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Fighting Brain Drain: The Ecuadorian Scholarship

By Alice Sanna*

In 2007, the Republic of Ecuador introduced a new scholarship program for financing Ecuadorian students intending to study abroad. This program still exists and stipulates a compulsory return to the students' home country after completing their studies abroad. Statistical data shows a return rate of about 90%, which is somewhat surprising at first glance. This paper aims to introduce the Ecuadorian scholarship program as a case study in the literature of financing systems of students' mobility in higher education, while attempting to give a first analysis of its mechanism design.

JEL Codes: F22, H52, I23

Keywords: brain drain, financing systems of students' mobility, higher education, students' mobility, developing countries

Introduction

Globalization has several implications for the mobility of students and skilled workers. Over the last decade, the phenomenon of 'brain drain', a clear and peculiar consequence of the current globalized world, has gained the attention of many academic researchers. In conjunction with the increasing number of international students, the percentage of students staying in the country where they studied is also increasing. To give an example, Van Bouwel (2010)¹, who analyzed the migration behavior of a sample of European economics students who obtained a PhD in the US, stated that "64% are currently working in the US, whereas only 24% moved back to their home country, and an additional 10% moved to another European country". Among other factors, as argued by Lange (2009), technological changes could explain the general linear rise in the stay rate since communication has become cheaper and travel costs have also reduced, allowing students and graduates in their host countries to stay in touch with their relatives and friends abroad.

Particularly interesting for people from developing countries, brain drain arises when the general socioeconomic conditions to stay abroad (that is typically the country they chose to study in) are better than those in their home country. This phenomenon is highly disadvantageous to human capital, since the need for highly skilled workers and highly educated citizens is more significant than in developed countries. Geesen (1998)² states that brain drain makes developing

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This paper is part of the doctoral process.

¹See also Van Bouwel and Veugelers (2014).

²See also Shahabadi et al. (2020)

countries less competitive than developed ones. In the same way, Docquier (2014)³ argued that among different country-specific factors, the country's level of development determines whether a country gains or losses in terms of the brain drain effect⁴. But on the other hand, it is highlighted the importance of the general trend and the 'mimicking effect' among mobile skilled workers. In particular, "when a return is significant, it gives incentives to other waves of returnees to come home"⁵.

One of the causes of the brain drain phenomenon could be attributed to a lack of efficiency in the financing systems of students' mobility, often discussed by Gérard (2007, 2008, 2012)⁶, and Gérard and Uebelmesser (2014). In particular, if the so called *country of origin's principle* discussed by the same author seems to be more efficient than the *host country* one, it still incentivizes the brain drain phenomenon. The 'sending' country (i.e., country of origin), is often paying scholarship fees to their students to study abroad, in the false hope of seeing those students return once they have completed their studies abroad.

Scant literature seems to exist on the causes of returning or staying after studying abroad. Of course, one could say that it is logical and is directly related to economic possibilities and higher salaries, but this argument is not exhaustive. In this sense, the work of Baruch et al. (2007) offers a lot of interesting evidence regarding the inclination to stay abroad after having studied. In particular, they argue that "students' perceptions of ethnic differences and labor markets, their adjustment process to the host country, and their family ties in the host and home countries all affect their intention to stay". Combining the 'push-pull' model developed by Baruch (1995) and the theory of 'reasoned action' by Ajzen and Fishbein (1980), they examined the attitudes and perceptions of 949 foreign students who came to study in the UK and USA.

In an attempt to tackle brain drain, the Republic of Ecuador introduced a new and original scholarship program to finance Ecuadorian students intending to study abroad. The Ecuadorian model stipulates a compulsory return to the home country with the obligation of working 'at home' for double the length of time that they spent abroad. If students do not fulfil that condition, they have to repay the entire cost of the scholarship. In exchange, authorities help students to find a job if necessary. Statistical data shows a return rate of about 90%⁷, which is somewhat surprising at first glance. On that basis, this work aims to understand that apparently successful outcome and, in particular:

- Brings the Ecuadorian scholarship as a case-study in the literature of financing systems of students' mobility.

³See also Djadjic et al. (2019).

⁴See also Kar-yiu and Chong (1999).

⁵Ireland after the fiscal reform of 1987 and Taiwan in the 1980s (see Docquier 2014).

⁶See also Gérard and Sanna (2017).

⁷SENECYCT 2019 (stands for 'Secretaría Nacional de Educación Superior, Ciencia, Tecnología e Innovación' and is the governmental institution that promotes scientific research and technological innovation).

- Attempts to analyse the mechanism design of this scholarship and see how the return conditions could be a contributing factor in solving the brain drain problem.

The paper is organized as follows: the second session gives a general analysis of the brain drain issue in Ecuador. The third session introduces the scholarship program in detail: data, facts, and institutions. Starting from the *country of origin principle*, the fourth session describes and attempts to analyze the mechanism design of Ecuador's policy. The fifth session proposes a detailed agenda for research as an extension of 'push-pull' model developed by Baruch (1995). The sixth session concludes this study and presents some tentative lessons for the management of the higher education system on students' mobility.

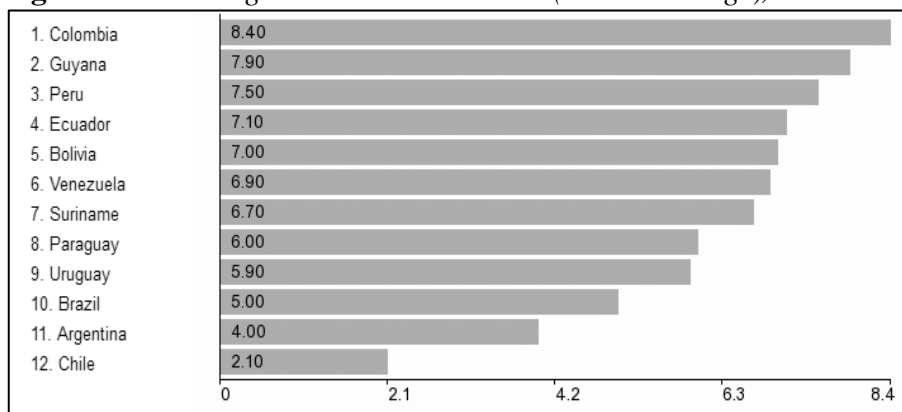
The Brain Drain in Ecuador

As previously discussed, brain drain is a worldwide phenomenon, especially problematic for developing countries that continue to lose skilled young people who decide to migrate to developed countries in search of better opportunities. Latin America is one of the regions where there are few incentives for highly skilled workers to stay in their home country, and Ecuador is one of them.

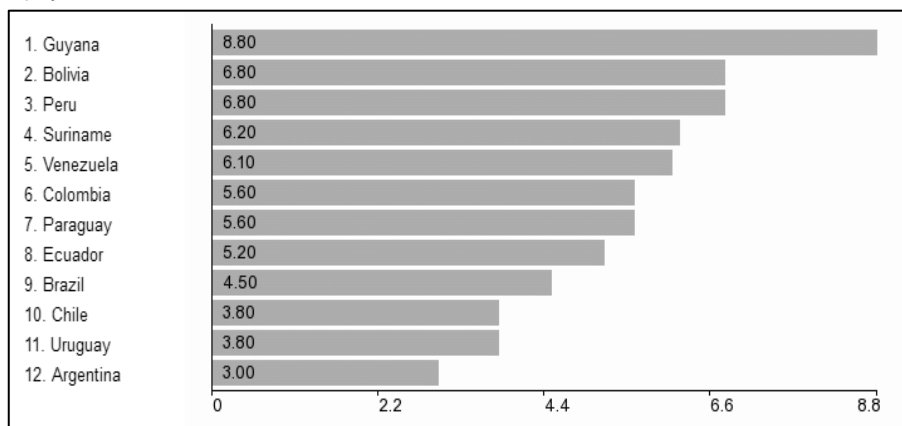
Ecuador is a developing country in the northern part of South America, with around sixteen million inhabitants. Between 2007 and 2014, it experienced a period of significant economic growth and consequent decrease in poverty which was mainly due to the boom in oil prices. It was precisely during this period that Ecuador introduced the scholarship program discussed in this paper, in order to try and invert the brain drain trend with new education policies, aimed at increasing the return rate after studying abroad.

Let me introduce some statistical data. If we look at Figures 1-3, we observe the human flight and brain drain indicator from 2007 to 2019. This indicator considers the economic impact of human displacement (for economic or political reasons) and the consequences on a country's development. The higher the index, the greater the human displacement. The average value is 6.56 index points with a minimum of 5.2 in 2019 and a maximum of 7.5 in 2010, and a shows decreasing trend since 2011.

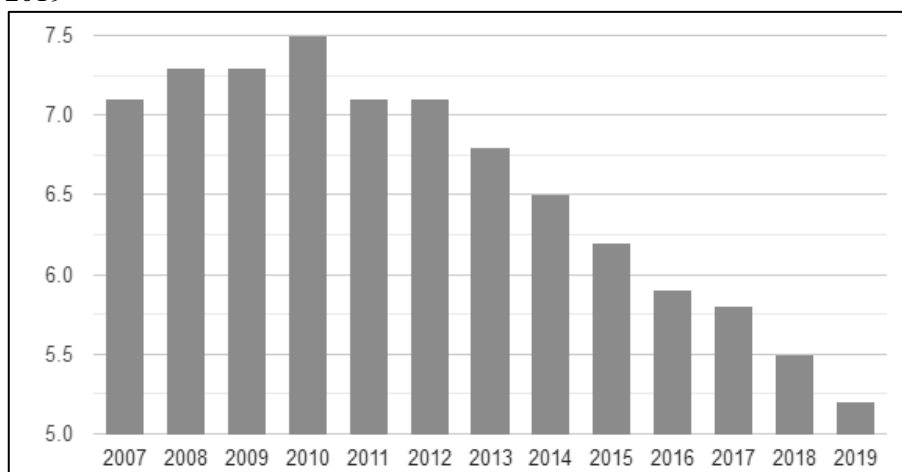
Observing figures for 2007 - Figure 1 - the government of the Republic of Ecuador realizes that among the twelve countries in Latin America, Ecuador ranked fourth, from the floor, when the human flight and brain drain index was at stake. Only Colombia, Guyana, and Peru behaved worse, while eight countries performed better: Bolivia, Venezuela, Suriname, Paraguay, Uruguay, Brazil, Argentina, and Chile. Twelve years later, in 2019 - Figure 2 - Ecuador has gained four places in that ranking; with only Brazil, Chile, Uruguay, and Argentina achieving better now.

Figure 1. *Human Flight and Brain Drain Index (0 Low – 10 High), Latin America, 2007*

Source: Fund for Peace.

Figure 2. *Human Flight and Brain Drain Index (0 Low – 10 High) - Latin America, 2019*

Source: Fund for Peace.

Figure 3. *Human Flight and Brain Drain Index (0 Low – 10 High) - Ecuador, 2007-2019*

Source: Fund for Peace.

How can this phenomenon be explained? What happened in between these periods? Why did brain drain decrease- at least in relative terms? This is an interesting observation that calls for a better study of its causes. At first glance, this could be linked with two phenomena: a higher return rate after studies abroad, possibly boosted by the government's scholarship program introduced in 2007, as well as the increasing number of highly-skilled workers coming from Europe after the 2008 economic crisis whom were hired in Ecuadorian universities as professors or researchers.

What is certainly true is that if Ecuador wanted to improve the quality of its capital (e.g., human capital, intangibles), compared to that of its neighboring nations, it had to face a double challenge: on the one hand, to send more young graduates abroad to obtain a master or PhD degree; and on the other hand, to incentivize that extra capital to return home after graduating with their advanced degrees.

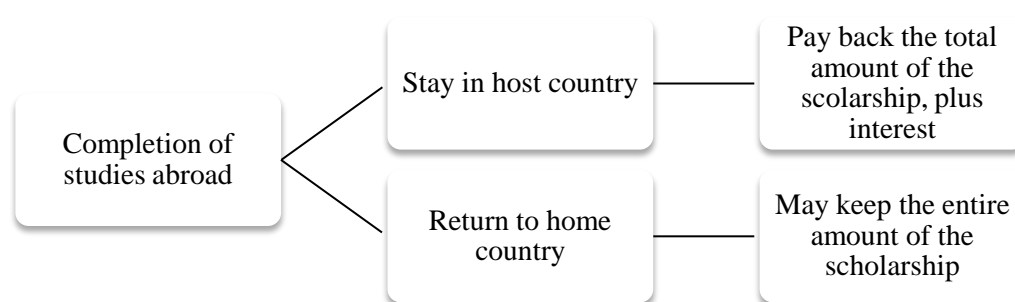
The Ecuadorian Scholarship: Data, Facts, and Institutions

In 2007, Ecuador introduced a new scholarship program for financing Ecuadorian students who intended to study abroad in order to transfer newly-acquired knowledge back to their own country after graduation. As mentioned in the program itself, higher education is one of the most fundamental pillars of the Ecuadorian development model, which has been created to tackle the main difficulties of a developing country: low-skilled workers, especially in the most sensitive and vulnerable sectors of the population. Moreover, the design of this particular type of scholarship has been designed in such a way as to avoid brain drain through a solid incentive to return to Ecuador after the completion of studies abroad.

The requirements of these programs are as follows: a natural person with Ecuadorian citizenship, ≤ 35 years old for master, ≤ 45 years old for PhD, certification of admission to a foreign university, a guarantor whose role is to pay back the entire amount of the scholarship in case the student decides to stay in the host country and does not have the means to repay the scholarship themselves. To obtain the scholarship there is a selection process that includes tests to verify a potential student's capacity for logic, mathematics, verbal expression, and English language ability. With a minimal result of 75% (60% for vulnerable categories), it is possible to progress to the final step- an interview, where the motivation level of the candidate is evaluated.

The Ecuadorian model stipulates a compulsory return to their home country with the obligation of working at home for twice the amount of time spent abroad. If students do not satisfy these conditions, they (or their guarantors) have to repay the entire scholarship plus a fixed amount of interest. In exchange, authorities help the students to find a job, if necessary.

To better understand the functioning of that scholarship device, let us focus on Figure 4 which explains the alternatives that the student faces once they finish their studies abroad.

Figure 4. *The Ecuadorian Scholarship Path*

It turns out that, *ceteris paribus*, if a student attains a good job abroad that allows them to repay the total amount of the scholarship, they will prefer to stay abroad. Vice-versa, they will choose to return to their home country.

The amount of the scholarship (see Table 1) depends on the country of destination, and takes into account the income level of the beneficiary.

Table 1. *Scholarship Maximal Amount according to the Destination Country*

Degree	Latin America and Caribbean	US, Canada, and Australia	Europe, Asia, and Africa
Master (max 2 years)	66,000 USD	103,000 USD	108,000 USD
Ph.D. (max 4 years)	162,000 USD	218,000 USD	204,000 USD
Professional Specialization in Medicine (per year)	38,000 USD	51,000 USD	57,000 USD

Source: SENE CYCT⁸.

Over the period of 2007-2018, the Ecuadorian Government funded 11,214 scholarships for both undergraduate and graduate-level students: 26% to study Engineering, 23% for Health and Medical Studies, 16% to Natural Sciences, Mathematics and Statistics, 11% for Social Sciences and Communication, and 7% for Information Technology Studies. For more details, see Table 2.

According to the available data (see Table 3), 43% of the beneficiaries chose a country in Europe, Asia or Africa, 35% a country in Latin America and Caribbean, and 22% opted for the US, Canada or Oceania.

The preferred host countries were: Cuba (16%), Spain (15%), UK (10%), US (10%), and Australia (8%) (see Table 4). The other destinations were below 5%. It may be useful to highlight the fact that there is a very good and well-known university for Medical Studies in Cuba, ‘*Escuela Latinoamericana de Medicina*’ which is the most highly regarded in Latin America. The fact that the second most popular destination is Spain could be justified by a language-oriented choice.

⁸SENE CYCT: <https://sia.senescyt.gob.ec/proceso/becas/>.

Table 2. *Field of Studies of Beneficiaries (2007-2018)*

Field of Studies	No. of students	% of total number of outbound students supported by the program
Engineering	2,570	26%
Health and Medical Studies	2,313	23%
Natural Sciences, Mathematics and Statistics	1,589	16%
Social Sciences and Communication	1,096	11%
IT	704	7%
Agriculture, Forestry, Fishery, and Veterinary	594	6%
Arts and Humanities	533	5%
Business, Management and Law	343	3%
Educational Sciences	236	2%

Source: SENEYCT.

Table 3. *Destination of Beneficiaries (Region of Studies)*

Region	No. of students	% of total number of outbound students supported by the program
Latin America and Caribbean	3,450	35%
US, Canada, and Oceania	2,209	22%
Europe, Asia, and Africa	4,319	43%

Source: SENEYCT.

Table 4. *Destination of Beneficiaries (Country of Studies)*

Country	No. of students	% of total number of outbound students supported by the program
Cuba	1,611	16%
Spain	1,519	15%
UK	1,047	10%
US	1,030	10%
Australia	801	8%
Canada	376	4%
Russia	358	4%
Honduras	343	3%
Netherlands	326	3%
Argentina	281	3%
France	276	3%
Chile	267	3%
Brazil	220	2%
Venezuela	212	2%
Mexico	211	2%
Costa Rica	168	2%
Germany	152	2%
Belgium	130	1%
Portugal	127	1%
Hungary	124	1%
Italy	102	1%

Source: SENEYCT.

As previously mentioned, statistical data shows a return rate of about 90%, which is somewhat surprising at first glance. Among the returnees, 34% work in

educational institutions, 18% in healthcare institutions, 15% in the private sector, and 14% for governmental institutions.

The ‘Country of Origin Principle’ and the Return Rate

As described in the literature by Gérard in 2007 and 2010, among others, we can distinguish two main ways of financing a student intending to study abroad: the *country of origin principle* and the *host country principle*. The first implies that the ‘sending country’ finances the student’s expenses, while in the latter, the ‘receiving country’ pays for them.

The existing system for financing students’ mobility, mostly based on the *host country principle*, is neither sustainable nor efficient (Gérard 2007, 2008, 2012, Haupt et al. 2011). One of the explored alternative solutions to the current *host country principle* is the *country of origin principle*. But, as argued by the same authors, it still appears to be inefficient because of the presence of a positive externality. However, the outcome of this design is more efficient than the previous one if the probability of returning home after completion of studies is higher than a given threshold.

To analyze the mechanism design of the Ecuadorian scholarship, we can start with the *country of origin principle* (see Gérard 2007) that is briefly described below, tracing the core parts of the model which are useful in understanding the discussed tool.

Under the assumption of a simple world consisting of two countries (i and j), the *country of origin* model is essentially based on the number of ECTS (European Credit Transfer System) obtained by the student, used as an indicator of the opportunity-cost related to the mobility. Each country wants to maximize their social welfare.

Supposing that the local production function of wealth ($f(x, z)$) is characterized by a technology using locally and internationally educated graduates, the objective function of the government of country i is:

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

where:

- e is the number of ECTS (European Credit Transfer Scale) where the first subscript indicates the origin country, and the second one indicates the destination country (for studying purposes).
- $\beta \geq 1$ is the ability to contribute to wealth production.
- c is the cost of producing ECTS.
- w is the opportunity cost of dedicating time to getting an ECTS rather than contributing to the current generation of local wealth.
- r is the probability of returning home after the completion of studies abroad.

To determine the number of ECTS e_{ij} (financed students to send abroad), the government of country i has to maximize equation (1) with respect to that latter variable. The equilibrium numbers of ECTS for the *country of origin* principle (O) are then the following:

$$e_m^O = r \frac{\beta}{c + w}$$

where the superscript O refers to *country of origin principle*, and the subscript m refers to internationally mobile students.

The lack of efficiency of this system has to be appreciated with respect to the efficient benchmark below that derives from the joint maximization of $W_i + W_j$ w.r.t $e_{ii}, e_{ij}, e_{jj}, e_{ji}$:

$$e_m^E = \frac{\beta}{c + w}$$

where the superscript E refers to *Efficient*. This lack of efficiency is then due to the presence of an externality:

$$e_m^E - e_m^O = (1 - r) \frac{\beta}{c + w} \quad (2)$$

which is positive anyway and it is the ‘present’ made by the origin country to the host country and consists of a fraction $1-r$ of the financed students remaining in the host country and being productive in the latter. Considering this, as discussed in the introduction, we know that the ‘stay rate’ in the U.S. is around 70% for international students, so it easy to appreciate the magnitude of this ‘loss’.

As previously examined, this brain drain phenomenon is particularly important when students from developing countries decide to study in a university in a developed country, which is the case for Ecuadorian students. The question that then arises is the following: starting from this *country of origin model*, could we reduce the positive externality by increasing the r parameter i.e. the probability of returning home after the completion of studies abroad? The answer seems to be positive and implicitly included in the Ecuadorian program discussed in this paper⁹. In fact, it suggests that it is possible to eliminate the ‘free-riding’ phenomenon better described by Gérard (2012): a country, which may have the studies of the further contributors to its GDP financed by taxpayers of the other country.

Returning to the *country of origin model*, it turns out that if the Ecuadorian model is capable of achieving a targeted return rate r^* of about 0.90, as announced by the authorities, the analyzed inefficiency in equation (2) will be close to zero and completely eliminated as $r^* \rightarrow 1$.

$$e_m^E - e_m^O = (1 - r^*) \frac{\beta}{c + w} = 0.1 \frac{\beta}{c + w}$$

⁹Other similar programs exist, for example the one applied in the US military force.

Then:

Proposition 1: When a government financing a scholarship under a country of origin adopts a constrained scholarship capable of boosting the return rate (r), the generated externality decreases, and the efficiency of the system increases.

The question now is how does this constrained scholarship influence the students' final decision to stay or to return. What is the probability of a student who has completed their studies abroad returning to their country of origin? And how could that probability change with the presence of a constraint, such as the one provided by the Ecuadorian scholarship program?

To answer this question, 'Ecuadorian student behavior' can be described by utilizing a simple variation of the migration model proposed by Borjas (1987) and repurposed by many authors like Clark et al. (2007). Note that the focus here is only whether to stay abroad, or return home after studies. We do not take into account the first step of a student wanting to study abroad, which is choosing this funding or not.

Let us suppose that a student (i), resident of the country of origin (O), and studying in host country (H), has to decide whether to go back after they complete their studies. Let us suppose that for studying abroad, they received a constrained 'Ecuadorian-scholarship' (S). The utility function of the student, and the probability that they will return to their country of origin is described below:

$$U_i = w_H(s_i)(1 - \rho_i) + w_O(s_i)\rho_i - \frac{c^2}{2}(1 - \rho_i)^2 S$$

where:

- ρ_i is the probability of returning home.
- $w_H(s_i)$ is the discounted value of the host country's salary, which depends on the students' skills (s_i).
- $w_O(s_i)$ is the discounted value of the country of origin's salary.
- S is the amount of the scholarship received plus interest.
- c is the 'stay-cost' (adaptability, cultural difference etc.).

Looking at the first order condition we have:

$$U'_p = -w_H(s_i) + w_O(s_i) + c^2(1 - \rho_i)S = 0$$

$$Sc\rho_i = Sc^2 + w_O(s_i) - w_H(s_i)$$

$$\rho_i = 1 + \frac{w_O(s_i) - w_H(s_i)}{c^2 S}$$

We can see that, for a given skill level:

- Higher wage rates in the host country, and lower mean wages in the country of origin increase the return rate.
- Higher stay costs increase the return rate.

So, the probability that a student who studied abroad returns home after graduation increases with the difference between the country of origin's wage and the host country's wage. Then:

Proposition 2: Since the difference between the country of origin's wage and the host country's wage is likely to be negative (because we suppose that the student chose to study in a 'richer' country), the probability of returning home is higher in the presence of a constrained scholarship.

An Agenda for Research: The 'Push-Pull Model'

The push/pull model from Baruch (1995), used to explain the phenomenon of international migration, describes the forces that push or pull one decision or another: namely, whether to stay, or to migrate. The final decision will be a weighted combination of the nature and the direction of these forces. Baruch identifies two main categories that influence the decision; the person's environment, and their societal context and target environment. In particular, their personal background, which includes personal values, needs, preferences, and aspirations, as well as political, social, and economic factors. At the same time, the target environment will be represented by culture, the legal system, and economy, etc.

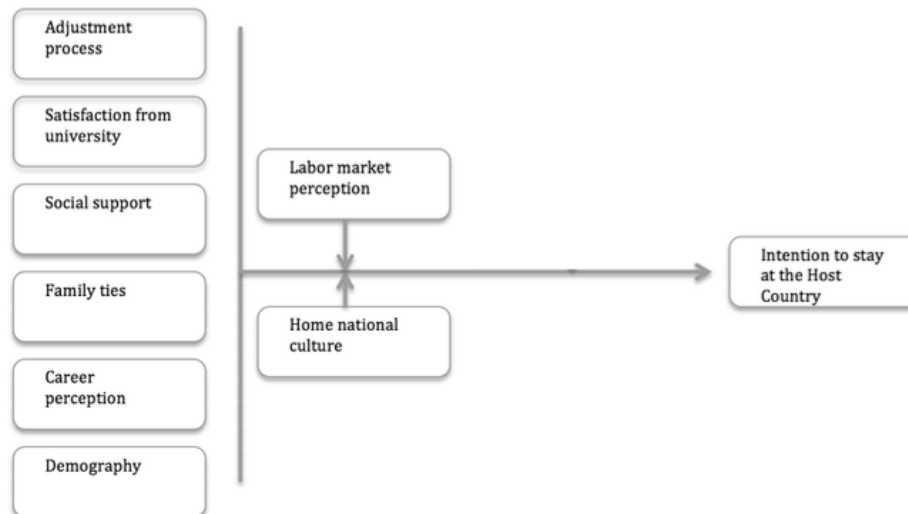
Baruch et al. (2007) developed a new model combining the push-pull model with the theory of reasoned action of Ajzen and Fishbein (1980) for emigration. The theory states that the student's decision to stay or return to their home country after studies will be "positively related to their inclination to do so, which, in turn, will be affected by their attitude. Different factors influence that inclination, for example, culture-shock" (Lee and Mauer 1999), the "adjustment process when moving to a different culture" (Shay and Baack 2004), "the students' orientation programs" (Martin and Dixon 1994), and "their level of satisfaction with the university" (Baruch et al. 2007).

Vaiman and Haslberger (2013) argue that another environment has emerged over the past few years: the transnational context. In particular, "whereas before it was a matter of weighing up the advantages and disadvantages of staying vs. (temporarily) migrating, now it is also a matter of the advantages and disadvantages of mobility in general (not any particular geography)". As they explain, having a 'mobile background' nowadays represents a positive quality on a worker's *Curriculum Vitae*. So the decision to move could also be influenced by this factor.

In particular, in their work, Baruch et al. examined the reasons for international students' inclination to stay in their host countries from a sample of 949 management students in the UK and US. Among this variety of factors (see Figure 5), their results support what they call a 'three-fold model of factors' that influences the final decision: the student's perceptions of ethnic differences and

labor markets, their adjustment process to the host country, and their family ties in their host and home countries.

Figure 5. *Factors Influencing the Decision to Stay Abroad (Baruch et al. 2007)*

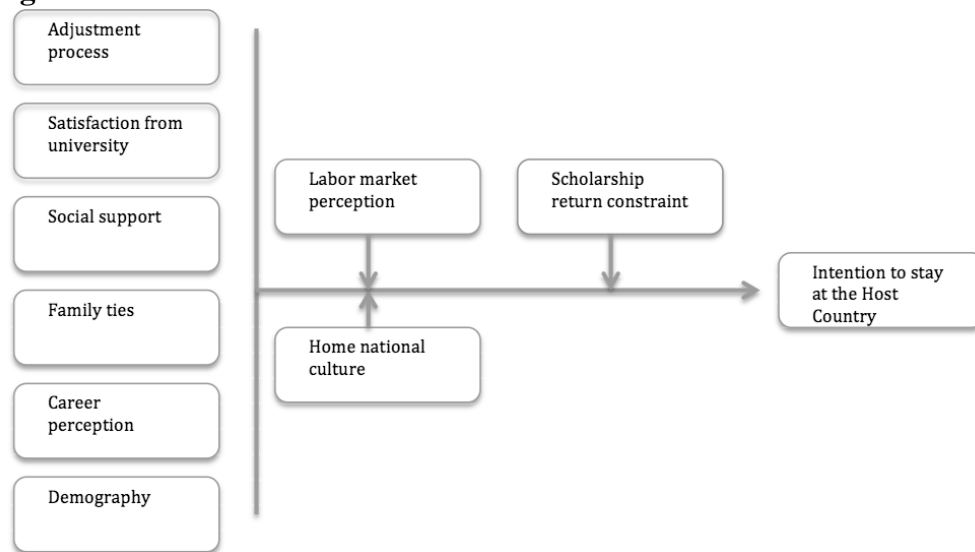


As previously discussed, the Ecuadorian scholarship model analysed in this paper could be a potential candidate for an efficient students' mobility financing system, since empirical data shows a high return rate, which is a key-parameter once we move to a *country of origin principle* financing system. The achievement of a high return rate could be explained by the presence of a compulsory return of the entire scholarship funding in the case the student decides to stay abroad after the completion of their studies. In terms of the push/pull model, the presence of the scholarship could be a key *push-factor* (in the sense that it 'pushes' the decision to return) that will positively influence the final decision to return to the country of origin. Then, the hypothesis to be tested in further research in the empirical model will be the following; which is Proposition 2 rewritten in a different way:

A scholarship with constraint, i.e. a compulsory return to the country of origin after the completion of studies abroad, will be positively associated with the intention of the foreign student to return to their country.

If this hypothesis is empirically confirmed, we can affirm that a country's financing system that grants a scholarship obliging students to return after the completion of their studies, such as the Ecuadorian model, increases the return rate, internalizing the positive externality associated to the standard *country of origin principle* financing system.

The extended push/pull model of the Ecuadorian system will then consider, among other factors, the presence of this important constraint: the constrained scholarship. Then the following model is proposed to be tested (Figure 6).

Figure 6. *The Ecuadorian Push/Pull Model to be tested*

The main idea for the empirical part is to test whether the presence of this constraint represents the main *push-factor* for the Ecuadorian students who decided to study abroad taking advantage of the government's scholarship.

Conclusion

Globalization has several implications for the students' and skilled-workers' mobility, and fosters the phenomenon of brain drain that, as discussed, is especially disadvantageous for human capital in developing countries.

We have seen that, although the *country of origin principle* seems to be more efficient than the *host country principle*, it still produces an externality represented by a brain drain. A new case study was proposed with a detailed analysis of the Ecuadorian financing system of students' mobility that introduced an important incentive to return home once qualified. In theoretical terms, what follows has been shown, which constitutes a tentative lesson for public policy. The probability that a student who studied abroad returns home after graduating increases with the difference between the country of origin's wage and the host country's wage. Since this difference is likely to be negative (because we suppose that the student chose to study in a 'richer' country), the probability of returning home is higher in the presence of an Ecuadorian constraint. So it seems that the Ecuadorian device acts as a strong incentive that fosters the return rate and helps in combatting the brain drain phenomenon. It is necessary to remark that this paper did not intend to analyze the efficiency or the sustainability of the system. Additional research is required in order to answer these two questions.

Finally, an agenda was presented for research introducing the *push-pull model*, and a proposal for a new extension that includes the scholarship as a *push-factor*. More about this data needs to be said in order to test whether the presence of the scholarship constitutes a *push-factor* for Ecuadorian students. A database

with 500 observations is already available and will be used for this proposed further research.

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