lead to multiple equilibria:[16] Either there are some forces which will lead the young people to return to their countries of origin, be a source of economic growth, and become the next elite. Or, if there is no exogenous shock leading to this optimistic possibility, the flow of young people will increase and the home country can be caught in a vicious circle leading to some form of poverty trap.

In conclusion, this paper has shown that migration of students has to become a subject of research not less important than migration of workers related to the issue of social mobility. Moreover, we have shown that the quality of universities between countries is a main variable which affects migration.

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[16] See Benassy and Brezis (2013).

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Appendix A– proof of proposition 1

The assumption is that $F_S = F_F$.

A. First let us prove that $B_S \succ B_F$

1. If $w_S > w_F$.

Then this is obvious.

2. If $w_F > w_S$

Under Condition I*a*, we get that $B_S \succ B_F$.

B. Let us prove that A_S is sub-optimal by proving either $A_F \succ A_S$ or $B_S \geq A_S$.

1. If $w_F > w_S$.

Then we get that $A_F \succ A_S$ (Recall that $P_o > P_S$).

2. If $w_S > w_F$

If $Q_F < Q_S$, then we get that $B_S \succ A_S$

If $Q_F > Q_S$, then under Condition I*b*, we get that $A_F \succ A_S$.

Appendix B– proof of proposition 2

Under which condition do we get that $A_F \succ B_F$?

1. If we assume these following intuitive assumptions:

$Q_F > Q_S$; $P_o > P_S$; and $F_F > F_S$.

Then if: $(P_o - P_S) + \lambda w_F (Q_F^{\alpha} - Q_S^{\alpha}) > (F_F - F_S)$

We get that $A_F \succ B_F$.

Under which condition do we get that $B_S \succ B_F$?

1. If $w_S > w_F$

Then this is obvious.

2. If $w_F > w_S$.

Then, under Condition I*a*, we get that $B_S \succ B_F$.

TABLE 1

REGRESSION RESULTS: DETERMINANTS OF STUDENTS EMIGRATION

Variable	Overall panel	Square EU15	Overall panel	Square EU15
Dependent variable: $Pmig$ - Probability of emigration from country S to country F				
Constant	-7.182035 (-60.24)	-6.435478 (-46.77)	-7.95478 (-73.18)	-6.244323 (-42.02)
$\Delta Quality$	1090795 (10.35)	.1303641 (9.73)	.1028747 (5.67)	.006896 (0.22)
$\Delta Wage$	-.0000999 (-4.61)	-.000155 (-3.31)	.0003671 (9.61)	.000042 (0.61)
ΔCu	-.1115142 (-3.00)	-.2533198 (-3.62)	-.1654175 (-4.12)	-.2716306 (-4.11)
$\Delta Tuition$	.0006905 (13.22)	.0007624 (8.25)	.0006239 (10.24)	.0011574 (9.21)
$\Delta Tuitionsq$	2.94e-07 (6.85)	4.23e-07 (5.40)	-7.26e-08 (-1.57)	-1.57e-07 (-2.19)
EU_F	.4820245 (4.34)	----------	1.02883 (14.39)	----------
Distance	-.0014917 (-20.54)	-.0011801 (-9.13)	-.0014072 (-18.90)	-.0015966 (-13.06)
Similarity	-.0560596 (-1.08)	.0369502 (0.41)	.0221401 (0.39)	.0580827 (0.68)
Language	1.75015 (14.58)	1.929312 (11.99)	1.455952 (11.23)	1.315127 (8.95)
Top5-quality	----------	----------	1.4821480 (13.49)	2.243006 (10.59)
Wage5	----------	----------	-.4348655 (-4.24)	-.5718809 (-4.15)
R^2	0.3194	0.4603	0.4303	0.5421
Obs	3030	1131	3030	1131

Note: t-values are in parenthesis.

TABLE 2

CORRELATION BETWEEN WAGES AND QUALITY OF HIGHER EDUCATION

	Top100	Top200	Top500
Average wage	0.34	0.37	0.33

Sources: Shanghai Jiao Tong University, World university ranking, 2007, and International Labor Organization, 2001-2006.

TABLE 3A

CONCENTRATION EFFECT – PERCENTAGE OF MIGRANTS BETWEEN LOW AND HIGH QUALITY GROUPS

	Low to Low	Low to High	High to Low	High to High
2001	19	48	14	19
2002	19	48	14	19
2003	19	47	15	19
2004	18	49	14	19
2005	19	47	15	19
2006	20	45	17	18

Source: Own calculation.

Notes: "High" represents the top 5 countries according to the quality index of the top 100. According to this index the top 5 countries are France, Germany, Sweden, Switzerland and United Kingdom. "Low" represents all the other countries.

TABLE 3B

CONCENTRATION EFFECT – PERCENTAGE OF MIGRANTS BETWEEN LOW AND HIGH WAGES GROUPS

	Low to Low	Low to High	High to Low	High to High
2001	73	15	11	1
2002	73	15	11	1
2003	74	15	10	1
2004	72	16	11	1
2005	71	18	9	2
2006	70	19	10	1

Source: Own calculation.

Notes: "High" represents the top 5 countries in wages. The top 5 countries are Austria, Denmark, Netherlands, Norway and Switzerland. "Low" represents all the other countries.