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

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Ifo Working Paper No. 74

July 2009

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This Version: July 6, 2009

Abstract

The paper presents a model of student migration in order to determine the optimal choice of non-resident tuition fees in a host country of higher education. Students with rational expectations consider a potential return migration in their first-round decision whether to study abroad, so that demand for the higher-education system in the host country and optimal non-resident tuition fees depend on the stay rates of foreign-born graduates. 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

*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. Furthermore, I appreciate comments by Zahra Siddique, Wolfram Richter, Lindsay Lowell, and participants at the IZA AM^2 Meeting in Bonn, the Journées LAGV#8 in Marseille, the PET09 in Galway and a faculty seminar at the University of Konstanz. I gratefully acknowledge financial support by the DFG Research Group "Heterogenous Labor", Fritz Thyssen Stiftung and the German Academic Exchange Service DAAD.

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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.

Keywords: tuition fees, oversea students, return migration, rational expectations, brain drain, preference for foreign lifestyle
JEL classification: F22, I29, D84

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, Bhagwati, 1976). 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 are supposed to gain from the immigration of highly-skilled workers, so that they apply various strategies to attract those workers, 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. A further 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. 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" (OECD, 2008b, pp. 83-84). Estimates for stay rates of foreign students within the U.S. are between one fifth (Rosenzweig, 2006, p. 24) and one third (Lowell et al., 2007, p. 45) or rather even about two thirds of foreign citizens who received a science or engineering doctorate in the U.S. (Finn, 2003, p. 5). For Germany, Hein and Plesch (2008, p. 11) report a stay rate of 35 percent of foreign students who participated in a special scholarship program. The host countries of foreign students (the U.S., the UK, Germany and France are the most important ones, together hosting about 50 percent of all international students worldwide) seem to be quite aware of the education of foreign students being a channel of recruiting high-skilled human capital, given their efforts to promote access of foreign students to the labor market, once they are graduated (see e.g. Tremblay, 2005; OECD, 2008b, Ch. 4; Chaloff and Lemaitre, 2009).

Finally, not only the recruitment issue plays 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 face a trade-off here between raising revenues and

charging reasonable fees in order to attract foreign students, or at least not to deter them from immigration.

1.2 Purpose of the paper

The present paper analyzes 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 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. This view, however, appears by far too narrow: (i) a more appropriate way to describe the host country's behavior is to think of tuition fees which are set 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 usually ignored in migration theory and because it plays an important role for 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 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-round 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 can be 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 individual 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 becomes particularly important and the host country *cuts down* on non-resident tuition fees when students' stay rates decline.

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). 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: section 2 presents a first look on the problem of choosing optimal non-resident tuition fees and highlights the influence of foresighted student-migration behavior. Section 3 derives the student-migration 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 briefly discusses the monopoly assumption with respect to the supply of higher education (4.1) and presents an extension considering the composition of the pool of international students (4.2), 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 and p the probability that a foreign student stays in the host country after graduating from university. The term 'tuition fees' is used in a very conceptional 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. where tuition fees are set in a highly decentralized way in a mixed public/private setting). 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 and grants. Furthermore, I assume that foreigners can only work in the DC upon graduation with a domestic university degree, i.e. immigration of workers who earned a degree in their home country (LDC) is ignored. The host country

maximizes the net-benefit from educating foreign 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 in principle be positive or negative; the cost side first and foremost includes resource costs, while the benefit side could include peer effects, cultural spillovers or economies of scale within institutions) 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 $\delta_G < 1$. 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 ($\partial S/\partial f < 0$). Survey data suggests for example that the (high) cost of U.S. tuition is the main reason why international students abstain from studying in the U.S. (Lowell et al., 2007, pp. 37-38). The optimal fee can be expressed by using the price elasticity of the demand for the education system:

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

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 cutback 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 optimal 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 $\Sigma := 2(\partial S/\partial f) + (\pi^c + f + \delta_G p \pi^g)(\partial^2 S/\partial f^2)$ has to be negative from the second order condition. A priori, the sign of df/dp is ambiguous. The reason is that the number of students is assumed 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 section 4.2) 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 come up with a more precise prediction with respect to the sign of (5) from the very conceptional model above.

Various factors can influence an individual's decision in the LDC whether to study abroad. First of all, 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. The 'pure' return to being educated in the DC is assumed to be the same both in the host country and the home country of students. This assumption is mainly made for convenience and is not crucial for the main results. 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 also appears reasonable. Beside the pure living standard in terms of earnings and career chances, there is usually a further motive for emigration, namely a preference for the (western) *lifestyle* in the DC. 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 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. Therefore, I assume some difference of quality-of-life between the host 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. The present section considers two reasons why a foreign student returns: (i) he *has* to return for some exogenous reason, 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.); (ii) he *wants* to return because he realizes a mistake with respect to expectations about the foreign lifestyle advantage Δv. Figure 2 helps to illustrate the return-migration pattern in the model.

Only after having finished their studies, foreign students learn whether they are 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 (the country-specific preference for the host country vanishes in that case), and they return to their home country and earn v^H there. 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

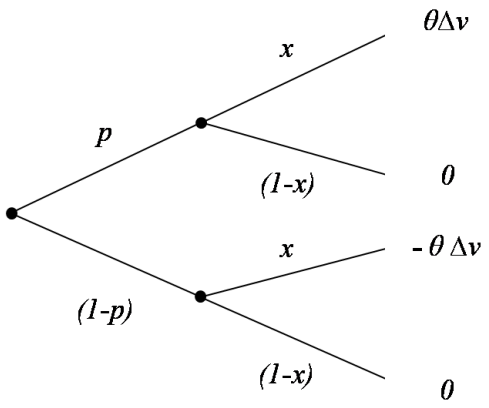

Figure 1: Preference for western lifestyle: stay versus return

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., in form of a reverse culture-shock).

When deciding whether to study abroad, students cannot be sure to which of the groups (i.e. those who are allowed to stay versus those who have to return for some exogenous reason and those who find their positive expectations about the foreign lifestyle coming true versus 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. Please note that the stay rate of students finally is $p \times x$. The assumption that $p \geq 1/2$ is therefore not too restrictive, as *overall* stay rates could still fall short of 50 percent. Therefore the migration model is very well consistent with stay rates smaller than 1/2 as for example reported by Rosenzweig (2006) and

Lowell et al. (2007) for the U.S. or Hein and Plesch (2008) for Germany. In order to keep things simple in this analysis, graduates who stay on in the host country upon graduation are assumed to do so for the rest of their life. While this assumption is not fully realistic because some people may want to return to their home countries once they have accumulated a certain amount of wealth, the model abstains from introducing an endogenous timing of return migration at some point in time during the working life of a high-skilled worker (like e.g., in Dustmann, 2003; Dustmann and Weiss, 2007), because the present paper focusses on the effects of (enforced or rather voluntary) return migration immediately after graduation. The main intuition for the results would not change qualitatively at the presence of an additional return-migration decision at a later date.

The student-migration behavior can then 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 gets from studying and working in his home country. An implicit assumption with respect to the migration model as presented by indifference condition (6) is that foreign students can always 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, differences in the consumption value of education or rather the value of 'college life' between the two regions are ignored. The individual discount factor applied to benefits accruing in the working period is $\delta_I < 1$ for all students. All students with a valuation of the foreign lifestyle $\theta \geq \hat{\theta}$ will study abroad, while those with a lower valuation stay on in their home country. With the overall size of the student body which is eligible for education in the DC being

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, θ is assumed to be 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 conceptional version of the model in section 2, different return-migration patterns of graduates affect both 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: (i) the lower the expected stay rate, the lower total demand S and therefore, the lower the marginal benefit from raising tuition fees (the idea goes along with the argument that a smaller tax base implies a smaller marginal benefit from increasing the tax rate); (ii) the lower the expected stay rate, the higher the absolute value of the sensitivity of demand to tuition fees, i.e. $\partial(|\partial S/\partial f|)/\partial\rho < 0$, $\rho \in \{p, x\}$, and therefore the higher the marginal cost of rasing tuition fees. The corresponding (combined) effect which implies an incentive to cutback tuition fees 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 $\overline{\theta}$). The difference in the validation of expected benefits in the future from the individual perspective 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 are the behavioral effects relative to the revenue effects in both (12) and (13) and therefore the more likely is 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, one 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-round (student-) migration decision, they mistake probabilities p and x in that they take $p = x = 1$ for granted. In that case, the demand for education in the rich country is

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

and the optimal tuition fee can be calculated as

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

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 if the actual stay rate px is smaller than one. 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 living 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

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

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

4 Discussion and extension

This section briefly challenges the monopoly assumption in the main part of the paper and analyzes whether results still hold for alternative market forms (4.1) and takes into account a further group of international students, namely those who want to study abroad but intend to return to their home country immediately upon graduation (4.2).

4.1 Competition for students in an oligopoly

The two-country setting which is used in sections 2 and 3 in order to illustrate how non-resident tuition fees in a DC, which is a monopolist in higher education, depend on the return-migration behavior of foreign students from LDC's is of course highly stylized. Given the fact that a handful of DC's actually host a majority of international students, one can argue that an oligopoly has to be the object of investigation capturing the fact that some large players are competing for the pool of potentially international students. Therefore, this section briefly discusses tuition-fee competition in a duopoly setting. When it comes to the evaluation of a change in the return-migration behavior of foreign students upon graduation on equilibrium tuition fees, the players' market power is shown to determine whether a behavioral effect as described earlier exists and therefore how tuition fees are finally adjusted.

Suppose first of all two identical countries (denoted by 1 and 2) which compete in a classical *Bertrand* set-up: both countries offer identical higher education and maximize net-benefits from educating foreign students over non-resident tuition fees, which are chosen in both countries simultaneously. Students from the LDC do not have any country-specific preferences with respect to DC 1 or 2, so that the demand for education in the DC i is

$$S_i^B(f_i, f_{-i}, p, x) = \begin{cases} S^B(f_i, p, x) & \text{if } f_i < f_{-i} \\ \frac{1}{2}S^B(f_i, p, x) & \text{if } f_i = f_{-i} \\ 0 & \text{if } f_i > f_{-i}. \end{cases} \tag{20}$$

In the (unique) Nash equilibrium (f_1^*, f_2^*), both countries set their tuition fees equal to costs net of non-tuition benefits accruing in the future, i.e.

$$f_1^* = f_2^* = f^* = -(\pi^c + \delta_G p x \pi^g). \tag{21}$$

Each country faces an infinitely elastic demand curve given the tuition fees charged by the other country, and therefore, the game finally induces the perfectly competitive outcome. In the pure Bertrand case with intensive price competition, the behavioral effect of a change in foreign students' return-migration behavior on the first-round demand for an education abroad does not play any role for the adjustment of equilibrium fees: a decrease in stay rates, which is either induced by a decline in p or x, increases equilibrium tuition fees unambiguously, i.e. $df^*/dp, df^*/dx < 0$. The more students return to their home countries upon graduation, the less fierce becomes competition in DC's for these students and therefore the higher equilibrium tuition fees.

Things change, however, if students are assumed to perceive some difference among the higher-education systems in the two countries. In contrast to the standard Bertrand game, the two host countries of foreign students now have some market power due to *product differentiation*. I will not specify the product differentiation any further because my focus is finally on the effect of stay rates of foreign students on equilibrium tuition fees. Beside differences within the higher-education system

itself, you could for example also think of spatial models of education differentiation in which LDC-students differ in their relative distance (e.g., in the sense of geographic and/or cultural distance) to one of the two DC's.

Country i then faces a demand of foreign students represented by a continuous function $S_i^{PD}(f_i, f_{-i}, p, x)$ (note that the demand function $S_i^B(f_i, f_{-i})$ was *dis*continuous at $f_i = f_{-i}$) with $\partial S_i^{PD}/\partial f_i < 0$ and $\partial S_i^{PD}/\partial f_{-i} > 0$. Each country i chooses tuition fees f_i given tuition fees $\overline{f}_{-i}$ in the other country in order to solve

$$\max_{f_i} \Pi_i = (\pi^c + f_i + \delta_G p x \pi^g) S_i^{PD}(f_i, \overline{f}_{-i}, p, x).$$

Country i's best-response function $b(f_{-i})$ is then implicitly determined by

$$S_i^{PD}(f_i, \overline{f}_{-i}, p, x) + (\pi^c + f_i + \delta_G p x \pi^g) \frac{\partial S_i^{PD}(f_i, \overline{f}_{-i}, p, x)}{\partial f_i} = 0. \tag{22}$$

In complete analogy to the monopoly setting, the behavioral effect now comes again into play when analyzing a decline in students' stay rates. I will focus here on a decline in p. The analysis for a decreasing x is in full analogy. For given $\overline{f}_{-i}$, the optimal tuition fee f_i either increases or decreases in p, depending on the strength of the behavioral effect:

$$\left.\frac{df_i}{dp}\right|_{b(f_{-i})} = -\frac{1}{\Gamma}\left\{\left[\frac{\partial S_i^{PD}}{\partial p} + (\pi^c + f_i + \delta_G p x \pi^g)\,\frac{\partial^2 S_i^{PD}}{\partial f_i \partial p}\right] + \delta_G x \pi^g \frac{\partial S_i^{PD}}{\partial f_i}\right\} \gtreqless 0, \tag{23}$$

where $\Gamma := 2(\partial S_i^{PD}/\partial f_i) + (\pi^c + f_i + \delta_G p x \pi^g)(\partial^2 S_i^{PD}/\partial f_i^2)$ has to be negative from the second order condition. For $\partial S_i^{PD}/\partial p, \partial^2 S_i^{PD}/(\partial f \partial p) > 0$ as in the main section of the paper, the behavioral effect (term in squared brackets) opposes the more standard effect through the reduced marginal cost of deterring students away by rising tuition fees when p decreases. Hence, the equilibrium fee f^* either decreases when p decreases (this is the case when the behavioral effect is dominant; see the stylized diagram (a) in figure 2) or increases (this is the case when the behavioral effect is offset; see diagram (b) in figure 2).

Therefore the main result in section 3 derived from a monopoly setting still holds if countries are assumed to offer some differentiated higher education and therefore effectively have some market power.

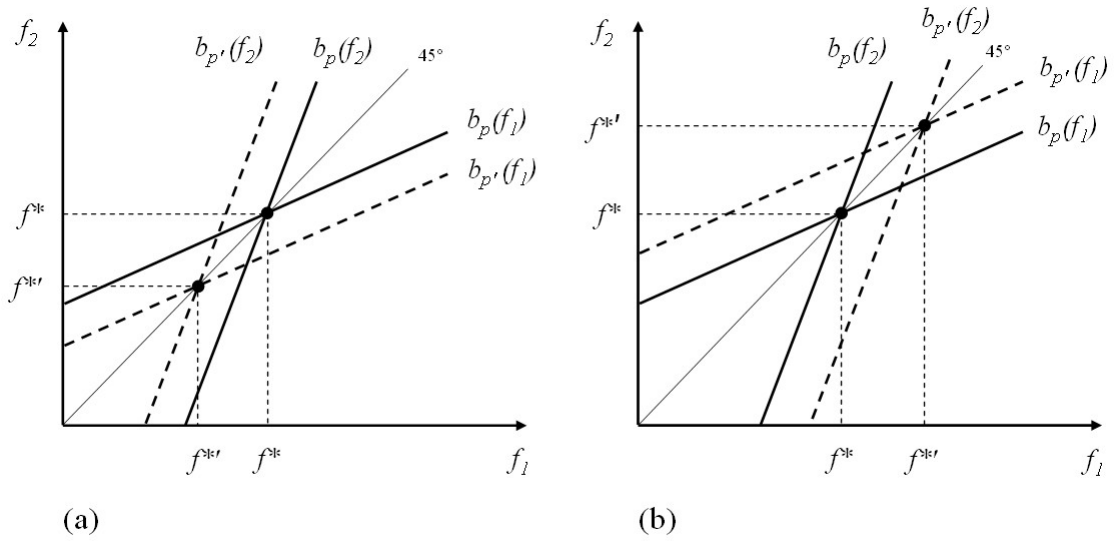

Figure 2: Bertrand competition with differentiated education; $p' < p$

4.2 The composition of the pool of international students

The analysis so far focused on a special sub-group of real-life foreign students, namely those who ex ante *intend to stay* in the host country upon graduation (given that their expectations about foreign lifestyle are fulfilled). One 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 on in the host country (one might call them MA-students for 'mission-accomplished' because they intend to return immediately after graduation).

Taking this latter group into account, a decline in the stay rates of foreign students can also be caused by a shift in the composition of foreign students from less IS-students 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, 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

$$S(f) = nS^{MA}(f) + (1-n)S^{IS}(f), \tag{24}$$

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

$$\begin{aligned} \max_f \Pi &= (\pi^c + f)S(f) + \delta_G p x \pi^g (1-n) S^{IS}(f) \\ &\text{s.t.} \quad S(f) = nS^{MA}(f) + (1-n)S^{IS}(f). \end{aligned} \tag{25}$$

The first order condition for the optimal tuition fee f is

$$\frac{\partial \Pi}{\partial f} = (\pi^c + f)\frac{\partial S}{\partial f} + S + \delta_G p x \pi^g (1-n)\frac{\partial S^{IS}}{\partial f} = 0. \tag{26}$$

See that an increase in n implies a decline in the stay rate of foreign students due to the shift towards MA-students. The effect on the optimal tuition fee can be calculated as

$$\frac{df}{dn} = -\frac{1}{\Omega}\left[(\pi^c + f)\left(\frac{\partial S^{MA}}{\partial f} - \frac{\partial S^{IS}}{\partial f}\right) + (S^{MA} - S^{IS}) - \delta_G p x \pi^g \frac{\partial S^{IS}}{\partial f}\right], \tag{27}$$

where $\Omega := 2(\partial S/\partial f) + (\pi^c + f)(\partial^2 S/\partial f^2) + \delta_G p x \pi^g (\partial^2 S^{IS}/\partial f^2)$ has to be negative from the second order condition.

According to (27), 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 the host country incurs a loss per student from training international students during the education period), a shift in the overall demand from IS-students 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 represented by the first term within the 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 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 within the squared brackets.

Finally, the third term within the 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, those fees will also depend on the stay rate of students upon graduation. The paper argues that for changing stay rates, the host country has not only to consider the direct effect on the expected benefits from retaining foreign students as high-skilled human capital, 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, the main part of the paper focusses 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, their expected benefits from studying abroad and therefore their first-round location decision is altered. 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 is dominant, 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 captured the first two categories. The extension in section 4.2 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 the present paper and which deserve more attention in future research. While the model treated the cause of return migration as exogenous, 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 of 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 issues 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 (see for example Gribble (2008) for an overview of policy options employed by sending countries experiencing some significant student outflow) so that DC's and LDC's actually could interact strategically, both 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

$$\delta_I \overline{\theta} x(2p-1)\Delta v - \delta_G p x \pi^g > \delta_I(v^H - \underline{v}) + \pi^c, \tag{28}$$

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, 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

$$\frac{\delta_I}{\delta_G} > \frac{p\pi^G}{\overline{\theta}(2p-1)\Delta v}. \tag{29}$$

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

$$\frac{\delta_I}{\delta_G} > \frac{\pi^G}{2\overline{\theta}\Delta v}. \tag{30}$$

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 (30) also automatically holds when (29) is fulfilled, thereby proving that $df/dp > 0$.

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