Return migration of foreign students and the choice of non-resident tuition fees *

Thomas Lange†

University of Konstanz
ifo Institute for Economic Research Munich

Draft: April 30, 2009

Abstract

In a classical brain drain constellation, the paper presents a model of student migration (including return migration) from a less-developed to a developed country in order to determine the optimal choice of non-resident tuition fees in the host country of higher education. Even if initially intending to stay in the host country upon graduation in case they study abroad, students

*The main part of the paper was written while visiting the Economics Department at Queen's University in Kingston. I am very grateful especially to Robin Boadway for his hospitality and comments on an early version of the paper.

†Mailing address: University of Konstanz, Box D133, D-78457 Konstanz, Germany; E-Mail: thomas.lange@uni-konstanz.de; Phone: +49 7531 88 2305; Fax: +49 7531 88 4101.

with rational expectations consider that they either might have to return or rather want to return to their home country once they graduated from the foreign university. The potential causes and consequences of return migration then should affect the first-round decision whether to study abroad. From the host country perspective, this finally implies that the foreign demand for the higher education system also depends on the stay rates of graduates within the country. Together with the public costs of education and the benefit from retaining foreign-born graduates as high-skilled human capital, the stay rate should determine the non-resident tuition fee chosen by the host country. A decline in stay rates of foreign students is demonstrated to induce a *cutback* of tuition fees if the costs of education per student are not too high. The fact that students take into account the possibility of return migration after graduation in their first-stage location decision in combination with rational expectations finally drives this result. In a brief extension, the paper considers the effect of a declining stay rate caused by a shift in the composition of the group of potential international students from those who (ex ante) intend to stay in the host country of education upon graduation to those who intend to return immediately after having earned the foreign university degree.

Keywords: tuition fees, oversea students, return migration, rational expectations, brain drain, preference for foreign lifestyle

JEL classification: F22, I28

1 Introduction

1.1 Background

The economic globalization rooted in the late 19th, early 20th century, brought a considerable integration of the world economy, not only in the sense of international flows of traded goods, services and capital, but also international migration flows. Back in the mid 1960s and 70s, the first contributions analyzing the economic effects of (especially high-skilled) labor migration on the host and sending countries of human capital flows emerged (e.g. Grubel and Scott, 1966, 1968; Aitken, 1968; Raymond, 1973; Bhagwati and Dellalfar, 1973; Bhagwati and Hamada, 1974). These early papers constituted a strand of the literature often referred to as the 'brain drain literature', highlighting various issues related to the question which regions benefit and which regions loose from these human capital flows (often in asymmetric settings with a developing and a rich country, e.g. Stark et al., 1997, 1998; Beine et al., 2001; Stark, 2004; Docquier and Rapoport, 2007) and trying to measure the actual brain brain (e.g. Carrington and Detragiache, 1998, 1999; Straubhaar, 2000; EEAG, 2003; Becker et al., 2004).

Countries which gain from the immigration of highly-skilled workers, might apply various strategies to attract those, for example by means of fiscal incentives (see CESifo, 2005), active immigration policies (like special job fairs, multilingual employment offer portals and assistance in administrative procedures during and after entry; see Chaloff and Lemaitre, 2009) and 'liberal' immigration regulations.[1] A fur-

[1]Chaloff and Lemaitre (2009, p. 30) report from a review of immigration policies in ten OECD

ther way to recruit high-skilled human capital – an this is what the present paper focuses on – is to attract foreign students and try to retain them in the country after they have graduated from university. Leaving the domestic higher education system, they are not only highly skilled but at the same time they can be easily integrated as they are also provided with country-specific human capital, usually have some good language proficiency and are familiar with the culture of the host country etc.[2] The international mobility of students increased considerably over the last few decades (OECD, 2008a) and "[students], especially from developing countries, often stay on in OECD countries for further research or employment and contribute to innovation in these countries."[3] The host countries of foreign students (the U.S., the UK, Germany and France are the most important ones, together hosting about 50% of all international students worldwide) seem to be quite aware of this potential, given their efforts to promote access of foreign students to the labor market, once they

countries that "[...] most of these policies are not so much designed to attract workers as to reduce the obstacles to their immigration. [...] What is surprising [...] is that 'active' policy is generally defined as simply creating exemptions from the restrictions on labour migration applied across-the-board. As shortages increase, truly 'active' policies for the high skilled may start to be adopted, especially outside the benchmark high-wage and English-speaking countries."

[2]Many countries also allow foreign students to work during their studies. These employments can provide students with a first contact to the host country's labor market and students can gain certain country- and market-specific experiences which should help them to find a job in the host country upon graduation and thereby increase the probability to stay on (see Chaloff and Lemaitre, 2009, pp. 24-25).

[3]OECD (2008b, pp. 83-84). See for example Baruch et al. (2007), Hein and Plesch (2008), Dreher and Poutvaara (2005) and Finn (2003) for some empirical evidence.

are graduated (see e.g. Tremblay, 2005; OECD, 2008b, Ch. 4; Chaloff and Lemaitre, 2009).

Finally, not only the recruitment issue might play a role when evaluating the effect of educating foreign students on the host country, but also things like the compensation of potentially lacking demand for the higher education system from domestic students, economies of scale in the education system, a promotion of diversity and creativity on campus, increased R&D activities, cheap foreign labor for the institutions (in labs, as TA's or as support of research activities) and the reliance on tuition fee revenues from foreign students. Especially the latter aspect is quite interesting, because host countries probably face a trade-off here between raising revenues and offering reasonable fees in order to attract foreign students, or at least not to deter them from immigration. *The Economist*[4] recently stated that

> [students] from outside the EU are vital to British universities' finances. Neither their numbers nor their fees are capped by government (UEA's foreign-student fees, around £10,000 a year for most courses, are pretty standard; nationally, fees paid by overseas students in higher education total some £2.5 billion). They keep open departments in some subjects – science, engineering – that are shunned by locals. And the more of them a university attracts, the higher it rises in the ever-more-important international league tables.

The same article argues that Britain has to make sure to really offer value for money

[4]"International students - Build it, and they will come," *The Economist*, Jan 15th 2009.

(in terms of service and quality) in order to remain an attractive host country for oversea students while other countries like for example Germany and Japan now also offer programs taught in English.

The fact that especially Australia, the UK and the U.S., charging the highest tuition fees, are still among the largest host countries, to a large extent probably reflects a higher 'market power' on the higher education market due to language related issues and the outstanding quality of the top-institutions in these countries. However, in general, the demand of foreign students for a certain education program should – ceteris paribus – depend (negatively) on the level of tuition fees.[5]

1.2 Purpose of the paper

The present paper wants to analyze a very specific aspect against the background of the ongoing internationalization of higher education, namely how the optimal choice of non-resident tuition fees changes with declining stay rates of foreign students in the host country after graduation. The very first intuition that fees will have

[5]The absolute level of tuition fees charged from foreign students as well as the relative level compared to domestic students varies largely among host countries. While Denmark, Sweden and Norway for example neither raise tuition fees from domestic nor from international students, Australia, Canada and New Zealand charge considerably higher fees for international than for domestic students. In the U.S., oversea students are treated like out-of-state students and in the UK students from non-EU countries have to pay higher fees than domestic and EU students. France, Italy, Japan, Korea and Spain charge the same tuition fees for domestic and foreign students. See e.g. OECD (2008b, Ch. C3).

to rise is usually based on a fixed-budget argument: the lower the proportion of foreign students staying in the host country after graduation as high-skilled human capital, the lower the benefit for the host country from educating foreign students. As a consequence, in order to cover costs per student, tuition fees have to rise.[6] This view, however, appears by far too narrow: (i) a more appropriate way to describe the host country's behavior is to set tuition fees in order to maximize some net-benefit from educating foreign students, instead of balancing a fixed budget; (ii) the optimal tuition policy has to consider that the number of foreign students depends negatively on the level of fees; (iii) the demand of foreign students might depend on the expected probability of staying in the host country after graduation. Especially the third point takes center stage in the present paper, because it is both interesting from the point of view of migration theory and the application to the question with respect to the choice of non-resident tuition fees: depending on what exactly causes the return migration of foreign students upon graduation, a higher probability of return should have an impact on rational students' first-stage decision whether to study abroad or not. A change in demand for the education system in the host country, in turn, should also influence the optimal choice of tuition fees. The theoretical migration literature usually treats migration decisions at various stages separately and analyzes

[6]Suppose the host country wants to generate some net-revenue $R = (f - c + p\pi^g)S$ from educating foreign students. S is the number of foreign students, f is tuition fees, c the public education cost per student, p is the stay rate of foreign students and $\pi^g > 0$ is the net-benefit from those foreign students staying in the host country as graduates. The lower the stay rate p, the higher tuition fees in order to keep the net-revenue constant: $(df/dp)|_{dR=0} = -\pi^g$.

either determinants of (first-time) emigration or determinants of return migration, ignoring that the perception of chances/preferences to stay abroad might affect the first emigration decision.

The student migration model derived in the main part of the paper shows that an increased return probability of foreign students decreases the demand for education abroad and increases the sensitivity of demand to marginal changes in tuition fees. The higher return rates are either due to some exogenous event (either in the host country or the country of origin, forcing the student to return no matter whether he actually would like to stay or not) or by a higher probability that a student ex ante overstates the positive value of the lifestyle abroad, causing return migration due to unmet expectations. In both cases, an increase in the return probability implies a reduction in the expected benefit from staying in the host country upon graduation and therefore reduces the demand for education abroad. As a consequence, when adjusting non-resident tuition fees as a response to the declining stay rate of foreign students, the host country has to tradeoff a behavioral effect (i.e. the effect caused by the changing student migration behavior) which provides an incentive to decrease tuition fees against the incentive to increase them due to the reduced loss of a marginal increase in fees from deterring foreign students from immigration. When the cost of education per student in the host country is not too large, the behavioral effect dominates and the host country decreases non-resident tuition fees when students' stay rates decline. Extending the model presented in the main part of the paper, I argue that a decline in stay rates, which is caused by a change in the composition of the group of potential international students (I distinguish between students who

ex ante intend to stay in the host country after graduation and students who plan to return immediately after graduation from the foreign university system), a priori has an ambiguous effect on the optimal choice of tuition fees.

The migration model and the choice of non-resident tuition fees is analyzed in a two-country setting: a developed country ('DC', e.g. the UK) hosts foreign students from a less-developed country ('LDC', e.g. China, India). From a theoretical/technical point of view this has the advantage that I can focus on the migration flows of students/graduates who are born in the LDC, while there is no migration of individuals born in the DC to the LDC. This is the usual approach of the theoretical brain drain models. As already stated earlier, it is only a small number of large/rich OECD countries which host a majority of international students. While Asia is the leading region of origin of international students, France, Germany, Japan and Korea are the largest single sending-countries. Students from China and India represent by far the largest group of foreign students in OECD countries from non-OECD countries (OECD, 2008b, Ch. 3).

The structure of the paper is as follows: the following section 2 presents a first look on the problem of choosing optimal non-resident tuition fees and highlights in a very general setting the influence of foresighted student migration behavior. Section 3 then derives the student and return migration model (3.1) and analyzes the optimal adjustment of tuition fees when the stay rates of foreign students in the host country decline (3.2). A special case of 'irrational' students, who believe that they can stay in the host country for sure and that their positive expectations

about foreign lifestyle will certainly come true, is presented as a benchmark in 3.3, in order to highlight the relevance of the consideration of the behavioral effect in the student migration decision when return probabilities change. Section 4 presents the extension considering the composition of the pool of international students, before section 5 concludes.

2 Choice of non-resident tuition fees: a first look

Suppose the host country faces a demand (in terms of the number of foreign students) of $S = S(f, p)$, where f denotes tuition fees[7] and p the probability that a foreign student stays in the host country after graduating from university. I assume that foreigners can only work in the DC upon graduation with a domestic university degree, i.e. I ignore immigration of workers who earned a degree in their home country (LDC). The host country maximizes the net-benefit from educating foreign

[7]The term 'tuition fees' is used in a very general way in this paper and is not necessarily to be taken literally. While it appears justifiable to think of a country/region or rather the government setting tuition fees in public higher education systems (like in some European countries), a more differentiated view would be needed for countries where also private institutions play an important role in the higher education sector (like e.g. in the U.S.), which are free to set tuition fees. One might argue however, that the government (for example at the state/province level) could still influence the price to be payed by students for example by providing scholarships or certain subsidies in cash or kind. In the simplified setting of the model presented here, the host country simply determines kind of a net-price for education, meaning tuition fees net of various subsidies.

students over tuition fee policy:

$$\max_f \Pi = (\pi^c + f + \delta_G p \pi^g) S(f, p), \tag{1}$$

where π^c denotes a net measure of costs and benefits per student to the host country during the education period (π^c could generally be positive or negative; the cost side includes first and foremost resource costs, while the benefit side could include peer effects, cultural spillovers, economies of scale within institutions etc.) and $\pi^g > 0$ denotes the benefit from retaining foreign students as high-skilled human capital after graduation (this could again include some positive externalities, positive net-contributions to the host country's social security system or above-average tax payments when the graduates are high-income earners). The government discounts the expected future benefits by the factor $\delta_G < 1$.[8] The first order condition for the optimal tuition fee is

$$\frac{\partial \Pi}{\partial f} = S + (\pi^c + f + \delta_G p \pi^g) \frac{\partial S}{\partial f} = 0. \tag{2}$$

The effect of a marginal increase of tuition fees on the number of students is supposed to be negative ($\partial S / \partial f < 0$). The optimal fee can be expressed by using the price elasticity of the demand for the education system:

$$f = -\frac{(\pi^c + \delta_G p \pi^g)}{1 + 1/\epsilon}, \tag{3}$$

[8]If I did not take the openness of study programs to foreign students in the rich country as given, the discounting might play a more prominent role as it does in the simple model, especially when the expenditures on education compete for public funding with alternative investments. The fact that the returns to the (risky) public education investment span a relatively long period of time, could let the investment appear less favorable (Raymond, 1973).

where $\epsilon = \frac{\partial S}{\partial f}\frac{f}{S} < 0$. Ignoring the expected benefits accruing in the host country from retaining foreign students after graduation, the optimal tuition fee policy actually comes up to a standard monopoly price setting when $\pi^c < 0$: the host country charges a price in excess of the marginal cost of providing education and the higher the country's monopoly power (as represented by the absolute value of $1/\epsilon$, which at $f = \arg\max \Pi(f)$ equals the well-known 'Lerner index' of monopoly power or rather the price-cost margin), the higher tuition fees. Taking into account expected future benefits $p\pi^g$ per foreign student trained in the host country, a higher price elasticity of demand for the education system also provides an incentive to cut down tuition fees in order to attract foreign students and realize those benefits. The overall effect then depends on the relative size of the costs and discounted benefits per student:

$$\frac{\partial f}{\partial |\epsilon|} = \frac{\pi^c + \delta_G p \pi^g}{(1+\epsilon)^2}. \tag{4}$$

The main focus of the paper is however not so much on the optimal tuition fee per se, but rather the effect of a decline in the stay rate of foreign students in the host country after graduation on the non-resident fees. From the first order condition (2) one can derive the effect of the students' stay rate p on the optimal level of tuition fees:

$$\frac{df}{dp} = -\frac{1}{\Sigma}\left\{\left[\frac{\partial S}{\partial p} + (\pi^c + f + \delta_G p \pi^g)\frac{\partial^2 S}{\partial f \partial p}\right] + \delta_G \pi^g \frac{\partial S}{\partial f}\right\} \gtreqless 0, \tag{5}$$

where $\Sigma := 2(\partial S/\partial f) + (\pi^c + f + \delta_G p\pi^g)(\partial^2 S/\partial f^2)$ is negative from the second order condition. A priori, the sign of df/dp is ambiguous. The reason is that I assume the number of students to depend on the stay rate p. Suppose S would only depend on the level of tuition fees f, i.e. $S = S(f)$, then $df/dp = -[\delta_G \pi^g(\partial S/\partial f)]/\Sigma < 0$. The

lower the stay rate p, the lower the marginal loss from raising tuition fees due to the reduced number of students and therefore the higher optimal tuition fees. However, and this is my main point here, this view seems to be too narrow. Students who think of whether to study abroad or in their home country should (and probably do) consider the possibility of returning to their home country after having studied abroad.

3 A student migration model and the choice of non-resident tuition fees

A more thorough analysis of the question how the host country should adjust non-resident tuition fees when a higher proportion of foreign students tends to return to their home countries should consider (i) *why* students return and (ii) *how* this affects students' decision whether to study abroad. Furthermore, the *composition* of the group of students who potentially end up studying in the DC can play an important role, as I demonstrate in a last section of this chapter, after presenting a specific student migration and return migration model and analyzing the optimal tuition fee problem again.

3.1 Student immigration and return

The following section introduces a student migration model in order to be able to come up with a more precise prediction with respect to the sign of (5) from the very

general model above.

Various factors can influence an individual's decision in the LDC whether to study abroad. First of all, I assume that the return to education as realized after graduation is higher when the student studied abroad: while a student gets a return to education $\underline{v}$ when he studies in his home country and works there afterwards, he gets $v^H > \underline{v}$ when working in his home country after having graduated from the foreign university. This implies that in general, all the students potentially want to study abroad. However, while the education is assumed to be for free in the home country, students have to pay fees f abroad. Finally, I consider some country-specific preference for the DC: suppose first of all that the 'pure' return to being educated in the DC is the same both in the host and the home country of students.[9] Beside the pure living standard in terms of earnings and career chances etc., there is probably another motive for emigration, namely a preference for the (western) *lifestyle* in the DC.[10] Therefore, I assume some difference of quality of life between the host and

[9]The more classical *brain drain* literature usually simply assumes that there is a wage differential between the DC and the LDC. However, it is not only wage rates that matter, but of course also the general price level. Furthermore, given that Chinese and Indian students for example have excellent career chances within their home countries with a foreign university degree and some international experience (Baruch et al., 2007) which should allow them a good standard of living, this assumption appears reasonable.

[10]While the lifestyle in the DC is a 'pull-factor' of migration, some characteristics of the LDC can be thought of as 'push-factors': "[...] migration is not necessarily induced by economic reasons of self-advancement to which one may attach low weight; [...] in fact, a substantial part of migration may be induced by 'non-economic' reasons, including political difficulties and personal problems arising from the inevitable tension between traditional societal laws and institutions in LDC's and

the home country, denoted by $\Delta v = v^F - v^H > 0$, which is subjectively valued by individuals who are heterogenous with respect to the weight $\theta \in [0, \overline{\theta}]$ which they attach to this quality-of-life difference.

The country-specific preference which is represented by $\theta \Delta v$ plays an important role in the student migration decision, especially with regard to individuals' evaluation of the cost/benefit of returning to the home country after graduation. I consider two reasons why a foreign student returns: (i) he *has* to return for some exogenous reason[11]; (ii) he *wants* to return because he realizes a mistake with respect to expectations about the foreign lifestyle advantage Δv. Figure 1 helps to illustrate the return migration pattern in the model.

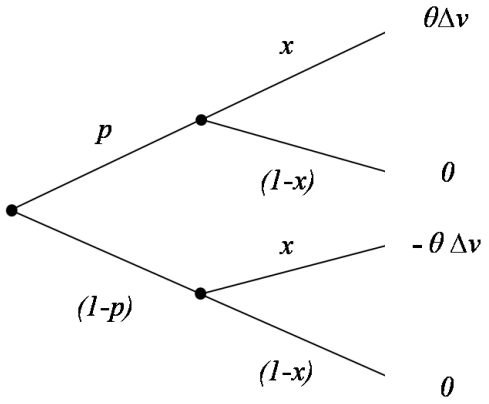

Figure 1: Preference for western lifestyle: stay vs. return

Only after having finished their studies, foreign students learn whether they are

the aspirations and needs of the 'modernized' professional classes" (Bhagwati and Dellalfar, 1973, p. 95). To some extent push- and pull-factors are two sides to a coin here.

[11]For example because he does not get a work permit, he fails to find a job at the foreign labor market, or for some reasons within the country of origin (has to take care for sick relatives etc.).

allowed/able to stay in the host country; the corresponding probability is denoted by p. With probability x the students' ex ante valuation of the quality-of-life-difference $\theta\Delta v$ turns out to be correct. Therefore, they stay in the host country and 'consume' the extra utility $\theta\Delta v$. With probability $(1-x)$ they realize that their expectations do not come true (I assume the country-specific preference for the host country to vanish in that case), so that they return to their home country and earn v^H there.[12] With probability $(1-p)$ the individual has to return to his home country for some exogenous reason. If he belongs to the group of graduates who changed their mind about the foreign lifestyle anyway (the probability of belonging to this group is $(1-x)$) and therefore want to return, he does not incur any utility loss but simply gets v^H in the home country. Things are different, however, for individuals who still have a preference for the foreign lifestyle (with probability x their expectations come true) and are forced to return to the poor region. I assume those individuals to incur a utility loss $\theta\Delta v$ which reflects mainly the psychic cost related to the involuntary migration (e.g. reverse culture-shock etc.).

[12]Given that expenses for tuition fees are sunk costs from the perspective of the graduate deciding whether to return and given the assumption that the pure return to education abroad is the same in the DC and the LDC, the vanished preference for the DC technically implies indifference of the graduate between staying and returning. I assume that graduates return in that case in order to capture the phenomenon of return due to unrealized positive expectations. An alternative would be to explicitly consider some small ε-benefit of returning in that case (or an ε-loss of staying), so that individuals have a strict preference for returning. This, however, introduces at least one further parameter without crucially influencing the main idea behind the migration model, so that I will stick to the simpler version.

When deciding whether to study abroad, students cannot be sure to which of the groups (i.e. those who are allowed to stay vs. those who have to return for some exogenous reason and those who find their positive expectations about the foreign lifestyle coming true vs. those who realize that they overstated the lifestyle abroad ex ante), so that they have to build expectations based on probabilities p and x. Their expected (extra) benefit from having the option to stay in the DC after studying abroad is $[p(x\theta\Delta v + 0) + (1-p)(-x\theta\Delta v + 0)] = \theta x(2p-1)\Delta v$. In what follows, I assume $p \in (1/2, 1]$ and $x \in (0, 1]$ so that the expected benefit is strictly positive.

The student migration behavior then can be depicted by the following indifference condition:

$$\delta_I[v^H + \hat{\theta}x(2p-1)\Delta v] - f = \delta_I \underline{v}. \tag{6}$$

A student is exactly indifferent between studying at home and studying abroad when the discounted net-benefit from studying abroad (i.e. the return to foreign studies plus the expected extra benefit from consumption of the foreign lifestyle net of tuition fees) equals the discounted reservation utility $\delta_I \underline{v}$ which he can get from studying and working in his home country.[13] The individual discount factor which is assumed to be identical for all students is $\delta_I < 1$. All students with a valuation of

[13] An implicit assumption with respect to the migration model as presented by indifference condition (6) is that foreign students always can afford the non-resident tuition fees in the DC. This means that either their initial endowment is already sufficiently high or that there are no credit constraints and the direct return to education (i.e. $v^H - \underline{v}$) always exceeds the individual expenses for the tuition fee. Furthermore I ignore differences in the consumption value of education or rather the value of 'college life' between the two regions.

the foreign lifestyle $\theta \geq \hat{\theta}$ will study abroad, while those with a lower valuation stay in their home country. With the overall size of the student body which is eligible for education in the DC normalized to one, the number of students actually going for education abroad then is:

$$S = \int_{\hat{\theta}}^{\overline{\theta}} dF(\theta) = 1 - F(\hat{\theta}),$$

where $F(\theta)$ is the cumulative distribution function of θ and the cut-off valuation of western lifestyle is

$$\hat{\theta} = \frac{\underline{v} - v^H + f/\delta_I}{x(2p-1)\Delta v} \tag{7}$$

by indifference condition (6). In order to be able to derive the optimal tuition fee in the next step explicitly, I assume that θ is uniformly distributed among the foreign student body over the interval $[0, \overline{\theta}]$, so that

$$S = 1 - \frac{[\underline{v} - v^H + f/\delta_I]}{\overline{\theta}x(2p-1)\Delta v}. \tag{8}$$

The demand of students for the education system in the DC depends negatively on tuition fees, positively on the probability of being allowed to stay in the host country after graduation and positively on the probability of finding one's positive expectations about foreign lifestyle fulfilled:

$$\begin{aligned}
\frac{\partial S}{\partial f} &= \frac{-1}{\delta_I \overline{\theta} x(2p-1)\Delta v} < 0, \\
\frac{\partial S}{\partial p} &= \frac{2(\underline{v} - v^H + f/\delta_I)}{\overline{\theta}x(2p-1)^2\Delta v} > 0, \\
\frac{\partial S}{\partial x} &= \frac{\underline{v} - v^H + f/\delta_I}{\overline{\theta}x^2(2p-1)\Delta v} > 0.
\end{aligned}$$

Technically, the positive signs for $\partial S/\partial p$ and $\partial S/\partial x$ follow from the constraint $S < 1$, which requires $[\underline{v} - v^H + f/\delta_I] > 0$. The intuition is moreover straightforward:

since the expected consumption value of the western lifestyle increases both in a student's possibility to stay in the host country and the probability that the positive expectations about the foreign lifestyle come true, the demand for education in the rich country increases in p and x.

3.2 Choice of tuition fees

The government of the host country again maximizes the net-benefit from educating foreign students:

$$\max_f \Pi = (\pi^c + f + \delta_G p x \pi^g) S(f, p, x) \quad \text{s.t.} \quad S(f, p, x) \in (0, 1). \tag{9}$$

The first order condition for the optimal non-resident tuition fee, using the education demand function as represented by (8), which was derived from the migration model above, reads:

$$\frac{\partial \Pi}{\partial f} = 1 - \frac{[\underline{v} - v^H + f/\delta_I]}{\overline{\theta} x (2p-1)\Delta v} - \frac{(\pi^c + f + \delta_G p x \pi^g)}{\delta_I \overline{\theta} x (2p-1)\Delta v} = 0, \tag{10}$$

from which the optimal fee can be determined as

$$f = \frac{1}{2}\left[\delta_I \overline{\theta} x (2p-1)\Delta v + \delta_I (v^H - \underline{v}) - (\pi^c + \delta_G p x \pi^g)\right]. \tag{11}$$

The restriction on the parameter range for the stay rate, $p \in (1/2, 1]$, ensures the second order condition for a maximum to hold. A decline in the percentage of foreign students staying in the host country can be due to a decline in p or in x. Tuition fees are adjusted accordingly:

$$\frac{df}{dp} = x\left(\delta_I \overline{\theta} \Delta v - \delta_G \frac{\pi^g}{2}\right), \tag{12}$$

$$\frac{df}{dx} = \frac{1}{2}\left[\delta_I \overline{\theta} (2p-1)\Delta v - \delta_G p \pi^g\right]. \tag{13}$$

The direction of both adjustments is a priori ambiguous. As already argued on the basis of the more general version of the model in section 2, different return migration patterns of graduates not only affect the benefits of the host country from educating foreign students, but also the students' migration behavior. Both aspects have to be considered in the decision on the optimal tuition fee policy. First of all, the lower the stay rate of graduates (i.e. the lower px), ceteris paribus, the lower the marginal cost of raising tuition fees due to the fee's deterrent effect on the number of foreign students and therefore the higher the non-resident fee. This effect is in each case represented by the second term in brackets in equations (12) and (13). Second, the expected stay rate affects the student migration pattern: the lower the expected stay rate, the lower total demand S and the lower the absolute value of the sensitivity of demand to tuition fees, i.e. $|\partial S/\partial f|$. The corresponding (combined) effect on the optimal tuition fee is represented in both cases by the first term in brackets in (12) and (13). I might refer to the latter effects as the 'behavioral effects', which are directly opposed to the more direct 'revenue effects'. The behavioral effects become more relevant the larger the difference in the quality of life for high-skilled individuals between the host and the sending country (as represented by Δv) and the larger the heterogeneity of students with respect to the ex ante valuation of the western lifestyle (as represented by $\overline{\theta}$).[14] The difference in the validation of expected benefits

[14]The degree of heterogeneity between agents is reflected by the difference between the highest and the lowest valuation for western lifestyle, i.e. $(\overline{\theta} - 0)$. See that the density of the cumulative distribution function $F(\theta)$ for a uniform distribution is equal to $1/\overline{\theta}$. The lower the density, the lower the sensitivity of the demand for education to a marginal increase in tuition fees.

in the future between the individual and the host country perspective also plays a role: the higher the importance of future payoffs for individuals' utility relative to the importance to governments' objectives (i.e. the larger δ_I relative to δ_G), the larger the behavioral effects relative to the revenue effects in both (12) and (13) and therefore the more likely a decline in tuition fees when stay rates of foreign students decrease.

The overall signs of df/dp and df/dx finally depend on the relative size of the parameter values in the model. Taking into account that the set of parameters has to ensure that the constraint $S(f, p, x) \in (0, 1)$ is met given the optimal choice of tuition fees, however, I can at least come up with the following insight: if the cost of education per student in the host country is not too large or if the host country's education system even observes a net-benefit ($\pi^c > 0$) from educating foreign students, the effect of a declining stay rate of students in the host country on non-resident tuition fees can be unambiguously signed. The following proposition states that more precisely:

Proposition 1 *$\delta_I(v^H - \underline{v}) > -\pi^c$ is a sufficient condition for the non-resident tuition fees to decrease if the stay rate of foreign students (from an LDC) in the host country (DC) upon graduation declines, i.e. $df/dp > 0$ and $df/dx > 0$.*

Proof Please refer to the Appendix.

Verbally, $\delta_I(v^H - \underline{v}) > -\pi^c$ means that the individual (discounted) direct return to education in the foreign country has to exceed the cost of education per student. This of course also includes cases where $\pi^c \geq 0$, saying that the host country actually

already benefits from the education of foreign students during the education period and not only when they stay within the country as high-skilled workers.

The analysis in this section makes clear that the consideration of the adjustment of students' migration behavior when the return migration pattern upon graduation changes is crucial for the optimal adjustment of non-resident tuition fees. Given that the condition in Proposition 1 holds, the behavioral effects will dominate the revenue effects, and therefore a decline in the stay rate of foreign students induces a decline in tuition fees. For all other cases, the overall signs of df/dp and df/dx depend on the relative size of the other parameters in the model, as explained above. The condition $\delta_I(v^H - \underline{v}) > -\pi^c$ is a sufficient but not a necessary condition for $df/dp > 0$ and $df/dx > 0$.

3.3 Special case: irrational expectations

A special case of the analysis presented above arises if students have irrational expectations in the sense that they believe that (i) they are allowed to stay in the host country for sure and (ii) they will in no case change their mind with respect to the valuation of the foreign lifestyle to be enjoyed when staying in the host country. In other words, in their first (student) migration decision, they err by taking $p = x = 1$ for granted. In that case, the demand for education in the rich country is

$$S^{IR} = 1 - \frac{[\underline{v} - v^H + f/\delta_I]}{\overline{\theta}\Delta v} > S \tag{14}$$

and the optimal tuition fee can be calculated as

$$f^{IR} = \frac{1}{2}\left[\delta_I \overline{\theta} \Delta v + \delta_I (v^H - \underline{v}) - (\pi^c + \delta_G p x \pi^g)\right] > f. \tag{15}$$

Since the irrationality of students effectively implies higher country-specific preferences for the DC (from an ex ante perspective) and therefore also a lower sensitivity of the number of foreign students to a marginal increase in tuition fees, unsurprisingly f^{IR} exceeds the tuition fee f from the main section above. The comparative statics effects with respect to the stay rate of foreign students are unambiguous:

Proposition 2 *With students having irrational expectations in the sense that they wrongly believe that they can stay in the foreign host country of education (DC) for sure and that their positive perception of the western lifestyle will not change once they really became acquainted with the life abroad, non-resident tuition fees in the DC will unambiguously increase with a declining stay rate of foreign students.*

This can be directly seen from

$$\frac{df^{IR}}{dp} = -\delta_G \frac{x\pi^g}{2} < 0, \tag{16}$$

$$\frac{df^{IR}}{dx} = -\delta_G \frac{p\pi^g}{2} < 0. \tag{17}$$

Non-resident tuition fees increase with a declining stay rate of foreign students. The reason is of course that a behavioral effect as presented in section 3.2 does not exist due to the irrationality of students. The remaining revenue effect then explains the increase in tuition fees.

This special case of irrational students serves as an important benchmark to the model with students who have realistic expectations about the chances and the

preferences for a life spent in the DC after being educated there. Depending on the perception of students' decision making against the background of these two (polar) cases, a change in student return migration might affect non-resident tuition fees raised in the host country in a directly opposed way.

Given the benchmark case of students having irrational expectations, the comparative statics in the rational-expectations setting in section 3.2 can actually be written as

$$\frac{df}{dp} = \underbrace{\frac{df^{IR}}{dp}}_{(<0)} + \underbrace{x\delta_I\overline{\theta}\Delta v}_{(>0)}, \tag{18}$$

$$\frac{df}{dx} = \underbrace{\frac{df^{IR}}{dx}}_{(<0)} + \underbrace{\frac{1}{2}\delta_I\overline{\theta}(2p-1)\Delta v}_{(>0)}. \tag{19}$$

4 Extension and scope for further research: the composition of the foreign student body

The analysis so far actually focused on a special sub-group of real-life foreign students, namely those who *intend to stay* in the host country (given that their expectations about the foreign lifestyle are fulfilled). I might call this group IS-students (for 'intend to stay'). Another group that can be of interest is those students who want to study abroad in order to increase career chances and the individual living standard within their home country after return and actually never intended to stay in the host country (I might call them MA-students for 'mission-accomplished' because they intend to return immediately after graduation).

Taking this group into account, a decline in the stay rates of foreign students could also be caused by a shift in the composition of foreign students from less IS- to more MA-students. The MA-students are assumed to return for sure in case they decide to study abroad. The number of MA-students actually going for education in the DC depends negatively on tuition fees. In order to study the composition effect, I assume that a fraction $n \in (0,1)$ of the whole foreign student body who potentially studies in the DC is of the MA-type and the fraction $(1-n)$ of the IS-type. The DC has no information on the individual types, but only knows the composition of the student body, i.e. n. The total demand for the foreign education system then is

$$S(f) = nS^{MA}(f) + (1-n)S^{IS}(f), \tag{20}$$

where S^{MA} and S^{IS} are the numbers of students from each group actually studying abroad.

I will not present a specific migration model here, but derive an implicit solution for f and df/dn. The rich country's optimization problem reads

$$\begin{aligned} \max_f \Pi \quad &= \quad (\pi^c + f)S(f) + \delta_G p x \pi^g (1-n) S^{IS}(f) \\ &\text{s.t.} \quad S(f) = nS^{MA}(f) + (1-n)S^{IS}(f). \end{aligned} \tag{21}$$

The first order condition for the optimal tuition fee f is

$$\frac{\partial \Pi}{\partial f} = (\pi^c + f)\frac{\partial S}{\partial f} + S + \delta_G p x \pi^g (1-n)\frac{\partial S^{IS}}{\partial f} = 0. \tag{22}$$

See that an increase in n implies a decline in the stay rate of foreign students due

to the shift towards MA-students.[15] The effect on the optimal tuition fee can be calculated as

$$\frac{df}{dn} = -\frac{1}{\Omega}\left[(\pi^c + f)\left(\frac{\partial S^{MA}}{\partial f} - \frac{\partial S^{IS}}{\partial f}\right) + (S^{MA} - S^{IS}) - \delta_G px\pi^g \frac{\partial S^{IS}}{\partial f}\right], \quad (23)$$

where $\Omega < 0$ from the second order condition.

According to (23), the overall effect can be decomposed in three components. First of all, the differences in sensitivities of demand for education abroad to a marginal increase in tuition fees between the two subgroups matters. If the demand from the MA-group for example reacts less strongly on a change in tuition fee policy than the demand from the IS-group (i.e. $|\partial S^{MA}/\partial f| < |\partial S^{IS}/\partial f|$) and if tuition fees fall short of education costs per students (i.e. $\pi^c + f < 0$ so that during the education period the host country incurs a loss per student from training them), a shift in the overall demand from IS- to MA-students – ceteris paribus – represents an incentive to cutback tuition fees. If the demand from the IS-group however is less sensitive, or tuition fees per student exceed costs per student, there is an incentive to increase tuition fees. This effect is represent by the first term in squared brackets.

Second, the demand for education abroad within the two subgroups plays a role. If for example always more individuals from within the IS-group go for education in the DC than individuals from within the MA-group, a shift towards a larger MA-group and therefore a smaller IS-group (i.e. a higher n, implying a higher overall

[15]The percentage of students who stay in the host country is

$$r = \frac{px(1-n)S^{IS}}{nS^{MA} + (1-n)S^{IS}}.$$

Then $\partial r/\partial n = -(pxS^{MA}S^{IS})/[nS^{MA} + (1-n)S^{IS}]^2 < 0$.

return rate of foreign students) – ceteris paribus – means a reduced marginal revenue from raising tuition fees, so that there is an incentive to cutback fees. This effect is represented by the second term in squared brackets.

Finally, the third term in squared brackets represents – ceteris paribus – an incentive to increase tuition fees if the stay rate of graduates (caused by an increase in n) declines. The reason is that a shift in the composition of foreign students towards MA-types effectively reduces the marginal cost of raising fees caused by the fees' negative effect on the demand from the IS-group and the related loss of post-education benefits to the host country.

Overall, without any further specifications of the migration behavior of students, the sign of df/dn is ambiguous. The development of a model which explicitly derives the migration decision of MA-students and relates that to the migration behavior of IS-students is left for further research.

5 Conclusion

The present paper started from the observed increasing relevance of international student mobility and the very fact that part of the international students intend to stay in the host country of education after graduation, which is probably especially true for students from LDC's who go for higher education in an OECD country (DC). Host countries therefore can generally benefit from educating foreign students beyond the pure period of education. When the choice of tuition fees for international students in the host country considers these benefits, they will also depend on the

stay rate of students upon graduation. The paper argues that for changing stay rates not only the direct effect on the expected benefits from retaining foreign students as high-skilled human capital is to be considered, but also a behavioral effect which reflects the adjustment of student migration behavior. Rational students are aware of the fact that they might return to their home countries after being educated abroad even if they initially intended to stay in the host country in order to be employed there, for further research or for launching a business. While the reasons for return can be manifold, in the main part of the paper I focussed on scenarios where (i) students return as graduates because they are 'forced' to do so (no matter what their actual preferences are) or (ii) because once staying abroad they realize that their positive expectations about the lifestyle abroad did not come true. At the time when deciding whether to study abroad, students can only build expectations about whether they might return for one of these reasons although they ex ante intend to stay in the host country. If students' perception of these events to occur in the future changes, this alters their expected benefits from studying abroad and therefore their first-round location decision. The optimal adjustment of tuition fees in the host country, finally, has to consider both the direct effect of a change in the stay rate of foreign students and the behavioral effect which alters the demand for its education system and which is directly opposed to the direct effect. If the cost of education per student is not too high, the behavioral effect dominates, so that a decline in stay rates of students in the host country induces a cutback in non-resident tuition fees.

According to Gmelch (1980), return migrants can be assigned to one of three

broader categories: (i) those who intended to stay but are *forced* to return, (ii) those who intended to stay but *choose* to return and (iii) those who only intended temporary migration and return once they have achieved their objectives abroad. The migration model in the main part of the paper tried to capture the first two categories. The extension in section 4 also considers returning graduates from the third category. Therein I analyzed a scenario where a decline in stay rates is caused by a shift in the composition of the group of potential foreign students from those who intend to stay abroad after graduation to those who intend to return promptly after 'accomplishing their mission'.

There are several aspects which are closely related to the issues analyzed in this paper and which deserve more attention in further research. While I treated the cause of return migration as exogenous in my model, the host country could generally also try to actively influence the stay rates of foreign students upon graduation. This can include immigration legislation, efforts to integrate foreign students into the domestic society and to reduce their risk failure to adapt, the provision of country-specific human capital and measures to facilitate national labor market access, just to name a few examples. The supposed positive impact on stay rates from which the host country could benefit, then has to be contrasted with the cost of introducing/extending these policies, which probably not only means resource costs but also political costs. Further interesting issues for example arise once also taking the source countries' perspective into account and recognizing that DC's might not only maximize 'profits' from educating foreign students, but could also be committed to foreign aid aspects of training international students, thereby considering explicitly

the utility of students as well as the source countries' welfare. Furthermore, the present analysis also ignores the source country as an active 'player' in the competition for high-skilled human capital: LDC's can in fact apply various policies to retain students or rather to promote their repatriation as graduates in case they went for education abroad,[16] so that DC's and LDC's actually could interact strategically, both possibly using quite different policies.

Appendix

The proof of Proposition 1 uses the constraint that the optimal tuition fee f is supposed to imply an interior solution with respect to the foreign demand for the education system in the DC. The constraint that the exogenous parameters in the model have to ensure that $S(f = \arg\max \Pi(f))$ is strictly smaller than one (i.e. not the entire pool of potential international students ends up in the DC) can be written as

$$\delta_I \overline{\theta} x(2p-1)\Delta v - \delta_G p x \pi^g > \delta_I(v^H - \underline{v}) + \pi^c, \tag{24}$$

where I used the optimal tuition fee as of (11) in the demand function $S(f, \cdot)$ as given by (8). This constraint directly shows that if the right hand sight of the inequality is positive, the left hand sight has to be positive as well, i.e. $\delta_I(v^H - \underline{v}) + \pi^c > 0$ implies $\delta_I \overline{\theta} x(2p-1)\Delta v - \delta_G p x \pi^g > 0$, the latter finally implying $df/dx > 0$ as can be seen from (13). This proves the first part of the proposition. The second part,

[16] See for example Gribble (2008) for an overview of policy options employed by sending countries experiencing some significant student outflow.

namely $df/dp > 0$, can be proved as follows: see that $\delta_I \overline{\theta} x(2p-1)\Delta v - \delta_G p x \pi^g > 0$ can be written as

$$\frac{\delta_I}{\delta_G} > \frac{p\pi^G}{\overline{\theta}(2p-1)\Delta v}. \tag{25}$$

See that from (12), df/dp is positive if

$$\frac{\delta_I}{\delta_G} > \frac{\pi^G}{2\overline{\theta}\Delta v}. \tag{26}$$

The fact that $\frac{p\pi^G}{\overline{\theta}(2p-1)\Delta v} > \frac{\pi^G}{2\overline{\theta}\Delta v}$ from our assumption on the range of p (namely $p > 1/2$), ensures that (26) also automatically holds when (25) is fulfilled, thereby proving that $df/dp > 0$.

References

Aitken, N. (1966). "The International Flow of Human Capital: Comment," *American Economic Review* 58, 539-545.

Baruch, Y., Budhwar P. and N. Khatri (2007). "Brain drain: Inclination to stay abroad after studies," *Journal of World Business* 42, 99-112.

Becker, S., Ichino, S. and G. Peri (2004). "How large is the 'brain drain' from Italy?," *Giornale Degli Economisti e Annali di Economia* 63, 1-32.

Beine, M., Docquier, F. and H. Rapoport (2001). "Brain drain and economic growth: Theory and Evidence," *Journal of Development Economics* 64, 275-289.

Bhagwati, J. and W. Dellalfar (1973). "The Brain Drain and Income Taxation," *World Development* 1, 94-101.

Bhagwati, J. and K. Hamada (1974). "The Brain Drain, International Integration of Markets for Professionals and Unemployment - A theoretical analysis," *Journal of Development Economics* 1, 19-42.

Carrington, W. and E. Detragiache (1998). "How big is the brain drain?," IMF Working Paper 98/102.

Carrington, W. and E. Detragiache (1999). "How extensive is the brain drain?," *Finance and Development* 36, 46-49.

CESifo (2005). "International Recruitment of the Highly Skilled," *DICE Report – Journal for Institutional Comparisons* 2/2005, 51-52.

Chaloff, J. and G. Lemaitre (2009). "Managing Highly-skilled Labour Migration: A Comparative Analysis of Migration Policies and Challenges in OECD Countries," OECD Social, Employment and Migration Working Paper Nr. 79.

Docquier, F. and H. Rapoport (2007). "Skilled Migration: The Perspective of Developing Countries," World Bank Policy Research Paper No. 3382.

Dreher, A. and P. Poutvaara (2005). "Student Flows and Migration: An empirical Analysis," IZA Discussion Paper 1612.

EEAG (2003). "Schould we worry about the brain drain?," in *Report on the European Economy*. EEAG European Economic Advisory Group at CESifo, Ch. 5.

Finn, M. (2003). *Stay rates of foreign doctorate recipients from U.S. universities*, Oak Ridge Institute for Science and Education, Oak Ridge.

Gmelch, G. (1980). "Return Migration," *Annual Review of Anthropology* 9, 135-159.

Gribble, C. (2008). "Policy options for managing international student migration: the sending country's perspective," *Journal of Higher Education Policy and Management* 30, 25-39.

Grubel, H. and A. Scott (1966). "The International Flow of Human Capital," *American Economic Review* 66, 268-274.

Grubel, H. and A. Scott (1968). "The International Flow of Human Capital: Reply," *American Economic Review* 58, 545-548 .

Hein, M. and J. Plesch (2008), "How can scholarship institutions foster the return of foreign studens?", DFG Research Group 'Heterogenous Labor' Discussion Paper 08/02.

OECD (2008a). *Education at a Glance 2008*, OECD, Paris.

OECD (2008b). *The Global Competition for Talent - Mobility of the Highly Skilled*, OECD, Paris.

Raymond, R. (1973). "The Interregional Brain Drain and Public Education," *Growth and Change* 4, 28-34.

Stark, O., Helmenstein, C. and A. Prskawetz (1997). "A brain gain with a brain drain," *Economics Letters* 55, 227-234.

Stark, O., Helmenstein, C. and A. Prskawetz (1998). "Human capital depletion, human capital formation, and migration: a blessing or a 'curse'?," *Economics Letters* 60, 363-367.

Stark, O. (2004). "Rethinking the Brain Drain," *World Development* 32, 15-22.

Straubhaar, T. (2000). "International Mobility of the Highly Skilled: Brain Gain, Brain Drain or Brain Exchange," HWWA Discussion Paper 88.