Immigration and the School System*

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Abstract

Immigration is an important issue in many societies, and it has wide-ranging effects on the educational systems of host countries. There is now a large empirical literature, but very little theoretical work on this topic. We introduce a model of family immigration in a framework where school quality and student outcomes are determined endogenously. This allows us to study the effect of immigration on the school system and how school quality may self-reinforce immigrants' and natives' schooling and learning choices. We can also explain the selection of immigrants in terms of parental motivation.

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1 Introduction

Immigration is a prevalent feature of many societies. Immigrants bring their families and have children. As a consequence, the future of the host societies clearly depends on these children.[1] First, these children have to be schooled and, by changing classroom composition and school resources, they have a sizable impact on school quality and the performance of their native peers. Also, the school success of immigrant children has a direct impact on human capital accumulation. Logically, the educational effect of immigration is a core concern of policy makers and has attracted a massive research effort to understand this phenomenon.[2] Most of this is effort is empirical and there is relatively little theoretical work to contextualize the many recent findings in the literature, to clarify the main mechanism at work and to inform future empirical investigations. In this paper, we provide such a framework and study the theoretical links between immigration and schooling.

In any theory connecting immigration to schooling, student outcomes must be determined endogenously as a result of the interplay between different families (immigrants and natives) and the school system. The schooling effects of immigration must be mediated by parents' characteristics, reflected for example in their wages, and their involvement in their children education process. While wages may reflect talent or skills, parental involvement re-

[1]For example, the US Census Bureau estimated in 2000, that 34% of all youth aged 15–19 were from minority groups and one in five school-age children live in immigrant families (Kao and Thompson, 2003). According to the Innocenti Research Center, in 2009 almost a quarter of children were immigrants in the Netherlands, Germany, Sweden and the United States. This proportion is about one-sixth in France and Great Britain (Alba, Sloan, and Sperling, 2011).

[2]Studies like those conducted by PISA, and other international organizations (like TIMSS or PIRLS), have allowed for the empirical analysis of immigrant educational success and the externalities imposed on natives. In many countries, a large fraction of immigrant children face substantial disadvantages in reaching educational parity with native children (Heath, Rothon, and Kilpi1, 2008; Anghel and Cabrales, 2010). Australia and Canada are the big exceptions where immigrants often outperform natives before controlling for individual characteristics (Schnepf, 2004). It is also not at all rare for some immigrant students to be top of the class (see Card (2005), Dustmann and Theodoropoulos (2010) and Dustmann, Frattini, and Theodoropoulos (2010)). Dustmann and Glitz (2010) has an overview on migration and education. Researchers by now agree that immigrant students perform differently by origin group (Levels, Dronkers, and Kraaykamp, 2008) and (Levels and Dronkers, 2008) and cross-nationally (Marks, 2005). Even immigrants from the same origin perform differently according to their destination country (Bertoli, Fernandez-Huertas Moraga, and Ortega, 2010, forthcoming). Moreover, the immigration mix differs considerably across countries, which is only partially due to colonial links (Alba, Sloan, and Sperling (2011), based on Kirszbaum, Brinbaum, and Simon (2009)).

flects the parents' concerns in their children's educational achievement. We refer to this attribute as *"motivation"*. Within this framework, we address two different but related research questions. First, we study the effect of immigration on the different dimensions of the school system, such as student effort, parental involvement, school incentives and resources and how the endogenous response of the school system to immigration is interrelated with both immigrants' and natives' educational choices. Second,we explain the selection of immigrants in terms of parental motivation and discuss how different types of immigrants are selected according to different immigration policies.

We develop a new model of the school system similar to Albornoz, Berlinski, and Cabrales (2011). Children are short-sighted and need to be motivated to study. Parents divide their time between working and motivating their children, and they decide whether or not to emigrate. Schools provide additional motivational schemes to enhance children's learning effort. The effect of these schemes depends on school resources, which are determined by the education policy. The contribution of this framework is to emphasize that learning is a process involving the interaction among children, parents, schools and the decision of school resources. Thus, attainment and school quality are endogenously determined by classroom composition, which is itself affected directly by immigration.

We show that the educational effect of immigration crucially depends on immigrant parental motivation and that the overall effect of immigrant children depends on the characteristics of the average native compared to the average immigrant parents. We establish first that children's learning effort increase in parental motivation. This result links the effects of immigration on schools to immigrant self-selection and how immigration affects classroom composition. Of course, more (less) motivated immigrants would involve more positive (negative) effects on the host country school system, but these effects are mediated by the characteristics of both the native parents and the pre-immigration school system. We show, for example, that, although a negative selection of immigrant parents reduces the school effort of native students, this particularly hits native students with relatively low parental motivation; a result that has been uncovered as a regularity in many empirical studies (Gould, Lavy, and Paserman, 2004).

We also look at the effect of immigration on school resources in a world where public schools are financed by parents through taxes. We assume that the policy maker maximizes the utility of the median voter parent, and show that school resources increase in immigrant motivation. Hence, a negative selection in parental motivation hits the native students directly through the

reaction of teachers and indirectly through a reduction in school resources by the policy maker. This suggests that at least part of the performance of schools with increasing number of immigrant children may be explained by the response of the education policy to immigration, and not only to the presence of immigrants themselves.

We embed our theory of education into a model of immigration decisions. We show that whether or not highly motivated parents are more likely to emigrate crucially depends on an appropriate condition that relates current wage gains of immigration with the ratio of the benefits from education in the host and origin countries.

Positive selection will occur if two conditions hold. One of them is satisfied if the ratio of skill-wage differentials between sending and receiving countries is high enough. The second one guarantees that the learning motivation provided in the foreign country is higher than the one of the sending country. Clearly, if the two conditions fail selection will then be negative. Interestingly, if the first condition is not satisfied but the second one is, then selection falls on parents with an intermediate range of motivation. Our analysis shows how school considerations are relevant to understand immigrant selection even if the school quality at the host country is not a first order motive for immigration. It also shows how the exogenous quality of the school system induces the selection of most motivated immigrants.

One advantage of our framework is tractability. We can study the impact of various policies for the selection of immigrants in terms of their motivation. For example, we study policies that allow immigrant children to naturalize and the effects of unanticipated family reunification program for temporary immigrants.[3] We also analyze the possibility that parents differ in their preferences about the values transmitted by the school. As a consequence, cultural alienation may emerge for those parents whose values differ substantially from those transmitted by the school. We show, for example, that cultural alienation may lead to negative selection. This suggests that school flexibility to incorporate different cultural values is a relevant tool to favor the arrival of the most motivated immigrants.

The remainder of the paper is organized as follows. Section 2 introduces the model of parental motivation and the school system. In section 3, we study the effects of immigration on school system. Section 4 looks at the implications of immigration for school resources. In section 5, we study immigrant selection and discuss under which circumstances higher emigration costs can improve parental selection. Section 6 turns to the question of

[3] As happened in the case of many guest worker programs around the world.

naturalization policies and what type of parent would emigrate if children were not able to come. We also study how the cultural orientation at school might interfere with immigrant selection. Section 7 discusses further implications of our model and concludes. After each prediction of our model, we document supportive empirical evidence. All proofs not in the main text are gathered in a technical appendix.

2 Parental concern and the school system

In this section, we develop the basic model of the school system. Our model of the school system is similar to Albornoz, Berlinski, and Cabrales (2011), where the school system results from the interaction of students (children, who need incentives to put effort on learning), parents (who work and set up costly incentives schemes for students), and teachers/headmasters (who decide on the incentive scheme provided at schools). We now describe our different actors in detail. We assume that every parent has one child.

The students' utility function:

The students are children who perceive learning as costly, because they would rather play, and do not internalize the future benefits of studying today. As a consequence, they need to be motivated to exert learning effort. The incentive scheme is put into place by parents and the school. Let c_{1i} be the parent i's reward for every unit of his child's effort e_i and c_2 be the school's reward. As suggested by empirical evidence (Houtenville and Smith Conway, 2008; Pop-Eleches and Urquiola, 2011), we assume that parents and school incentives are substitutes.[4] Then, children's short-term utility is given by:

$$U_i^c = (c_{1i} + c_2)\, e_i - \frac{1}{2} e_i^2, \tag{1}$$

where $\frac{1}{2}e_i^2$ is the cost of learning.

The parents' utility function:

Unlike children, parents understand the long-term consequences of their children's choices today, namely how the child's learning effort when young influences the child labor market prospects in the future. In particular, the probability that the child will work in a high-skilled job equals the child's learning effort e_i, while the child will become an unskilled worker with probability $(1 - e_i)$. Wages at skilled jobs and unskilled jobs are denoted

[4]No qualitative change ensues if we assume the incentives to be complementary. This is because the substitutability at the children's utility level is mitigated by complementarities elsewhere. Albornoz, Berlinski, and Cabrales (2011) discuss this issue in depth.

ϕ^S and ϕ^U respectively. These wages can differ across countries as well as between natives and immigrants. Hence a child's future labor market prospect is given by $\left(\phi^S e_i + (1 - e_i)\,\phi^U\right)$.

A parent has to split her total time T between working and providing incentives to her child. How much time a parent dedicates to generating educational incentives for her child depends on parental motivation and the cost of generating the reward. Parental motivation is modeled as the weight θ_i a parent gives to her child's labor market prospect in her utility function.[5] The time to generate the reward is given by $c_{1i}e_i/2$ while the cost of generating incentives for their child is the foregone parental wage, given by:

$$w_i' = \phi_i', \tag{2}$$

where ϕ_i' is the parental wage.[6] Hence, the parental utility function is given by the expression

$$U_i^P = \theta_i \left(\phi^S e_i + (1 - e_i)\,\phi^U\right) + \left(T - \frac{1}{2}c_{1_i}e_i\right)\phi_i'. \tag{3}$$

The school's utility function:

Schools/teachers also fully understand and care about the future job perspectives of their students, assigning weight θ^T to the average student's success. The teachers have to decide how much of the time T_T that remains after teaching their compulsory hours they will use to motivate their students (such as training or preparing learning activities), and how much they will use for outside job opportunities (such as private tuition) which are paid at wage rate γ^T. The teacher's time spent generating the reward c_2 is equal to $\frac{1}{2N}\sum_{i=1}^{N}\frac{1}{2}c_2e_i$ where N is the total number of children in the classroom.

[5]Empirically, parental motivation is likely to be positively correlated with parental work ethic. Although this link is not captured in the present model, it is easy to extend the model to incorporate work ethic by letting parents allocate their time between leisure, education and work and assuming that the same parameter affects the weight given to education and inversely the enjoyment of leisure. This specification was used in a former version of the model leading to qualitatively similar results.

[6]Our model could be modified to incorporate parental talent v_i'. On the one hand, parental talent v_i' increases wages $w_i' = v'\phi_i'$. On the other hand parental talent decreases the time parents need to spend for generating their child's incentive reward. This time is now given by $c_{1i}e_i/2v_i'$. Introducing talent into our model would only complicate the exposition but would not affect the main results.

The school's utility function is therefore

$$U^{HM} = \frac{\theta^T}{N} \sum_{i=1}^{N} \left(\phi^S e_i + (1 - e_i) \phi^U \right) + \left(T_T - \frac{1}{2N} \sum_{i=1}^{N} c_2 e_i \right) \gamma^T. \quad (4)$$

Let $N = N_I + N_N$ where N_I is the number of immigrant children and N_N the number of native children. We can rewrite the school's utility function as

$$\begin{aligned} U^{HM} &= \frac{\theta^T}{N} \left(\left(\phi^S - \phi^U \right) \left(\sum_{k=1}^{N_N} e_k + \sum_{i=l}^{N_I} e_l \right) + \phi^U N \right) \\ &\quad \left(T_T - \frac{c_2}{2N} \left(\sum_{k=1}^{N_N} e_k + \sum_{l=1}^{N_I} e_l \right) \right) \gamma^T. \end{aligned}$$

The structure of the game: The school system is modeled as a two-stage game. In the first stage, parents and schools simultaneously decide and announce optimal levels of rewards per unit of effort: c_1 and c_2 respectively. After observing these announcements, children decide their optimal effort e_i.

Equilibrium: We solve the game by backward induction.

In the second stage children choose their optimal effort e_i by maximizing their utility function (1) taking parental incentives c_{1i} and school incentives c_2 as given. This leads to the following optimal effort decision by the children

$$\begin{aligned} \frac{\partial U^c}{\partial e_i} &= 0 = c_{1i} + c_2 - e_i \\ e_i &= c_{1i} + c_2. \end{aligned} \quad (5)$$

In other words, children's effort is simply the sum of parental and school incentives. We can now turn to the first-stage of the game where we need to substitute this expression (5) into the parent's utility (3) and the school's utility (5). Taking the optimal effort decision of children (5) into account, the teacher's problem is to choose the level of c_2 that maximizes

$$\begin{aligned} U^{HM} &= \frac{\theta^T}{N} \left(\left(\phi^S - \phi^U \right) \left(\sum_{k=1}^{N_N} (c_{1k} + c_2) + \sum_{l=1}^{N_I} (c_{1l} + c_2) \right) + \phi^U N \right) \\ &\quad + \left(T_T - \frac{c_2}{2N} \left(\sum_{k=1}^{N_N} (c_{1k} + c_2) + \sum_{l=1}^{N_I} (c_{1l} + c_2) \right) \right) \gamma^T. \end{aligned}$$

leading to the optimal school incentives

$$c_2 = \frac{\theta^T}{\gamma^T}\left(\phi^S - \phi^U\right) - \frac{N_N\overline{c_1^N} + N_I\overline{c_1^I}}{2N}, \tag{6}$$

where

$$\overline{c_1^N} = \frac{1}{N_N}\sum_{k=1}^{N_N} c_{1i}^N, \overline{c_1^I} = \frac{1}{N_I}\sum_{l=1}^{N_I} c_{1l}^I.$$

The incentives set by schools depend on the average parental involvement of both natives and immigrants, to which we turn now. Parents choose their incentive scheme c_1 to maximize

$$U_i^P = \theta_i\left(\phi^S\left(c_{1i}+c_2\right) + \left(1-\left(c_{1i}+c_2\right)\right)\phi^U\right) + \left(T - \frac{1}{2}\left(c_{1i}+c_2\right)c_{1i}\right)\phi_i'.$$

leading to the optimal parental choice

$$c_{1i} = \left(\phi^S - \phi^U\right)\frac{\theta_i}{\phi_i'} - \frac{1}{2}c_2. \tag{7}$$

In order to save some notation let us define

$$\psi_i = \frac{\theta_i}{\phi_i'}, \tag{8}$$

that is, as the ratio of parental motivation to their wage. Also, we define the average motivation to parental wage ratio among the native and foreign population as

$$\overline{\Omega_k} = \frac{1}{N_k}\sum_{i=1}^{N_k}\frac{\theta_i}{\phi_i'} = \frac{1}{N_k}\sum_{i=1}^{N_k}\psi_i \text{ for } k = N, I. \tag{9}$$

Using this notation, we can now derive the interior solution of the game.

Lemma 1 *For a given school the optimal level of incentives set by the school and by native parents $j = N$ and immigrant parents $j = I$ are*

$$c_{1l}^j = \max\left[0, \left(\phi^S - \phi^U\right)\left(\psi_l^j - \frac{2}{3}\frac{\theta^T}{\gamma^T} + \frac{N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{3(N_N+N_I)}\right)\right] \tag{10}$$

$$c_2 = \max\left[0, \frac{2}{3}\left(\phi^S - \phi^U\right)\left(\frac{2\theta^T}{\gamma^T} - \frac{N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{(N_N+N_I)}\right)\right]. \tag{11}$$

If both the schools and the child's parent l choose positive incentives the corresponding child $i's$ effort is

$$e_i^j = \left(\phi^S - \phi^U\right)\left(\psi_l^j + \frac{2}{3}\frac{\theta^T}{\gamma^T} - \frac{N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{3(N_N + N_I)}\right) \text{ for } j = N, I \tag{12}$$

Proof. See the appendix. ■

The above expressions indicate that the schools and parental incentives are substitutes. Both incentives are driven by the potential gains from education captured by $\left(\phi^S - \phi^U\right)$. School incentives increase in school motivation θ^T and decrease in teacher's outside job opportunities γ^T and in average ratio of parental motivation to wage, since $\frac{N_A\overline{\Omega_I}+N_N\overline{\Omega_N}}{(N_N+N_I)} = \frac{1}{N}\sum_{i=1}^{N}\psi_i$. The higher this average, which implies the more parents care on average for education, the more incentives parents provide.

An interior solution (i.e. a solution with $e_i^j \leq 1$) exists where both the parents and the school provide positive incentives for some conditions on the distribution of ψ_l^j. Specifically, positive incentives require $\psi_l^j + \frac{N_A\overline{\Omega_I}+N_N\overline{\Omega_N}}{3(N_N+N_I)}$ $> \frac{2}{3}\frac{\theta^T}{\gamma^T} > \frac{N_I\overline{\Omega_I}+N_N\overline{\Omega_N}}{3(N_N+N_I)}$ which is a relationship comparing parental motivation and their wages with school motivation and wages for outside job opportunities for teachers. Observe that $\frac{\theta^T}{\gamma^T}$ can be interpreted as a measure of school quality. Hence the condition for positive incentives can be interpreted as a relationship between school quality and parental quality defined by the tradeoff between parental care and marginal cost of education ψ.

Until now we have allowed parental concerns to be unrelated with school concerns. However, it is realistic to assume that parental motivation positively reinforces school motivation. This corresponds to situations where teachers' incentives are encouraged by interacting with highly motivated parents. It is demoralizing for teachers to deal with disinterested parents or, more generally, with student apathy. To capture this link formally, we postulate:

Assumption 1 *θ^T depends on the average parental motivation. That is,*

$$\theta^T = k\overline{\theta} = \frac{k}{N}\sum_{i=1}^{N}\theta_i, \tag{13}$$

where N is the number of parents affecting the education of a particular school class of children and k indicates the exogenous weight that the school assigns to the future wages of their students.

We are now in a position to analyze how parental motivation in general and immigrants' parental motivation in particular affect the quality of the school system.

2.1 The effect of parental skill levels on school incentives

Using assumption (1) in equation (11), we can express the incentives provided by a particular school as:

$$c_2 = \max\left[0, \frac{2\left(\phi^S - \phi^U\right)}{3N}\sum_{i=1}^{N}\left(\left(\frac{2k}{\gamma^T} - \frac{1}{\phi_i'}\right)\theta_i\right)\right], \tag{14}$$

Hence schools will only provide positive incentives if

$$\sum_{i=1}^{N}\left(\frac{2k}{\gamma^T} - \frac{1}{\phi_i'}\right)\theta_i > 0. \tag{15}$$

We will derive the conditions for positive school incentives in a world where parents can have skilled and unskilled jobs. We also show how school incentives react to parental motivation.

Proposition 1 *In a school with N^U unskilled and N^S skilled parents with corresponding wages ϕ^U and $\phi^S = \alpha\phi^U$, where $\alpha > 1$, the school will provide positive incentives if*

$$\phi^S = \alpha\phi^U > \frac{\gamma^T}{2k} \tag{16}$$

and

$$\phi^U > \frac{(\beta + \alpha)\,\gamma_l^T}{2\,(1+\beta)\,k\alpha} \tag{17}$$

where $\beta = \sum_{i=1}^{N^S}\theta_i / \sum_{i=1}^{N^U}\theta_i$.

These school incentives always increase in the parental motivation of skilled parents. If

$$\phi^U > \frac{\gamma^T}{2k} \tag{18}$$

school incentives also increase in parental motivation of unskilled parents. However, if (18) fails then school incentives decrease in the parental motivation of unskilled parents.

Proof. The condition for positive school incentives given by (15) cannot be satisfied if $\frac{2k}{\gamma^T} < \frac{1}{\phi_i'}$ for both skilled and unskilled parents which leads us to (16). However, we might allow for the possibility that (18) fails. In this case the requirement for positive school incentives becomes

$$\frac{1}{N}\sum_{i\in N}\left(\frac{2k}{\gamma_l^T}-\frac{1}{\phi_i'}\right)\theta_i = \frac{1}{N^S+N^U}\sum_{i\in N^S\cup N^U}\left(\frac{2k}{\gamma^T}-\frac{1}{\phi_i'}\right)\theta_i > 0$$

which is equivalent to:

$$\beta = \frac{\sum_{i\in N^S}\theta_i}{\sum_{i\in N^U}\theta_i} > \frac{\frac{1}{\phi^U}-\frac{2k}{\gamma_l^T}}{\frac{2k}{\gamma^T}-\frac{1}{\alpha\phi^U}} = \frac{\alpha\left(\gamma^T-2k\phi^U\right)}{2k\alpha\phi^U-\gamma^T} \Longleftrightarrow \phi^U > \frac{(\beta+\alpha)\,\gamma^T}{2\,(1+\beta)\,k\alpha}$$

To see how positive school incentives change with parental motivation we need to look at

$$sign\frac{\partial c_2}{\partial\theta_i} = sign\left(\frac{2k}{\gamma^T}-\frac{1}{\phi_i'}\right),$$

which tells us that the incentives provided by the school (14) increase in parental motivation for parents whose wages are such that $2k/\gamma^T > 1/\phi_i'$ which translates into condition (16) for skilled parents and condition (18) for unskilled parents and decrease in parental motivation for parents with wages such that $2k/\gamma^T < 1/\phi_i'$. ■

Note that condition (16) and condition (18) state that parental wages cannot be too low compared to the ratio of school's opportunity cost of providing students incentives to the weight schools give to the future performance of the children (which can be interpreted as the inverse of school quality). These condition will hold for high k schools (schools highly concerned with their students' future) and for countries where γ^T is low and are arguably a relatively mild assumption for high-skilled parents.

The weaker condition (17) for unskilled parents is more easily satisfied the higher the levels of α and β, that is, for countries where the wage gap between high and low skilled jobs is big and where total parental motivation is higher for skilled parents than for unskilled parents ($\beta > 1$). Not surprisingly a fall in exogenous school quality ($2k/\gamma^T$) will eventually lead to a violation of condition (17), pushing in turn school incentives to zero.

3 The effects of immigration on the school system

School incentives are difficult to observe. For this reason, student outcomes constitute a typical empirical measure of school quality. We therefore need

to examine children's learning effort in more detail. It is clear from equation (12) that among children in the same school it is their parents' characteristics ψ_i, that determines who has the higher learning effort. If we apply this to the difference in learning effort between an immigrant child and a native child, then

$$e_i^I - e_j^N = \left(\psi_i^I - \psi_j^N\right)\left(\phi^S - \phi^U\right) = \left(\frac{\theta_i^I}{\phi_i'^I} - \frac{\theta_j^N}{\phi_j'^N}\right)\left(\phi^S - \phi^U\right),$$

which implies that for immigrant children to make greater effort on average than the natives, the following condition has to be satisfied:

$$\frac{1}{N_I}\sum_{i\in N_I} e_i^I > \frac{1}{N_N}\sum_{i\in N_N} e_i^N \text{ whenever } \frac{1}{N_I}\sum_{i\in N_A}\frac{\theta_l^I}{\phi_l'^I} > \frac{1}{N_N}\sum_{i\in N_N}\frac{\theta_i^N}{\phi_l'^N}.$$

Having established this, the next proposition follows immediately:

Proposition 2 *The children of immigrants exert more effort at a given school than natives if and only if the average of the ratio of parental motivation to wage in the immigrant parents' group is larger than that of native parents.*

While Proposition 2 is stated for the school level, it generally holds when the environment of immigrants and natives are the same. In a country as a whole it would hold if all schools are the same and immigrants and natives are equally distributed among schools.

Using assumption (1) allows us to derive how a child's learning effort depends on parental motivation, namely

$$e_i = \left(\phi^S - \phi^U\right)\left(\frac{\theta_i}{\phi_i'} + \frac{1}{3N}\sum_{i=1}^{N}\left(\frac{2k}{\gamma^T} - \frac{1}{\phi_i'}\right)\theta_i\right), \tag{19}$$

From this equation it is straightforward to establish:

Proposition 3 *Children's learning effort is always increasing in parental motivation.*

Proof. This follows from $\frac{\partial e_i}{\partial \theta_i} > 0$ ■

Although fairly simple, this result has some interesting implications.

The channels through which motivation affects performance: First, even in situations where school incentives decrease in parental motivation, the direct effect of rising parental involvement on student effort offsets its negative impact on the school. Hence, the greater learning effort of children from highly motivated parents must come because of the parents' higher demands. The empirical evidence of pushy immigrant parents is vast in the case of immigration to the US. As shown by Glick and White (2004) and Hao and Bonstead-Bruns (1998), immigrant parents are associated with greater demands on their children in terms of school engagement and academic achievement. Keller and Tillman (2008) find that both parental and self-reported expectations have significant direct effects on college attendance. Goyette and Xie (1999) provide evidence that in the US the behaviors and expectations of Asian immigrant parents' tend to raise their children's school attendance above the average.

Effects on natives and immigrants: Turning to the effect of immigration on schooling, proposition 3 implies that this effect is mediated by parental characteristics and the way immigrants are schooled. To see this more clearly, we can rewrite (19) and obtain:

$$e_i = \left(\phi_l^S - \phi_l^U\right) \frac{\theta_i}{\phi_i'} + \frac{1}{2} c_2^l. \tag{20}$$

This expression allows us to analyze how immigration affects the performance of native pupils. For a given school, the relative effect of immigration on native children varies with their parents' characteristics, which are captured by $\psi_i = \theta_i/\phi_i'$. A change in c_2^l simply shifts the initial c_1 up (if immigrants are better on average) or down (otherwise), and therefore the effect on e_i is lower the higher the initial c_1 or equivalently, for children associated with a higher ψ_i. In other words, the performance of disadvantaged children (low ψ_i parents) is more affected by immigration than that of their more advantaged classmates (high ψ_i parents). The evidence for this is very strong. Gould, Lavy, and Paserman (2009) provide evidence for this prediction. Focusing on the mass migration wave from the former Soviet Union to Israel in the early 1990s, they find a negative effect of immigrants on native outcomes which is larger for natives from a more disadvantaged social background. Similarly, Betts (1998) shows that immigration reduces the probability of completing high-schools for American-native minorities (Blacks and Hispanics). No negative effect of immigrants is found for non-minority groups. Finally Brunello and Rocco (2011) study whether a higher share of immigrant pupils affects the school performance of natives using

aggregate multi-country data from PISA. They find evidence of a negative and statistically significant relationship but the size of the estimated effect is small and it is bigger for natives with a relatively disadvantaged parental background.[7]

Expression (20) also allows us to examine the effect of schools on immigrant performance. A typical measure of school quality is the pre-immigration performance or general performance of its native pupils. As discussed above, overall native performance is partly driven by c_2. According to (20), a higher level of c_2 would benefit all children at the school, and hence this would include the immigrant children. This is consistent with the vast evidence suggesting that better schools benefit immigrants (Dronkers and Fleischmann, 2010). The "Operation Solomon"provides a natural experiment for this result. This refers to the exodus of 15,000 Ethiopian immigrants, who were airborne to Israel within 36 hours in May 1991. Importantly, they were randomly sorted across the country. According to our model the average performance of those immigrants who were randomly placed into better schools should be higher. As shown by Gould, Lavy, and Paserman (2004), this was exactly the case: those Ethiopians who were assigned to better elementary schools[8] had better results in high school.

The impact on segregation and of segregation: So far, we have always considered exogenous classroom composition. But a corollary of the previous point is that the selection of immigrants can have important implications on school segregation. If the selection of immigrants is negative, or even if positive, if it involves mainly unskilled workers, this can easily lead to a flight from some schools into others. In many countries this implies a flight to the private schools sector. Indeed, Betts and Fairlie (2003) find that American native students fly toward private secondary schools in response to the influx of immigrants into public institutions. Also, Berniell (2010) discussing the massive recent flow of immigrants into Spain shows that "in 1998-99, when the fraction of immigrants in Madrid was only 2.6%, about 59% of natives were attending public schools, while one decade later -when immigrants comprised 17% of total population roughly 50% of natives chose public institutions. On the other hand, in 1998-99 only 68% of immigrant

[7]Similarly, Ohinata and van Ours (2011) find no evidence of negative spillovers of immigrants on native Dutch children. They do find however that the share of immigrants in a classroom is negatively associated with the reading scores of immigrant children.

[8]The measure of better elementary schools used by Gould, Lavy, and Paserman (2004) was the average standardized maths scores before Ethiopian entered or other environmental measures such as welfare rate and average high school matriculation rate.

parents were choosing public schools, while in 2008-09 this number raised to 77%."

In a world with skilled and unskilled workers school, incentives can also be rewritten as

$$c_2 = \frac{2\left(\phi_l^S - \phi_l^U\right)}{3\left(N^U + N^S\right)}\left(\left(\frac{2k}{\gamma_l^T} - \frac{1}{\phi^U}\right)N^U\overline{\theta^U} + \left(\frac{2k}{\gamma_l^T} - \frac{1}{\alpha\phi^U}\right)N^S\overline{\theta^S}\right). \quad (21)$$

Assume that (18) holds, which is likely in countries which are targeted by immigration since these countries typically have a reasonable exogenous level of school quality ($2k/\gamma^T$).

Consider situations where schools are segregated by the skill level of parents, i.e. children of unskilled workers are schooled together and so are children of skilled workers. Then, the natives always benefit if immigrants have a high parental motivation, and they suffer otherwise. In countries where children of skilled and unskilled parents are schooled together and randomly assigned to schools, immigration is likely to change the skilled/unskilled composition of the classroom. If immigrants are positively selected according to parental motivation and are only high-skilled workers matched to high-skilled jobs, the effect on native student's effort is positive. If, however, immigrants are all positively selected but unskilled and the overall classroom size is constant, then selection has to be extremely restrictive in the sense that only immigrants with the highest motivation are admitted for the overall effect on school incentives to be positive. Similarly, a negative selection of only unskilled immigrants will always affect natives negatively, while a negative selection of skilled immigrants has to be extremely negative to have the same effect. If skilled and unskilled immigrants come in the same proportion than skilled and unskilled natives, a positive (negative) selection in parental motivation will always benefit (harm) native children.

4 The effect of immigration on school resources

We are now going to endogenize school resources to see whether some new effects arise from the feedback between immigrants' ethos and resource provision. Let us denote by r the amount of resources an administration gives to a particular school. This could be thought of as class size (or teacher-student ratio) as well as other resources, such as support to teaching staff, computers and other means of making the provision of incentives easier for teachers. The level of resources, r which is the same for all schools is announced by the policymaker before parents and headmasters decide on the

level of incentives, so they take r as given when they make their decisions. Given r the utility of a headmaster is now:

$$U_{HM} = \frac{\theta^T}{N} \sum_{i=1}^{N} \left(\phi^S e_i + (1 - e_i) \phi^U \right) + \left(T - \frac{1}{2rN} \sum_{i=1}^{N} e_i c_2 \right) \gamma^T. \tag{22}$$

Following the previous analysis, we can obtain the equilibrium values of the key variables of the school system:

Lemma 2 *The optimal incentives set by parents are given by*

$$c_{1l}^j = \left(\phi^S - \phi^U \right) \left(\psi_l^j - \frac{2}{3} \frac{r\theta^T}{\gamma^T} + \frac{N_I \overline{\Omega_I} + N_N \overline{\Omega_N}}{3(N_N + N_I)} \right) \text{ for } j = N, I. \tag{23}$$

while the optimal school incentives are

$$c_2^A = \frac{2}{3} \left(\phi^S - \phi^U \right) \left(\frac{2r\theta^T}{\gamma^T} - \frac{N_I \overline{\Omega_I} + N_N \overline{\Omega_N}}{(N_N + N_I)} \right). \tag{24}$$

The learning effort of an immigrant child and a native child given by (5) are therefore

$$e_i^j = \left(\phi^S - \phi^U \right) \left(\psi_l^j + \frac{2}{3} \frac{r\theta^T}{\gamma^T} - \frac{N_I \overline{\Omega_I} + N_N \overline{\Omega_N}}{3(N_N + N_I)} \right) \text{ for } j = N, I \tag{25}$$

Proof. See the appendix. ■

Now we introduce the utility of the policymaker who decides the level of resources for the schools. The policymaker maximizes the complete utility of the (median-voter) parent (denoted by $\bar{P}_i$) which requires adding the cost of the school resources (r). This median-voter is a native, and in fact we are choosing him as the median of the natives, as in most countries first-generation immigrants do not get the right of vote, or they get it when they are naturalized at which point most of their children will have already gone (at least partially) through the education system.[9] The costs of resources r are paid by parents through general taxation, which parents care about,

[9]To become a US citizen an immigrant must have been a permanent resident for at least five years. Becoming a permanent resident also takes a few years, and we are considering immigrants who already have children at the time they emigrate.

and are internalized by the policymaker when deciding r. Resource costs are assumed to be quadratic.[10]

Thus, we can represent the policymaker's preferences as,

$$U_{PM} = U_{P_M} - \frac{\rho}{2} r^2, \tag{26}$$

where ρ is a constant parameter summarizing the cost of resources. Our formulation assumes that schools are financed out of lump sum taxation and the government keeps a balanced budget.

Substituting (25) and (23) into (26), and then optimizing U_{PM} over r we obtain:

$$r = \frac{\left(\phi^S - \phi^U\right)^2 \frac{2}{3}\frac{\theta^T}{\gamma^T}\left(\theta_{i_M} + \phi_{i_M}\left(\frac{N_I\overline{\Omega_I}+N_N\overline{\Omega_N}}{3(N_N+N_I)}\right)\right)}{\rho - \phi_{i_M}\left(\left(\phi^S - \phi^U\right)^2\left(\frac{2}{3}\frac{\theta^T}{\gamma^T}\right)^2\right)}$$

Note that resources increase in the motivation of the immigrant populations through two sources. First r is increasing in θ^T which by assumption (13) depends on the average motivation of the student parents. Secondly, it also depends positively on the motivation of immigrants through $\overline{\Omega_I}$. Hence, the motivation of immigrants reinforces the effects of immigrants selection that happen through c_2, which we already discussed in section 3. Thus, a poorly selected immigrant population hits the native students (and the more motivated immigrants) directly through school incentives, and indirectly through a reduction in school resources by the policymakers.

Several authors have found evidence that bad immigrant selection leads to a reduction in public spending on schooling. Using a quantitative model of school choice and voting over public education Coen-Pirani (Forthcoming) shows that education spending per student in California would have been 24 percent higher in the year 2000 if U.S. immigration had been restricted to its 1970 level. As in our paper, Coen-Pirani (Forthcoming) abstracts from illegal immigration and allows only native households to vote. His calibrated parameters indicate that immigrants in California care relatively less for education than natives, hence our model provides an alternative explanation for his findings. The relationship between resources dedicated to public schools and immigration is also examined by Dottori and Shen

[10]This can be justified by taking into consideration that the state has monopsony power in the market for teachers and faces a marginal cost function that increases in the number of teachers hired. This is so, for example, because to attract one more teacher the monopsonist has to pay an extra cost, since the marginal potential teacher needs a higher reward to be attracted to the profession.

(2008) . They provide cross-country evidence (e.g. a mean-difference test) that countries that experience negative changes in public expenditure per pupil from 1990 to 2004 (Docquier and Marfouk (2006) data set) are those with larger increases in the low-skilled immigrants' share of the population (UNESCO data). This finding is consistent with our model, if low-skilled immigrants are also less concerned about education on average than high skilled immigrants. Indeed, this negative correlation disappears when Dottori and Shen (2008) look at changes in the share of immigrants with tertiary education and lagged changes in public expenditure per pupil. As we also discussed in section 3, these effects will be reinforced if, in addition, there is a flight of natives away from public schools into private ones, as Berniell (2010) documents has happened in Spain recently, for example.

There is possibly one more channel for immigrants' motivation to impact education. So far, we have assumed that the median voter is the median of the natives, the only ones who can vote. But suppose that immigrants earn the right of vote sufficiently early after arrival to the destination country. Then, poorly selected immigrants would shift the median voter toward an individual who cares less about education and hence lowers the level of resources even further. Obviously, the vicious cycle of selection becomes virtuous in case of positive selection. There is a higher level of c_2, a higher level of resources r and the immigrant effect may be improved by enfranchising the immigrants.

Another important observation is that our assumption on funding resources implies that immigrants are legal, so they pay taxes. If they are illegal (non-tax paying) but exogenous in number, we would effectively have a higher level of ρ, which would entail a lower level of resources. If they were illegal and also their number were endogenous, an increase in resources would bring more of them, and the effect is less easy to compute but similar to having a technology with more rapidly decreasing returns to extra resources.

5 Immigrant self-selection

The previous section tells us that it is crucial for the future human capital of an immigration receiving country that immigrant selection is positive in terms of parental motivation. We therefore need to study the immigration decision to understand whether or not this positive selection can be induced.

We now assume that there are two countries: Home H (the source or origin) and Abroad A (the destination or host). Each parent i in country H

faces a fixed cost of immigration F_i.The variable F_i follows the distribution $F(.)$ in a large compact interval. We will allow for immigration policies to affect this distribution.

Both countries have a skilled and unskilled labor market and their schools system can be described by the model of the previous section. However, they may differ in the economic opportunities and the quality of the school system. Parents have expectations concerning these parameters and will be able to calculate their expected utility when living abroad and their expected utility of staying at home and will emigrate if the utility difference is bigger than their realized immigration cost. Let $U_{P_i}^j$ denote parental utility when living within country j, namely

$$U_{P_i}^j = \theta_i \left(e_i^j \left(\phi_j^S - \phi_j^U \right) + \phi_j^U \right) - \frac{1}{2} c_{1i}^j e_i^j \phi_i'^j + T\phi_i'^j \text{ for } j = H, A \tag{27}$$

Using the optimal incentive and effort decisions derived in Lemma 1 we can write parental utility after some simplification as

$$U_{P_i}^j = T\phi_i'^j + \theta_i \phi_j^U + \frac{\phi_i'^j}{2} \left(e_i^{j^*} \right)^2 \text{ for } j = H, A \tag{28}$$

where $e_i^{j^*}$ is the optimal learning effort of $i's$ child when schooled in country j which by (12) is

$$e_i^{j^*} = \left(\phi_j^S - \phi_j^U \right) \left(\psi_l^j + \frac{2}{3} \frac{\theta_j^T}{\gamma_j^T} - \frac{\overline{\Omega_j}}{3} \right) \text{ for } j = N, A$$

where $\overline{\Omega_j} = \frac{1}{N_j} \sum_{k=1}^{N_j} \psi_k^j$ is the average parental motivation to expected wage ratio in a school in country j. We can therefore write parental utility as

$$\begin{aligned} U_{P_i}^j &= T\phi_i'^j + \theta_i \phi_j^U \\ &+ \frac{\left(\phi_j^S - \phi_j^U \right)^2}{2} \left(\frac{\theta_i^2}{\phi_i'^j} + 2\theta_i \left(\frac{2}{3} \frac{\theta_j^T}{\gamma_j^T} - \frac{\overline{\Omega_j}}{3} \right) + \phi_i'^j \left(\frac{2}{3} \frac{\theta_j^T}{\gamma_j^T} - \frac{\overline{\Omega_j}}{3} \right)^2 \right) \end{aligned} \tag{29}$$

Observe that the first term of parental utility $T\phi_i'^j$ corresponds to the maximum earnings from working (what a parent can get by working all the time), while the second term $\theta_i \phi_j^U$ reflects the parental utility if the child does not make any educational effort. Providing incentives to children increases the parental utility whenever skilled jobs are better paid than unskilled jobs; that is if $\phi^S > \phi^U$ as is reflected in the third term of (29).

A parent i will emigrate from country H to country A if $U_{P_i}^A - F_i > U_{P_i}^H$. From (29) it follows that

Lemma 3 *$U_{P_i}^A - F_i > U_{P_i}^H$ if and only if*

$$\begin{aligned} & T\left(\phi_i'^A - \phi_i'^H\right) + \theta_i\left(\phi_A^U - \phi_H^U\right) \\ & + \frac{\theta_i^2}{2}\left(\frac{\left(\phi_A^S - \phi_A^U\right)^2}{\phi_i'^A} - \frac{\left(\phi_H^S - \phi_H^U\right)^2}{\phi_i'^H}\right) \\ & + \theta_i\left(\left(\phi_A^S - \phi_A^U\right)^2\left(\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{\overline{\Omega_A}}{3}\right) - \left(\phi_H^S - \phi_H^U\right)^2\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right)\right) \\ & + \frac{1}{2}\left(\phi_i'^A\left(\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{\overline{\Omega_A}}{3}\right)^2\left(\phi_A^S - \phi_A^U\right)^2 - \phi_i'^H\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right)^2\left(\phi_H^S - \phi_H^U\right)^2\right) \\ > \; & F_i. \end{aligned} \tag{30}$$

Since the primary motive for emigration is the possibility to take advantage of better economic opportunities, we assume that wages abroad are at least as high as wages at home and one of the three wage parameters (expected parental wage ϕ_i', expected child's wage if skilled ϕ^S and if unskilled ϕ^U) must be strictly higher. Then we can interpret the condition for immigration in Lemma 3 as follows: $T\left(\phi_i'^A - \phi_i'^H\right) + \theta_i\left(\phi_A^U - \phi_H^U\right)$ describes the wage gain due to immigration if the immigrant parent dedicates all the time to work. The parent might get a higher expected pay $\phi'_A \geq \phi'_H$ and the unskilled child might also earn more money $\phi_A^U \geq \phi_H^U$ which is weighted by the parental concern parameter θ_i. The remaining 3 lines of the sum describe the change in parental utility from emigrating that is achieved by incentivating the child at school and can be rewritten as $\frac{\phi'_A}{2}e_A^2 - \frac{\phi'_H}{2}e_H^2$ (see equation (28)). Parents and schools want to incentivate children to increase their chance to get a high-skilled job, which is why the absolute difference between skilled and unskilled wages enters in the three parts of the sum that corresponds to the parental utility derived from the child's effort. Since the parental wage is the opportunity cost of incentivating the child, a higher wage has a negative effect on effort as captured by ϕ' dividing in the second line of the sum. However, since school incentives are substitutes to parental incentives a higher ϕ' has an indirect effect by increasing effort that is captured by the final line of the sum. The third term of the sum captures the change in parental utility due to a change in school quality combined with the incentives for education.

Suppose the heterogeneity is such that the vector of variables

$$\xi_i \equiv \left(\theta_i, \phi_i^A, \phi_i^H\right) \in \Xi,$$

characterizing each individual belongs to a finite set of types Ξ. At the same time the variable F_i follows the distribution $F(.)$ in the compact interval $[0, A]$. Note that according to equation (30) if an individual with type ξ_i and value for the cost of moving F_i wants to move, another individual with type $\xi_j = \xi_i$ and $F_j < F_i$ also wants to move. Hence, the equilibrium can be characterized by a set of thresholds. For each type $\xi \in \Xi$ there is some F_ξ such that for all i with $\xi_i = \xi \in \Xi$ the individual moves to A if and only if $F_i < F_\xi$.

Proposition 4 *An equilibrium in entry decisions characterized by thresholds always exists.*

Proof. See the appendix. ■

In order to understand the effects of differences in parental motivation on the receiving and sending countries we now use the link of school motivation to parental motivation stipulated in (13).

Proposition 5 *Assume that immigrants are a sufficiently small part of the population both on the origin and the destination countries, so that*

$$\frac{\partial \overline{\Omega_{NA}}}{\partial \theta_\xi} = \frac{\partial \overline{\Omega_H}}{\partial \theta_\xi} = 0$$

and that wages are at least as high abroad as at home. Within the same skill level

1. *immigrant selection is positive in parental motivation if*

$$\frac{\left(\phi_A^S - \phi_A^U\right)^2}{\left(\phi_H^S - \phi_H^U\right)^2} > \frac{\phi'^A}{\phi'^H} \tag{31}$$

$$\begin{aligned} &\left(\phi_A^U - \phi_H^U\right) \\ &+\frac{1}{3}\left(\left(\phi_A^S - \phi_A^U\right)^2\left(\frac{2k_A}{\gamma_A^T}\overline{\theta_A} - \overline{\Omega_A}\right) - \left(\phi_H^S - \phi_H^U\right)^2\left(\frac{2k_A}{\gamma_A^T}\overline{\theta_H} - \overline{\Omega_H}\right)\right) > 0 \end{aligned} \tag{32}$$

2. *intermediately motivated parents emigrate if condition (31) is violated and condition (33) is satisfied.*

3. *immigrant selection is negative in parental motivation if both conditions (31) and (33) are violated.*

Proof. See appendix ■

Notice that condition (31) for positive immigrant selection in parental motivation can be satisfied even when the skill premium is much lower in the receiving country. The reason is that the skill premium is usually defined as the ratio of skilled to unskilled wages in a particular country, whereas condition (31) refers to the absolute differences in skilled and unskilled wages (for children). Also, the left-hand side of condition (31) captures the relative gain of being skilled abroad versus at home and therefore the ratio of absolute (wage) benefits of education at home and abroad. The condition requires that these relative gains from education are higher than the (square root of) relative parental wage gains from immigration. In some sense the condition places an upper bound on parental wages abroad. It nicely captures the trade-off parents face when incentivating their children: forgone parental wage versus higher expected wages of children.

Since $\left(\phi_A^U - \phi_H^U\right) > 0$ a sufficient condition for (33) to hold is given by

$$\left(\phi_A^S - \phi_A^U\right)^2 \left(\frac{2k_A}{\gamma_A^T}\overline{\theta_N} - \overline{\Omega_A}\right) \geq \left(\phi_H^S - \phi_H^U\right)^2 \left(\frac{2k_H}{\gamma_H^T}\overline{\theta_H} - \overline{\Omega_H}\right) \tag{33}$$

This condition (33) captures the incentives provided by schools in different countries and is really endogenous, pointing to the differences that arise due to heterogeneity. To get an intuition for its meaning it will be helpful to consider a situation with two countries that are identical except for their wage structure. More technically, both countries have the same exogenous school qualities, $2k_A/\gamma_A^T = 2k_H/\gamma_H^T$; the same initial distribution of parental motivation; the same distribution of parental motivation among skill groups; and the same proportion of people in skilled employment. Under these conditions, inequality (33) definitely holds if the absolute skill premium abroad is at least as high as it is at home. To see this, notice that due to the equality in exogenous school quality $\left(\frac{2k_A}{\gamma_A^T}\overline{\theta_N} - \overline{\Omega_A}\right) > \left(\frac{2k_H}{\gamma_H^T}\overline{\theta_H} - \overline{\Omega_H}\right) \Leftrightarrow \overline{\Omega_A} \leq \overline{\Omega_H}$, or equivalently $\frac{1}{N_H}\sum \theta_i/\phi_i^H \geq \frac{1}{N_A}\sum \theta_j/\phi_j^{NA}$. This is true since wages in country A are at least as high as wages in country H, and the distribution of parental motivation among skill groups is identical. Obviously if the exogenous school quality is better abroad than at home so that $2k_A/\gamma_A^T > 2k_H/\gamma_H^T$, condition (33) is relaxed.

When both condition (31) and condition (33) are violated, the wage increase due to education abroad is lower than at home, hence the incentives to

educate children are weaker. Moreover, unskilled wages abroad are not that much higher than at home. This makes parents with a higher parental concern worse off and immigrant selection is likely to fall on the least motivated parents.

When condition (31) is violated but (33) is satisfied, parental selection is likely to fall on intermediate levels of parental motivation. On the one hand the tension between parental wages abroad and the child's future wages is resolved in such a way that parents work more hours and incentivate their children less, which is a loss for motivated parents. On the other hand, children gain from being educated abroad, which is a gain for motivated parents. These two countervailing forces are likely to prevent the most motivated and the least motivated parents from emigrating.

Proposition 5 sheds light on how immigration policies that affect immigration costs for all immigrants influence the selection of immigrants and consequently the educational performance of immigrant children, which is increasing in parental motivation. The effect of immigration costs clearly depends on whether or not conditions (31) and/or (33) are satisfied.

When condition (31) is satisfied Consider first different host and origin countries for which condition (31) is satisfied. This implies that more highly motivated parents have higher benefits from emigrating, and therefore selection improves with higher emigration costs. This explains why in destination countries where (31) is satisfied:

(i) for a given origin country, immigrant children perform better in host countries for which the emigration costs are higher,

(ii) for a given host country, the immigrant children who perform better are those whose parents faced the higher emigration costs.

It is easy to think of examples where case (i) holds. To begin with, the condition imposed by (31) should be satisfied for emigration from Latin America to host countries as different as Spain and the U.S.. Also, based on cultural reasons, it should also be clear that emigrating from Latin America to Spain involves relatively lower costs than settling in the U.S. Although not directly related to parents' selection as in our model, Bertoli, Fernandez-Huertas Moraga, and Ortega (forthcoming) show that Ecuadorian immigrant selection to the U.S. is better than for immigrants coming to Spain.

Spain as a host country also provides an example for case (ii). Given its language and the pre-existence of an important and organized Ecuadorian

community, migrants from Ecuador incur in lower immigration costs than, for example, immigrants from Romania. Our model then can explain why Romanian children do better at school than Ecuadorians, conditional on observable socioeconomic background, to the point of getting higher scores than them in the Spanish language class (Anghel and Cabrales, 2010).

When condition (31) is not satisfied The implications of the model can change considerably if we look at host and origin countries where condition (31) is violated. This happens for example if it is mainly the unskilled jobs that are better paid in the destination country than in the origin country. If condition (33) is also violated, it makes sense for the destination country to adopt policies that reduce immigration costs in order to be able to attract also immigrants with a high parental motivation, irrespectively of their level of skills. An example of this situation is given by the immigrants hosted in Argentina from countries like Bolivia, Peru or Paraguay (Gasparini, Cruces, and Tornarolli, 2009). These origin countries are characterized by a very high differences between skilled and unskilled wages, certainly as high as in Argentina. Also, the wages in Argentina are not that much higher. This gives some theoretical support to the strategy of Argentina, which has one of the most generous immigration laws in the world (Albarracín, 2004).

If (33) holds, selection falls on the intermediate range of parental motivation. In this case whether it is good for a country to adopt policies that reduce or increase immigration costs depends on the exact distribution of θ. Under intermediate selection a decline in immigration costs will expand the interval of values of θ for which emigration occurs at both extremes which can influence in either direction the immigrants' average level of θ. More specifically, if θ follows a non-increasing density function, then a reduction in immigration costs induces a decline in the average level of θ (McKenzie and Rapoport, 2010).

5.1 School quality

In the previous section the incentives to immigrate where both shaped by the economic incentives and possibly the difference in school systems. It will be useful to understand the effect of differences in school quality in isolation. In order to do so, we assume that school quality is the only difference between H (Home) and A (Abroad), and that school quality is better abroad, i.e. $\left(\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{\overline{\Omega_A}}{3}\right) > \left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right)$. Under these assumptions immigration occurs

if (30) holds which reduces to

$$\begin{aligned} & \theta_i \left(\phi^S - \phi^U\right)^2 \left(\left(\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{\overline{\Omega_A}}{3}\right) - \left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right)\right) \\ & + \frac{1}{2}\left(\phi^S - \phi^U\right)^2 \phi_i' \left(\left(\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{\overline{\Omega_A}}{3}\right)^2 - \left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right)^2\right) \\ > \quad & F_i. \end{aligned} \tag{34}$$

which after some examination implies:

Proposition 6 *The cost that a parent is willing to pay to immigrate increases in school quality, but it increases proportionally more for parents with higher motivation.*

Proof. It is easy to see that the cross derivative of left hand side of (34) with respect to θ and $\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{\overline{\Omega_A}}{3} > \frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}$ is positive. ■

In other words, if immigration costs increase, but at the same time school quality increases, the selection of immigrants should improve since those that get discouraged with the higher costs are more likely to be those for whom the increase in school quality matters less. Although we do not believe that school quality *per se* is the main reason of emigration for the majority of people who leave their country, the result nevertheless has an interesting testable implication: the school performance of immigrant children should be better in countries with higher immigrations costs and high quality (public) schools. Gibson and McKenzie (2011) provide some evidence for this prediction: they show that the quality of Australian schools is a key pull factor for the most qualified immigrants arriving from New Zealand, Tonga and New Guinea Papua.

6 Immigration and government policies

In this section we discuss how different government policies can affect the selection of immigrants in terms of the importance they attribute to education. Most of these policies are taken for other reasons, so this discussion should not be viewed as providing policy implications, and it is also very hard to do that reasonably in the absence of a general equilibrium model. Our general aim here is to study the educational *side-effects* of different policies which affect immigration. Moreover, they often provide empirical implications which help assess the descriptive validity of our model.

6.1 Naturalization of immigrants

An important issue is whether or not to allow immigrants, and especially their children, to naturalize. Naturalization typically means easier access to better jobs in the future.[11] Hence, naturalization implies that immigrant children will have a higher wage for high-skill jobs. This does not hold not for their parents, and therefore it increases the range of parameters for which condition (31) holds. In other words, naturalization favors the selection of highly motivated immigrant parents and leads to better school performance of immigrant children. This prediction in consistent with Dronkers and Fleischmann (2010) who study immigration in 13 EU countries and find that a significant macro-characteristic for the educational performance of immigrant children is the destination country's naturalization policy. In particular, the more generous the naturalization policy, the higher the educational attainment of immigrant children.

From our point of view, an interesting question is the selection of immigrant parents of children left in the origin country.

Immigrants who have to leave their children behind cannot motivate directly their learning effort, but they will have to remit money in order to pay someone to do so.[12] Hence remitting parents maximize

$$\max_{c_1} \theta_i \left(\phi_H^S e + (1-e)\,\phi_H^U\right) + \left(T - \frac{1}{2}c_1 e\right)\phi_i'^A$$

leading to

$$\begin{aligned} U_{P_i^R}^A &= T\phi_i'^A + \theta_i \phi_H^U \\ &\quad + \frac{\left(\phi_H^S - \phi_H^U\right)^2}{2}\left(\frac{\theta_i^2}{\phi_i'^A} + 2\theta_i\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right) + \phi_i'^A\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right)^2\right) \end{aligned} \tag{35}$$

Immigration occurs if $U_{P_i^R}^A - U_{P_i}^H > F_i$, which reduces to

$$T\left(\phi_i'^A - \phi_i'^H\right) + \frac{\left(\phi_H^S - \phi_H^U\right)^2}{2}\left(\theta_i^2\left(\frac{1}{\phi_i'^A} - \frac{1}{\phi_i'^H}\right) + \left(\phi_i'^A - \phi_i'^H\right)\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right)^2\right) > F_i$$

[11] Bratsberg, Ragan, and Nasir (2002) provide evidence that in the U.S. naturalized immigrants have a more favorable job distribution and higher wages than non-naturalized immigrants. Moreover, naturalization leads to further wage growth. It allows entry into certain jobs that are reserved to nationals only, but also gives advantages in terms of signaling long term commitment and the flexibility to travail. The same results are found by Steinhardt (2008) for Germany and Fourgère and Fougère and Safi (2008) for France.

[12] Remittance by immigrants is often meant to keep their children in school or to pay for a better education by schools.

It is easy to see that the left hand side is decreasing in θ_i since $\frac{1}{\phi_i'^A} < \frac{1}{\phi_i'^H}$ and parents who emigrate without their children are now negatively selected.

One might argue that if children are not allowed to come, parental motivation should not be an important selection criterion, as the effects of their children at school is the only externality generated by motivation. However, laws can change over time and immigrants who were not allowed to bring their children might later be allowed to reunite as is illustrated by many historical examples.[13] There are good reasons to believe that new temporary immigrant programs are likely to lead to the same result, since the pressure toward granting immigrants more rights and at least basic family rights has increased. The United Nations and the International Labor Organization have enacted a number of international conventions in this direction (Weissbrodt, 2003). Unless this is fully anticipated and temporary family separation involves sufficiently low cost, our analysis would suggest that a host country can get a better immigrant selection if family immigration is facilitated from the beginning. The negative selection in parental motivation when forced to leave their children behind can explain the bad school performance of the later reunited children of German guest workers (Dronkers and de Heus, 2010).

6.2 The role of culture orientation at school

Countries differ in their cultures. As a consequence, the values transmitted at schools are likely to be different across countries. In order to consider the effect of school cultural differences in the decision to migrate, we assume parents care about the school orientation. We describe their utility by:

$$U^P = \theta \left(\phi^S e + (1-e)\,\phi^U\right) \Delta + \left(T - \frac{1}{2} c_1 e\right) \phi',$$

where Δ captures the cultural differences between parents and the school. To be more precise, let Δ be

$$\Delta = 1 - (\Phi - \tau)^2 .$$

In this expression, Φ and τ summarize the culture orientation of the school and parent respectively. If $\Delta = 1$ there is no cultural alienation. We assume

[13] There are many historical examples of this possibility. Guest worker programs all over the world served to establish permanent immigrant minorities. Consider for example Germany, which signed a guest worker program with Turkey in 1961, allowing for temporary immigration only. While many Turkish guest workers returned when they were supposed to return, the agreement between Germany and Turkey ended in 1973 and many Turkish guest workers established themselves permanently, bringing their families later on.

native parents do not feel any cultural alienation, the possibility of cultural alienation only affects immigrants. Following the same steps as in Lemma 1 it is easy to derive the incentive system implemented in the immigration receiving country as

$$c_2^A = \frac{2}{3}\left(\phi_A^S - \phi_A^U\right)\left(\frac{2\theta_A^T}{\gamma_A^T} - \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{(N_N+N_I)}\right) \tag{36}$$

$$c_{1i}^I = \left(\phi_A^S - \phi_A^U\right)\left(\frac{\Delta\theta_i}{\phi_i'^A} - \frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} + \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{3(N_N+N_I)}\right)$$

$$c_{1i}^N = \left(\phi_A^S - \phi_A^U\right)\left(\frac{\theta_i}{\phi_i'^N} - \frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} + \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{3(N_N+N_I)}\right)$$

Hence the utility of an immigrant parent living in country A is given by

$$\begin{aligned} U_{i_A}^P &= T\phi_i'^A + \Delta\theta_i\phi_A^U \\ &+\frac{\left(\phi_A^S-\phi_A^U\right)^2}{2}\left(\frac{\Delta^2\theta_i^2}{\phi_i'^A} + \frac{2\Delta\theta_i}{3}\left(\frac{2\theta_A^T}{\gamma_A^T} - \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{(N_N+N_I)}\right)\right. \\ &\left.+\frac{\phi_i'^A}{9}\left(\frac{2\theta_A^T}{\gamma_A^T} - \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{(N_N+N_I)}\right)^2\right) \end{aligned} \tag{37}$$

Hence, parental utility clearly falls with larger differences in cultural orientation. Since all children go to school, cultural alienation even affects children who remain unskilled. Moreover, the probability to remain unskilled increases in cultural alienation since it reduces the effort incentives set by parents, a reduction which is not fully compensated by incentives set by schools and hence children's' learning effort falls.

The utility of staying at home who is not culturally alienated is as before given by (29). In the appendix we show in Section A.5 how this affects immigrant selection. Not surprisingly, the conditions for positive selection within the same skill group are harsher. In particular, for positive selection the following two conditions have to be satisfied:

$$\frac{\Delta^2\left(\phi_A^S-\phi_A^U\right)^2}{\left(\phi_H^S-\phi_H^U\right)^2} > \frac{\phi_i'^A}{\phi_i'^H} \tag{38}$$

and

$$\begin{aligned} &\left(\Delta\phi_A^U - \phi_H^U\right) \\ &+\frac{1}{3}\left(\Delta\left(\phi_A^S-\phi_A^U\right)^2\left(\frac{2\theta_A^T}{\gamma_A^T} - \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{(N_N+N_I)}\right) - \left(\phi_H^S-\phi_H^U\right)^2\left(\frac{2\theta_H^T}{\gamma_H^T} - \overline{\Omega_H}\right)\right) > 0. \end{aligned} \tag{39}$$

and a violation of both conditions clearly leads to negative selection.

Observe that conditions (38) and (39) are violated for low Δ even if conditions (31) and (33) hold, which are the corresponding conditions for positive immigrant selection in parental motivation in the absence of cultural concerns. The possibility of cultural alienation drives away the most motivated immigrants and may lead to negative selection. The effect of cultural alienation is to reduce the weight parents assign to the future wage opportunities of children abroad, both to the unskilled wage and the absolute wage difference between skilled and unskilled wages, hence only immigrant countries where the unskilled wage and the wage difference between the skilled and unskilled wage are very large can aspire to attract the most motivated immigrants if cultural differences matter. This imposes an important policy trade-off for the destination country. The fact that school orientation may affect selection implies that flexibility on the school orientation and incorporation of some foreign values at schools could favor the attraction of more motivated immigrants.

This implication of our model might throw some light on recent empirical findings by Dronkers (2010). In a cross-country comparison of language skills using the PISA data, Dronkers (2010) found that pupils from Islamic countries have a substantial disadvantage in language scores compared to immigrant pupils from other countries of origin, which cannot be explained on the basis of individual socioeconomic background, school characteristics or the education system's characteristics.[14] Given that the Muslim culture differs considerably from the mainstream culture of most immigrant receiving countries, and that many Muslims have strong cultural concerns, our model predicts that in their case it is the less motivated parents who emigrate. As shown in the appendix, the educational effort of Muslim children is lower than that of other immigrants through two channels. On the one hand, they are less stimulated by their parents, who care relatively less about their education. On the other hand, cultural alienation reinforces this lack of concern even further. This problem could be mitigated by allowing for Muslim schools. Indeed, Dronkers (2010) provides evidence that a higher share of pupils with an immigrant background in a school hampers educational performance (of all students), but if these pupils have the same regional origin (Islamic countries; non-Islamic Asian countries), a higher share of pupils with an immigrant background at that school promotes educational performance.

[14] As captured by the degree of differentiation in secondary education.

7 Concluding discussion

In this paper, we propose a model of endogenous migration and human capital production. The model allows us to understand the differential selection, and hence performance, of immigrants from the same country into different destinations. It can also explain why students from different origins exhibit so widely different performances in the same host country, even after controlling for observables. The model also informs about the effects of different policies in terms of the selection of immigrants. Finally, we can study endogenous reactions of the school system to the presence of immigrants, and through that channel, the impact on natives and immigrants alike.

The focus of this paper is on the school effects of immigration in the host country. However, applying our model it is straightforward to understand the effect on the educational system in the source country. For example, if immigrants were positively selected and, thus, the most motivated parents leave their countries, this would imply negative effects on their compatriots who stay home. In particular, this can lead to lower school incentives in the source country, and hence to smaller learning efforts of non-emigrant children under plausible conditions.[15]. Refocusing the analysis to the home country is an obvious follow-up of this paper.

We restrict our analysis to the effects of immigration on the school system. Clearly, immigration involves effects beyond schools; in the health sector, in the labor market and in many other socially important phenomena. Hence, we do not provide any specific prediction about the optimal policy mix regarding the number of immigrants. Nevertheless, our model uncovers important side and feedback effects, which are generally overlooked in the design and implementation of immigration policy. Notwithstanding the importance of these side effects, a rigorous evaluation of immigration policies requires a model able to capture their general equilibrium implications; an avenue we leave for future research.

Another important extension concerns the interactions between the political economy of the host country and education; immigrants, or at least their children, often eventually achieve political rights and could importantly, and perhaps unexpectedly, affect political outcomes.[16]

[15]For example, if (18) holds in the home country. The same is also true if (18) fails but conditions (16) and (17) hold and all emigrants are high-skilled.

[16]See Levy (2005) for an example of the subtle interaction between different types of groups and education provision in a political economy context.

References

Alba, R., J. Sloan, and J. Sperling (2011): "The Integration Imperative: The Children of Low-Status Immigrants in the Schools of Wealthy Societies," *Annual Review of Sociology*, 37, 395–415.

Albarracín, J. (2004): "Selecting Immigration in Modern Argentina: Economic, Cultural, International and Institutional Factors," mimeo, University of Florida.

Albornoz, F., S. Berlinski, and A. Cabrales (2011): "Motivation, resources and the organization of the school system," .

Anghel, B., and A. Cabrales (2010): "The determinants of success in primary education in Spain," .

Berniell, L. (2010): "Sorting of Students by Cultural Traits: The Effects of Immigration," mimeo.

Bertoli, S., J. Fernandez-Huertas Moraga, and F. Ortega (2010): ""Crossing the Border: Self-selection, Earnings and Individual Migration Decisions," .

——— (forthcoming): "Immigration Policies and the Ecuadorian Exodus," *World Bank Economic Review*.

Betts, J. (1998): "Educational crowding out: do immigrants affect the educational attainment of American minorities?," in *Help or Hindrance? The Economic Implications of Immigration for African–Americans*, ed. by D. Hamermesh, and F. Bean. Russell Sage Foundation, New York.

Betts, J., and R. Fairlie (2003): "Does immigration induce 'native flight' from public schools into private schools?," *Journal of Public Economics*, 87, 987–1012.

Bratsberg, B., J. Ragan, and Z. Nasir (2002): "The Effect of Naturalization on Wage Growth: A Panel Study of Young Male Immigrants," *Journal of Labor Economics*, 20(3), 568–597.

Brunello, G., and L. Rocco (2011): "The Effect of Immigration on the School Performance of Natives: Cross Country Evidence Using PISA Test Scores," .

Card, M. (2005): "Is the new immigration really so bad?," *The Economic Journal*, 115, 300–323.

Coen-Pirani, D. (Forthcoming): "Immigration and spending on public education: California, 1970-2000," *Journal of Public Economics*.

Docquier, F., and A. Marfouk (2006): "International migration by education attainment (1990-2000)," in *International migration, remittances and the brain drain*, ed. by C.Ozden, and M.Schiff, chap. 5. Palgrave-Macmillan.

Dottori, D., and I. L. Shen (2008): "Low-skilled immigration and education Policy with Endogenous Fertility," .

Dronkers, J. (2010): "Positive but also negative effects of ethnic diversity in schools on educational performance? An empirical test using cross-national PISA data," MPRA Paper No. 25598.

Dronkers, J., and M. de Heus (2010): "Negative selectivity of Europe's guest-workers immigration? The educational achievement of children of immigrants compared with the educational achievement of native children in their origin countries," in *From Information to Knowledge; from Knowledge to Wisdom: Challenges and Changes facing Higher Education in the Digital Age*, ed. by E. de Corte, and J. Fenstad, pp. 89–104. Portland Press, London.

Dronkers, J., and F. Fleischmann (2010): "The Educational Attainment of Second Generation Immigrants from Different Countries of Origin in the EU Member-States," *Quality and Inequality of Education*, 2, 163–204.

Dustmann, C., T. Frattini, and N. Theodoropoulos (2010): "Ethnicity and Second Generation Immigrants in Britain," CReAM Discussion Paper No 04/10.

Dustmann, C., and A. Glitz (2010): "Migration and Education," in *Handbook of Economics of Education*, vol. Handbooks in Economics. Elsevier Science.

Dustmann, C., and N. Theodoropoulos (2010): "Ethnic minority immigrants and their children in Britain," *Oxford Economic Papers*, 62, 209–233.

Fougère, D., and M. Safi (2008): "Naturalization and Employment of Immigrants in France (1968-1999)," CEPR working paper: DP7092.

Gasparini, L., G. Cruces, and L. Tornarolli (2009): "Recent trends in income inequality in Latin America," Working Papers 132, ECINEQ, Society for the Study of Economic Inequality.

Gibson, J., and D. McKenzie (2011): "The microeconomic determinants of emigration and return migration of the best and brightest: Evidence from the Pacific," *Journal of Development Economics*, 95(1), 18–29.

Glick, J., and M. White (2004): "Post-secondary School Participation of Immigrant and Native Youth: The Role of Familial Resources and Educational Expectations," *Social Science Research*, 33(2), 272–299.

Gould, E., V. Lavy, and D. Paserman (2009): "Does Immigration Affect the Long-Term Educational Outcomes of Natives? Quasi-Experimental Evidence," *The Economic Journal*, 119(540)(1243-1269).

Gould, E., V. Lavy, and M. Paserman (2004): "Immigrating to Opportunity: Estimating the Effect of School Quality Using a Natural Experiment on Ethiopians in Israel," *Quarterly Journal of Economics*, 119(2), 489–526.

Goyette, K., and Y. Xie (1999): "Educational Expectations of Asian American Youths: Determinants and Ethnic Differences," *Sociology of Education*, 72(1), 22–36.

Hao, L., and M. Bonstead-Bruns (1998): "Parent-Child Differences in Educational Expectations and the Academic Achievement of Immigrant and Native Students," *Sociology of Education*, 71(3), 175–198.

Heath, A., C. Rothon, and E. Kilpi1 (2008): "The Second Generation in Western Europe: Education, Unemployment, and Occupational Attainment," *Annual Review of Sociology*, 34, 211–235.

Houtenville, A., and K. Smith Conway (2008): "Parental Effort, School Resources, and Student Achievement," *Journal Human Resources*, 43(2), 437–453.

Kao, G., and J. Thompson (2003): "Racial and Ethnic Stratification in Educational Achievement and Attainment," *Annual Review of Sociology*, 29, 417–442.

Keller, U., and K. Tillman (2008): "Post-secondary Educational Attainment of Immigrant and Native Youth," *Social Forces*, 87(1), 121–152.

Kirszbaum, T., Y. Brinbaum, and P. Simon (2009): "The Children of immigrants in France: The emergence of a second generation," Unicef IWP-2009-13.

Levels, M., and J. Dronkers (2008): "Educational performance of native and immigrant children from various countries of origin," *Ethnic and Racial Studies*, 31(8), 1404–1425.

Levels, M., J. Dronkers, and G. Kraaykamp (2008): "Immigrant Children's Educational Achievement in Western Countries: Origin, Destination, and Community Effects on Mathematical Performance," *American Sociological Review*, 73, 835–853.

Levy, G. (2005): "The Politics of Public Provision of Education," *Quarterly Journal of Economic*, 120, 1507–1534.

Marks, G. (2005): "Accounting for Immigrant Non-immigrant Differences in Reading and Mathematics in Twenty Countries," *Ethnic and Racial Studies*, 28, 925–946.

McKenzie, D., and H. Rapoport (2010): "Self-Selection Patterns in Mexico-U.S. Migration: The Role of Migration Networks," *The Review of Economics and Statistics*, 92(4), 811–821.

Ohinata, A., and J. C. van Ours (2011): "How immigrant children affet the academic achievement of native Dutch children," CEPR DP 8178.

Pop-Eleches, C., and M. Urquiola (2011): "Going to a better school: Effects and Behavioral Responses," .

Schnepf, S. (2004): "How Different Are Immigrants? A Cross-Country and Cross-Survey Analysis of Educational Achievement," IZA DP No. 1398.

Steinhardt, M. (2008): "Does citizenship matter? The economic impact of naturalizations in Germany," Development Working Papers 266, Centro Studi Luca dÁgliano, University of Milano.

Weissbrodt, D. (2003): "Final report on the rights of non-citizens," UN Doc E/CN.4/Sub.2/2003/23 http://www1.umn.edu/humanrts/demo/noncitizenrts-2003.html.

A Appendices

A.1 Proof of Lemma 1

Using the notation introduced in (8) and (9), the optimal level of incentives of native and immigrant parents (7) can be written as

$$c_{1i}^{N} = \psi_i^N \left(\phi^S - \phi^U\right) - \frac{1}{2}\left(\frac{\theta^T}{\gamma^T}\left(\phi^S - \phi^U\right) - \frac{N_N\overline{c_1^N} + N_I\overline{c_1^I}}{2N}\right). \quad (40)$$

$$c_{1l}^{I} = \psi_l^I \left(\phi^S - \phi^U\right) - \frac{1}{2}\left(\frac{\theta^T}{\gamma^T}\left(\phi^S - \phi^U\right) - \frac{N_N\overline{c_1^N} + N_I\overline{c_1^I}}{2N}\right). \quad (41)$$

The average parental incentives of immigrants and natives can therefore be written as

$$\overline{c_1^N} = \overline{\Omega_N}\left(\phi^S - \phi^U\right) - \frac{1}{2}\frac{\theta^T}{\gamma^T}\left(\phi^S - \phi^U\right) + \frac{N_N\overline{c_1^N} + N_I\overline{c_1^I}}{4N}. \quad (42)$$

$$\overline{c_1^I} = \overline{\Omega_I}\left(\phi^S - \phi^U\right) - \frac{1}{2}\frac{\theta^T}{\gamma^T}\left(\phi^S - \phi^U\right) + \frac{N_N\overline{c_1^N} + N_I\overline{c_1^I}}{4N}. \quad (43)$$

Notice as well that $\overline{c_1^I} = \left(\overline{\Omega_I} - \overline{\Omega_N}\right)\left(\phi^S - \phi^U\right) + \overline{c_1^N}$. Using this and simplifying, $\overline{c_1^N}$ and $\overline{c_1^I}$ become:

$$\overline{c_1^N} = \left(\phi^S - \phi^U\right)\left(\frac{4N - N_I}{3N}\overline{\Omega_N} + \frac{N_I}{3N}\overline{\Omega_I} - \frac{2}{3}\frac{\theta^T}{\gamma^T}\right). \quad (44)$$

$$\overline{c_1^A} = \left(\phi^S - \phi^U\right)\left(\frac{3N + N_I}{3N}\overline{\Omega_I} + \frac{N - N_I}{3N}\overline{\Omega_N} - \frac{2}{3}\frac{\theta^T}{\gamma^T}\right), \quad (45)$$

and therefore:

$$N_N\overline{c_1^N} + N_I\overline{c_1^I} = \frac{2}{3}\left(\phi^S - \phi^U\right)\left(2\left(N_I\overline{\Omega_I} + N_N\overline{\Omega_N}\right) - \frac{(N_N + N_I)\theta^T}{\gamma^T}\right). \quad (46)$$

Plugging (46) into (40), (41) and 6) we then get the desired result.

A.2 Proof of Lemma 2

Using the first order conditions for children's effort decision (5) we get:

$$\begin{aligned} U_{HM} &= \frac{\theta^T}{N}\left(\sum_{k=1}^{N_N}\left(\left(\phi^S-\phi^U\right)\left(c_{1k}^N+c_2\right)+\phi^U\right)+\sum_{l=1}^{N_I}\left(\left(\phi^S-\phi^U\right)\left(c_{1k}^I+c_2\right)+\phi^U\right)\right) \\ &+\left(T-\frac{1}{2rN}c_2\left(\sum_{k=1}^{N_N}\left(c_{1k}^N+c_2\right)+\sum_{l=1}^{N_I}\left(c_{1k}^I+c_2\right)\right)\right)\gamma^T. \end{aligned}$$

Hence

$$\frac{\partial U_{HM}}{\partial c_2}=\frac{\theta^T}{N}\left(\sum_{k=1}^{N_N}\left(\phi^S-\phi^U\right)+\sum_{l=1}^{N_I}\left(\phi^S-\phi^U\right)\right)-\left(\frac{1}{2}\left(\sum_{k=1}^{N_N}c_{1i}^N+\sum_{l=1}^{N_I}c_{1l}^I\right)+Nc_2\right)\frac{\gamma^T}{Nr}=0.$$

So

$$c_2=\frac{r\theta^T}{\gamma^T}\left(\phi^S-\phi^U\right)-\frac{N_N\overline{c_1^N}+N_I\overline{c_1^I}}{2N}, \tag{47}$$

For parents the only change now is that school resources cost money which they will have to pay from general taxation, but given the quasi-linearity in income of utility and that taxation is already decided at the time parents choose their effort, the amount of those taxes do not affect the parental effort decision. Hence

$$c_{1i}^j=\frac{\theta_i}{\phi_i'}\left(\phi^S-\phi^U\right)-\frac{1}{2}c_2 \text{ for } j=N;I. \tag{48}$$

Similar calculations as in Lemma 1 yield the desired result.

A.3 Proof of Proposition 4

Let $I_+\left(F_\xi\right)=\left\{i\in N|\xi_i=\xi,F_i<F_\xi\right\}$, and $I_-\left(F_\xi\right)=\left\{i\in N|\xi_i=\xi,F_i\geq F_\xi\right\}$.Denote by $N_+\left(F_\xi\right)$ the cardinality of $I_+\left(F_\xi\right)$ and by $N_-\left(F_\xi\right)$ the cardinality of $I_-\left(F_\xi\right)$ Then, under a threshold equilibrium, we can write for any vector of thresholds $F=\left(F_\xi\right)_{\xi\in\Xi}$,

$$\overline{\Omega_I}\left(F\right)=\frac{\sum_{i\in I_+\left(F_\xi\right)}\frac{\theta_i}{\phi_i'}}{\sum_{\xi\in\Xi}N_+\left(F_\xi\right)},\ \overline{\Omega_H}\left(F\right)=\frac{\sum_{i\in I_-\left(F_\xi\right)}\frac{\theta_i}{\phi_i'}}{\sum_{\xi\in\Xi}N_-\left(F_\xi\right)}.$$

Clearly

$$\overline{\Omega_A}\left(F\right)=\frac{N_+\left(F\right)\overline{\Omega_I}\left(F\right)+N_N\overline{\Omega_N}}{\left(N_N+N_+\left(F\right)\right)}.$$

Let for any i with $\xi_i = \xi \in \Xi$

$$\begin{aligned} G_\xi(F) \equiv\ & T\left(\phi_i'^A - \phi_i'^H\right) + \theta_i\left(\phi_A^U - \phi_H^U\right) \\ & + \frac{\theta_i^2}{2}\left(\frac{\left(\phi_A^S - \phi_A^U\right)^2}{\phi_i'^A} - \frac{\left(\phi_H^S - \phi_H^U\right)^2}{\phi_i'^H}\right) \\ & + \theta_i\left(\left(\phi_A^S - \phi_A^U\right)^2\left(\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{\overline{\Omega_A}(F)}{3}\right) - \left(\phi_H^S - \phi_H^U\right)^2\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}(F)}{3}\right)\right) \\ & + \frac{1}{2}\left(\phi_i'^A\left(\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{\overline{\Omega_A}(F)}{3}\right)^2\left(\phi_A^S - \phi_A^U\right)^2 - \phi_i'^H\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}(F)}{3}\right)^2\left(\phi_H^S - \phi_H^U\right)^2\right) \end{aligned} \tag{49}$$

Under these conditions existence is guaranteed by a straightforward application of Brouwer's fixed point theorem, since $G(.)$ is a continuous function and we have defined F to belong to the convex, compact set $[0, A]$.■

A.4 Proof of Proposition 5

Under the assumption that $\frac{\partial\overline{\Omega_{NA}}}{\partial\theta_\xi} = \frac{\partial\overline{\Omega_H}}{\partial\theta_\xi} = 0$ and we only look at individuals within the same skill group, i.e. individuals are homogeneous in wages we need to calculate the derivative of the left-hand side of (30) with respect to parental motivation and determine its sign. This derivative is given by

$$\begin{aligned} & \left(\phi_A^U - \phi_H^U\right) \\ & + \theta_i\left(\frac{\left(\phi_A^S - \phi_A^U\right)^2}{\phi'^A} - \frac{\left(\phi_H^S - \phi_H^U\right)^2}{\phi'^H}\right) \\ & + \left(\left(\phi_A^S - \phi_A^U\right)^2\left(\frac{2}{3}\frac{\theta_A^T}{\gamma_A^T} - \frac{1}{3}\overline{\Omega_A}(F)\right) - \left(\phi_H^S - \phi_H^U\right)^2\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{1}{3}\overline{\Omega_H}(F)\right)\right), \end{aligned}$$

Using the link between school and parental motivation the last line can becomes

$$\frac{1}{3}\left(\left(\phi_A^S - \phi_A^U\right)^2\left(\frac{2k_A}{\gamma_A^T}\overline{\theta_A} - \overline{\Omega_A}\right) - \left(\phi_H^S - \phi_H^U\right)^2\left(\frac{2k_A}{\gamma_A^T}\overline{\theta_H} - \overline{\Omega_H}\right)\right)$$

so that the derivative can be rewritten as

$$\begin{aligned} & \theta_i\left(\frac{\left(\phi_A^S - \phi_A^U\right)^2}{\phi'^A} - \frac{\left(\phi_H^S - \phi_H^U\right)^2}{\phi'^H}\right) + \\ & \left(\phi_A^U - \phi_H^U\right) + \frac{1}{3}\left(\left(\phi_A^S - \phi_A^U\right)^2\left(\frac{2k_A}{\gamma_A^T}\overline{\theta_A} - \overline{\Omega_A}\right) - \left(\phi_H^S - \phi_H^U\right)^2\left(\frac{2k_A}{\gamma_A^T}\overline{\theta_H} - \overline{\Omega_H}\right)\right) \end{aligned}$$

It is positive if both lines are positive which gives us conditions (31) and (33). If (31) is violated the derivative is positive for sufficiently small θ_i and negative for sufficiently high θ_i. If both (31) and (33) are violated the derivative is negative.

Since $\phi'^A > \phi'^H$ by assumption, (31) cannot hold if $\left(\phi_A^S - \phi_A^U\right)^2 < \left(\phi_H^S - \phi_H^U\right)^2$. It is then sufficient to assume that school quality at home cannot be much larger than the one abroad, so that we never have the possibility of a violation of condition (33) without a violation of condition (31)

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A.5 Cultural alienation

The utility of living abroad is given by (37) while the utility of staying at home is

$$\begin{aligned} U_{i_H}^P &= T\phi_i'^H + \theta_i \phi_H^U \\ &\quad + \frac{\left(\phi_H^S - \phi_H^U\right)^2}{2}\left(\frac{\theta_i^2}{\phi_i'^H} + 2\theta_i\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right) + \phi_i'^H\left(\frac{2}{3}\frac{\theta_H^T}{\gamma_H^T} - \frac{\overline{\Omega_H}}{3}\right)^2\right) \end{aligned}$$

Hence immigration occurs if $U_{i_A}^P - U_{i_H}^P > F_i$, namely

$$\begin{aligned} & T\left(\phi_i'^A - \phi_i'^H\right) + \theta_i\left(\Delta\phi_A^U - \phi_H^U\right) \\ & + \frac{\theta_i^2}{2}\left(\frac{\Delta^2\left(\phi_A^S - \phi_A^U\right)^2}{\phi_i'^A} - \frac{\left(\phi_H^S - \phi_H^U\right)^2}{\phi_i'^H}\right) \\ & + \frac{\theta_i}{3}\left(\Delta\left(\phi_A^S - \phi_A^U\right)^2\left(\frac{2\theta_A^T}{\gamma_A^T} - \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{(N_N + N_I)}\right) - \left(\phi_H^S - \phi_H^U\right)^2\left(\frac{2\theta_H^T}{\gamma_H^T} - \overline{\Omega_H}\right)\right) \\ & + \frac{2}{9}\left(\left(\phi_A^S - \phi_A^U\right)^2\phi_i'^A\left(\frac{2\theta_A^T}{\gamma_A^T} - \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{(N_N + N_I)}\right)^2 - \left(\phi_H^S - \phi_H^U\right)^2\phi_i'^H\left(\frac{2\theta_H^T}{\gamma_H^T} - \overline{\Omega_H}\right)^2\right) \\ > \; & F_i \end{aligned}$$

By looking at the derivative of the LHS with respect to parental motivation we can now study how parental motivation influences the immigration decision within the same skill group. This derivative is

$$\left(\Delta\phi_A^U - \phi_H^U\right) + \frac{1}{3}\left(\Delta\left(\phi_A^S - \phi_A^U\right)^2\left(\frac{2\theta_A^T}{\gamma_A^T} - \frac{\Delta N_I\overline{\Omega_I} + N_N\overline{\Omega_N}}{(N_N + N_I)}\right) - \left(\phi_H^S - \phi_H^U\right)^2\left(\frac{2\theta_H^T}{\gamma_H^T} - \overline{\Omega_H}\right)\right)$$

$$+\theta_i \left(\frac{\Delta^2 \left(\phi_A^S - \phi_A^U \right)^2}{\phi_i'^A} - \frac{\left(\phi_H^S - \phi_H^U \right)^2}{\phi_i'^H} \right).$$

Positive selection requires both lines to be positive which gives rise to conditions (38) and (39).