Immigration and the School System*

Facundo Albornoz† Antonio Cabrales‡ Esther Hauk§

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Abstract

Immigration is an important feature of many societies, and it has wide-ranging effects on the education systems of host and source countries. There is now a large empirical literature, but very little theoretical work on this topic. We study a model of family immigration in a framework where school quality and student outcomes are determined endogenously. We explain the selection of immigrants in terms of parental motivation and discuss the selection effect of different immigration policies. We provide novel evidence that is consistent with one of our main theoretical results: for a given socioeconomic background and skill level of parents, school performance of immigrant children in Spain improves with parental immigration costs. We also provide a detailed analysis of 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.


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†Universidad de San Andrés; email: falbornoz@udesa.edu.ar
‡Department of Economics, University College London; email: a.cabrales@ucl.ac.uk
§Instituto de Análisis Económico (IAE-CSIC) and Barcelona Graduate School of Economics, Campus UAB, Bellaterra (Barcelona); email: esther.hauk@iae.csic.es
1 Introduction

Immigration is a prevalent feature of many societies. Given that immigration involves families, the future of the host societies depends on how immigrant children perform at school and how their presence affects the school system.\(^1\) Clearly, the school success of immigrant children has a direct impact on human capital accumulation in the host country. But also, as immigrant children are to be schooled, they change classroom composition and school resources. Therefore, they might have a sizable (not necessarily negative) impact on school quality and the performance of their native peers.\(^2\) The goal of this paper is to clarify the effect of immigration on schooling through changes in class composition, school resources and parental and teachers’ involvement in the learning process.

Logically, the educational effect of immigration is a core concern of policy makers and has attracted a massive research effort to understand this phenomenon.\(^3\) Most of this 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 develop a framework to study the theoretical links between

\(^1\)To grasp the importance of immigrant children, according to the US Census Bureau, 34% of all youth aged 15-19 in 2000 were from minority groups and one in five school-age children live in immigrant families (Kao and Thompson, 2003). The Innocenti Research Center reports that almost a quarter of children were immigrants in 2009 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).

\(^2\)Similarly, immigration may affect class composition and school resources in the source country when migrants take their children with them.

\(^3\)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 Kilpi, 2008; Anghel and Cabrales, 2014). 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, 2013, 2011). 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)).
immigration and schooling and, within the confines of this unified framework, we explain different facts uncovered by the empirical literature and our own work.

In any theory connecting immigration with schooling, student outcomes must be determined endogenously as a result of the interplay between different families (immigrants and natives) and the school system. In our model, parents (immigrants and native) not only differ in their wages (reflecting different talent or skills), but also in “(parental) motivation”; a term we use to refer to parents’ concerns about their children’s education achievement. Thus, the schooling effects of immigration must be mediated by parents’ characteristics, reflected in their wages and parental motivation. We show how introducing this dimension into a theory of education and migration choices help us understand the empirical relationship established between immigration costs and student performance, as well as many other important facts already uncovered by the literature.

Within our framework, we address two different but related research questions. 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 also 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.

In our framework, 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. We first establish why immigration receiving countries would like to attract immigrants with a high parental motivation. First, we obtain the obvious but reassuring result according to which children’s learning effort increases in parental motivation; hence highly motivated immigrant parents are more likely to have skilled children thereby positively contributing to the future human capital of their host country. But we also
obtain a subtler result between school quality and immigration: when school quality is sufficiently high, as it is usually the case of host countries, school involvement increases in parental motivation. In other words, the endogenous school quality improves with higher parental motivation.

By embedding our theory of education into a model of immigration decisions, we identify conditions under which migration is selected by parents with higher parental motivation. These conditions involve a sufficiently high expected absolute skill premium for the immigrant children relative to the parental wage gain from immigration and sufficiently strong education incentives at the host country. Meeting these conditions implies a positive selection in terms of parental motivation within different skill levels. The empirical observable implication of this result is that, under the conditions for positive selection, student performance of immigrant children should be better the higher the costs associated with migrating from the source country. In the empirical appendix of this paper, we discuss original empirical evidence consistent with this result. More specifically, we exploit the standardized evaluation of the universe of students at the region of Madrid (Spain) and show that immigrant children in the Madrid region perform better if their parents faced higher emigration costs. Importantly, this result is robust to controls for different family and country of origin characteristics. That is, the positive association between immigration costs and school performance cannot be easily explained by pure selection of immigrations in skills or education levels.

Another implication of our result on motivation-based selection is that the performance of immigrants at school from the same origin country varies across destinations. Dustmann, Frattini, and Lanzara (2012) find that Turkish immigrants outperform those of the same cohort who stayed in Turkey. This difference in educational achievement between migrants and non-migrants from the same country persists even after controlling for family education background and socioeconomic characteristics. Although consistent with our model, this result may reflect a higher quality of the school system at the host countries. In fact, Dustmann, Frattini, and Lanzara (2012) consider Austria, Germany, Switzerland and Denmark; destination countries which perform similarly in

\[4\] Notice that our notion of positive immigrant selection is very different from the typical notion of positive immigrant selection in terms of skills in the immigration literature as analyzed for example by Borjas (1987, 1999). In this literature the skill premium is also important: Grogger and Hanson (2011) account for positive selection in terms of skills associated with the absolute difference in earnings of skilled workers at the host and source country. But the only skill premium that matters in this literature would be our parental skill premium. In our model selection is in terms of parental motivation and the expected skill premium of the children is crucial.
reading and maths at the PISA assessment but with scores considerably higher than those obtained by Turkey. However, Turkish emigrants in Switzerland and Denmark outperform those who migrated to Germany and Austria despite the relatively similar levels of the school quality in these countries. Again, this result is not explained by differences in education levels of parents and socio-economic characteristics. Our model can explain this fact as costs of migrating to Switzerland and Denmark are arguably higher than those associated with Germany and Austria; where the Turkish community is large and strong.

Next, we turn to a more nuanced analysis of the effect of immigration on the school system. Of course, more (less) motivated immigrant parents 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 show that positive selection in parental motivation might not have a positive effect on the school quality if immigration mainly involves low skilled workers. In this case, high parental involvement of immigrant parents will crowd out school involvement and negatively hit native students.

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 parental 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. Evidence of immigration reducing public education expenditures in Europe is provided by Speciale (2012). Therefore, immigration also affects schooling through the responses of the education policy, not only by the presence of immigrants themselves.

This paper is related to a recent literature that focuses on how the effect of different education policies depends on the behavioral responses of the different actors involved in the education process. For example, Pop-Eleches and Urquiola (2013) find a positive effect of school quality on student scores for the case of Rumanian high schools. Furthermore, they show as well that

\footnote{The evidence provided by Dustmann, Frattini, and Lanzara (2012) suggests that there has to be a within skill attribute.}

\footnote{Our analysis also shows how the exogenous quality of the school system influences immigrant selection in terms of parental motivation.}
parental effort and quality-improving school activities substitute with each other, as in our model.\footnote{Additional evidence of the substitution between parental effort and school resources is provided by Houtenville and Smith Conway (2008)} Stinebrickner and Stinebrickner (2008) and De Fraja, Oliveira, and Zanchi (2010) provide empirical evidence on the positive impact of parental and student effort on educational achievement. De Fraja, Oliveira, and Zanchi (2010) also find that school motivational activities are positively associated with student scores.\footnote{Sahin (2004) provides another example of how parent and student responses affect the impact of education policies for the case of higher education tuition subsidies. Evidence of the interaction between parents and the school system mediated by monitoring of schools is offered by Liang and Ferreyra (2011).} Albornoz, Berlinski, and Cabrales (2011) rationalize all these empirical findings in a model that connects the effect of education policy on student outcomes with the behavioral responses of students, teachers, parents and education authorities to policy-driven changes in classroom composition. Our model retains this element but focuses on the endogenous determination of immigration selection and its effects on native students and school quality.

Our work contributes to an incipient theoretical literature focusing on how immigration affects the education system at the host country. In a recent paper, Dottori, Estevan, and Shen (2013) show that if the immigrant population has low skills, there is a push for high-skilled natives to segregate into private schools. This, in turn, makes them less keen to finance of public education, which entails a negative shock on the welfare of less-skilled natives. Farre, Ortega, and Tanaka (2011) establish similar results in a calibrated model for the Spanish education system. In particular, they find that the increase of the immigrant population led to a large reduction of about 11 percent in public spending per student.

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 immigrant selection and discuss under which circumstances higher emigration costs can improve parental selection. Appendix A provides evidence of a positive relationship between immigration costs and immigrant children school performance. Section 4 studies the implications of the model for the school performance of natives and immigrants. Section 5 examines how these implications differ according to the skill composition of immigrant parents. Section 6 looks at the implications of immigration for school resources. Section 7 discusses some immigration policy implications and concludes.
2 Parental motivation and the school system

In this section, we develop the basic model of the school system. To fix ideas, we focus on the host country, although our analysis extends straightforwardly to the case of the source country. As in Albornoz, Berlinski, and Cabrales (2011), our 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 also assume that every parent has one child. We now describe our different actors in detail.

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 \( c_p \) be the strength of parental involvement for every unit of child’s effort \( e_i \). Similarly, \( c_T \) refers to the strength of the school /teacher’s involvement. As suggested by empirical evidence (Houtenville and Smith Conway, 2008; Pop-Eleches and Urquiola, 2013), we assume that parents and school involvements are substitutes. We assume that both parental and school involvement enter positively into the children’s short-term utility which is given by:

\[
U^c_i = (c_p + c_T) e_i - \frac{1}{2} e_i^2, \tag{1}
\]

where \( e_i^2 \) is the cost of learning.

The parents’ utility function:

\( c_p \) Parental involvement includes activities at home like supervising children, explicit help with the homework, discussing school issues and providing reward schemes as well as school based activities like volunteering at school, attending school functions etc (Hoover-Dempsey and Sandler (1997)).

\( c_T \) Schools organize motivational schemes and special outings (e.g. school trips, theatre and museum visits) and set learning goals choosing reward schemes.

\( c_T \) 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.

\( c_T \) Instead of using positive reinforcement for learning efforts parents and schools could also work with punishment when children do not study. It is not difficult to see that negative reinforcement induces the same behavior in children than the positive reinforcement we model here.
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 by $w_s$ and $w_u$ respectively.\(^{13}\) Hence a child’s future labor market prospect is given by

$$w^c_i = w^s_i e_i + (1 - e_i) w^u_i.$$ \hspace{1cm} (2)

Parents differ in their parental motivation\(^{14}\) which is modeled as the weight $\theta_i$ a parent gives to her child’s labor market prospect in her utility function.\(^{15}\) Parents also value their own welfare $W^P_i$. Hence parental utility is given by

$$U^P_i = \theta_i w^c_i + W^P_i.$$  

A parent has to split her total time $T$ between working and setting up and executing an incentive plan for her child. The time to generate the reward is given by $c_p e_i / 2$, while the cost of generating incentives for their child is the foregone parental wage $w^p_i$\(^{16}\). Hence, the parental utility function is given by the expression

$$U^P_i = \theta_i (w^s_i e_i + (1 - e_i) w^u_i) + \left(T - \frac{1}{2} c_p e_i\right) w^p_i.$$ \hspace{1cm} (3)

The school’s utility function:

Schools/teachers also fully understand and care about the future job perspectives of their students, assigning weight $\theta^T$ to the average student’s success. The teachers have to decide how much of the time $T_T$ that remains

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\(^{13}\)These wages can differ across countries as well as between natives and immigrants.

\(^{14}\)Heterogeneity in parental motivation is one of the major differences of the present model to Albornoz, Berlinski, and Cabrales (2011).

\(^{15}\)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.

\(^{16}\)Our model could be modified to incorporate parental talent $v^P_i$. On the one hand, parental talent $v^P_i$ increases wages $w^P_i = v^P_i \phi^P_i$ where $\phi^P_i$ refers to the parental baseline wage rate. 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 $c_p e_i / 2 v^P_i$. Introducing talent into our model would only complicate the exposition but would not affect the main results.
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 tutoring) which are paid at wage rate $w^T$. The teacher’s time spent generating the reward $c_T$ is equal to $\frac{1}{N} \sum_{i=1}^{N} \frac{1}{2} c_T e_i$, where $N$ is the total number of children in the classroom. The school/teacher’s utility function is therefore

$$U^T = \frac{\theta^T}{N} \sum_{i=1}^{N} (w_s^c e_i + (1-e_i) \ w_u^c) + \left( T_T - \frac{1}{2N} \sum_{i=1}^{N} c_T e_i \right) w^T. \quad (4)$$

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

$$U^T = \frac{\theta^T}{N} \left( (w_s^c - w_u^c) \left( \sum_{k=1}^{N_N} c_k + \sum_{l=1}^{N_I} e_l \right) + w_u^c N \right) + \left( T_T - \frac{c_T}{2N} \left( \sum_{k=1}^{N_N} c_k + \sum_{l=1}^{N_I} e_l \right) \right) w^T. \quad (5)$$

**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 the optimal strength of their educational involvement in each unit of child’s effort: $c_{pi}$ and $c_T$ 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 $c_{pi}$ and school incentives $c_T$ as given. This leads to the following optimal effort decision by the children

$$e_i = c_{pi} + c_T. \quad (6)$$

In words, children’s effort is simply the sum of parental and school educational involvement. We can now turn to the first-stage of the game where we need to substitute this expression (6) into the parent’s utility (3) and the school’s utility (5). Taking the optimal effort decision of children (6) into account, the teacher’s problem is to choose the level of $c_T$ that maximizes

\textsuperscript{17}In order to ensure an interior solution, we impose motivation rewards to be positive as to avoid corner solutions where $c_{pi}$ and $c_T$ may be zero.
\[ U^T = \frac{\theta^T}{N} \left( (w_s^c - w_u^c) \left( \sum_{k=1}^{N_N} (c_{p_k} + c_T) + \sum_{l=1}^{N_I} (c_{p_l} + c_T) \right) + w_u^c N \right) + \left( T - \frac{c_T}{2N} \left( \sum_{k=1}^{N_N} (c_{p_k} + c_T) + \sum_{l=1}^{N_I} (c_{p_l} + c_T) \right) \right) w^T. \]

leading to the optimal school involvement/incentives
\[
    c_T = \frac{\theta^T}{w^T} (w_s^c - w_u^c) - \frac{N_N \overline{c_p} + N_I \overline{c_p}}{2N},
\]

where
\[
    \overline{c_p} = \frac{1}{N_N} \sum_{k=1}^{N_N} c_{p_k}, \quad \overline{c_p} = \frac{1}{N_I} \sum_{l=1}^{N_I} c_{p_l}.
\]

The strength of the school involvement depends on the average parental involvement of both natives and immigrants, to which we turn now. Parents choose their incentive scheme \( c_{p_i} \) to maximize
\[
    U_i^P = \theta_i (w_s^c (c_{p_i} + c_T) + (1 - (c_{p_i} + c_T)) w_u^c) + \left( T - \frac{1}{2} (c_{p_i} + c_T) c_{p_i} \right) w^p.
\]

leading to the optimal parental choice
\[
    c_{p_i} = (w_s^c - w_u^c) \frac{\theta_i}{w^p} - \frac{1}{2} c_T.
\]

We define relative parental concern \( \psi_i \) as the ratio of parental motivation to their wage
\[
    \psi_i = \frac{\theta_i}{w^p}.
\]

Also, we define the average relative parental concern among the native and foreign population as
\[
    \overline{\psi}_k = \frac{1}{N_k} \sum_{i=1}^{N_k} \frac{\theta_i}{w^p_i} = \frac{1}{N_k} \sum_{i=1}^{N_k} \psi_i \text{ for } k = N, I.
\]

Using this notation, we can now derive the interior solution of the game.
Lemma 1. For a given school the optimal strength of parental and school involvement are

\[ c_{p}^j = \max \left[ 0, (w_{c}^s - w_{c}^u) \left( \psi_{p}^j \frac{2}{3} \theta^T \frac{N_{I}^{\Omega_I} + N_{N}^{\Omega_N}}{3(N_{N} + N_{I})} \right) \right] \] (11)

\[ c_{T} = \max \left[ 0, \frac{2}{3} (w_{c}^s - w_{c}^u) \left( \frac{2 \theta^T}{w^T} \frac{N_{I}^{\Omega_I} + N_{N}^{\Omega_N}}{3(N_{N} + N_{I})} \right) \right] . \] (12)

where \( j = N \) refers to natives and \( j = I \) to immigrants.

If both the schools and the child’s parent choose a positive strength of involvement the corresponding child’s effort is

\[ e_{i}^j = (w_{c}^s - w_{c}^u) \left( \psi_{i}^j + \frac{2}{3} \theta^T \frac{N_{I}^{\Omega_I} + N_{N}^{\Omega_N}}{3(N_{N} + N_{I})} \right) \] for \( j = N, I \) (13)

Proof. See Appendix B.1. □

The above expressions indicate that school and parental involvement are substitutes. Both involvements are driven by the potential gains from education captured by \((w_{c}^s - w_{c}^u)\). School involvement increase in school motivation \(\theta^T\) and decrease in teacher’s outside job opportunities \(w^T\) and in average relative parental concern since \(\frac{N_{I}^{\Omega_I} + N_{N}^{\Omega_N}}{(N_{N} + N_{I})} = \frac{1}{N} \sum_{i=1}^{N} \psi_{i}\). The higher this average, which implies the more parents care on average for education, the higher parental involvement in their child’s education.

An interior solution (i.e. a solution with \( 0 < e_{i}^j < 1 \)) exists where both the parents and the school choose positive strengths of learning involvement for some conditions on the distribution of \(\psi_{i}^j\). Specifically, positive strengths require \(\psi_{i}^j + \frac{N_{I}^{\Omega_I} + N_{N}^{\Omega_N}}{3(N_{N} + N_{I})} > \frac{2}{3} \frac{\theta^T}{w^T} \frac{N_{I}^{\Omega_I} + N_{N}^{\Omega_N}}{3(N_{N} + N_{I})}\) which is a relationship comparing parental motivation and their wages with school motivation and wages for outside job opportunities for teachers. Observe that \(\frac{\theta^T}{w^T}\) can be interpreted as a measure of school quality and we will refer to it as net/relative school concern. Hence the condition for positive incentives can be interpreted as a relationship between school quality measured by the relative school concern and individual and average parental quality measured by the relative individual parental concern and relative average parental concern respectively.

Until now, we have allowed parental concerns to be unrelated to 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 \( \theta^T \) depends on the average parental motivation. That is,

\[
\theta^T = k\bar{\theta} = \frac{k}{N} \sum_{i=1}^{N} \theta_i,
\]  

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.

Using assumption 1 in equation (12), we can express the optimal strength of school involvement as:

\[
c^T = \max \left[ 0, \frac{2(w^c_s - w^c_u)}{3N} \sum_{i=1}^{N} \left( \left( \frac{2k}{w^T} - \frac{1}{w^p} \right) \theta_i \right) \right],
\]  

(15)

Hence, schools will only choose a positive strength of involvement if

\[
\sum_{i=1}^{N} \left( \frac{2k}{w^T} - \frac{1}{w^p} \right) \theta_i > 0.
\]  

(16)

In words, parental involvement will not crowd out school involvement if the relative school concern is at least half the size of the average relative parental concern. Schools must care sufficiently about their students’ performance. Moreover,

Proposition 1 School involvement \( c^T \) increases in parental concern \( \theta_i \) if and only if \( w^p > \frac{w^T}{2k} \).

Proof. To see how positive school involvement changes with parental motivation we need to look at

\[
\text{sign} \frac{\partial c^T}{\partial \theta_i} = \text{sign} \left( \frac{2k}{w^T} - \frac{1}{w^p_i} \right),
\]

which tells us that school involvement (15) increases in parental motivation for parents whose wages are such that \( 2k/w^T > 1/w^p_i \).

The ratio \( \frac{k}{w^T} \) is the exogenous term determining the net school concern \( \bar{\theta} = \frac{k}{w^T} \bar{\theta} \) and can therefore be interpreted as the exogenously given school
quality. It is also (proportional to) the marginal effect of parental motivation of parent $i$ on the net school concern while the marginal effect on average relative parent concern is (proportional to) $\frac{1}{w_{pi}}$. The condition of Proposition 1 relates parental wage, namely the opportunity cost of parental involvement, to the inverse of exogenous school quality which is the ratio of the school’s opportunity cost of teacher’s involvement to the weight schools give to the future performance of their students. A higher parental concern will increase parental involvement but this increase might affect school involvement negatively since parental and school involvement are substitutes. A sufficiently high exogenous school quality make school involvement more valuable and allows for both parental and school involvement to increase in parental concern. Therefore the lower bound on parental wage for school involvement to increase in parental concern is proportional to the inverse of exogenous school quality.

Assumption 1 allows us to characterize how a child’s learning effort depends on parental motivation, namely

$$ e_i = (w^c_s - w^c_u) \left( \frac{\theta_i}{w^p_i} + \frac{1}{3N} \sum_{i=1}^{N} \left( \frac{2k}{w^T_i} - \frac{1}{w^p_i} \right) \theta_i \right), $$

(17)

From this equation it is straightforward to establish:

**Proposition 2** Children’s learning effort is always increasing in parental motivation $\theta_i$.

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

Propositions 1 and 2 reveal the crucial role of parental concern/motivation. On the one hand, more motivated parents produce children with higher learning efforts. On the other hand, if schools have a sufficiently high exogenous quality, more motivated parents have a positive spillover on the entire system by leading to a higher school involvement $c_T$. Therefore, immigration receiving countries would like to attract immigrants with a high parental concern.

### 3 Immigrant self-selection

In this section, we study the immigration decision. There are two countries: Home ($H$), the source or origin country, and Abroad ($A$), the destination or host country. 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. Immigration policies may affect this distribution in various ways and we clarify
their impact in terms of whether they induce immigration to have a positive impact on the school system.

Both countries have a skilled and unskilled labor market and their schools system can be described by the model of the previous section.\(^{18}\) However, they may differ in the economic opportunities and the quality of the school system. Based on these parameters, parents estimate the expected utilities of both staying and leaving their country of origin. Immigration requires the utility difference to be higher than the immigration cost.

Let \(U_{P_i}^j\) denote parental utility when living within country \(j\), namely

\[
U_{P_i}^j = \theta_i \left( e_{s_i}^j \left( w_{s_i}^j - w_{u_i}^j \right) + w_{u_i}^j \right) - \frac{1}{2} c_{p_i}^j e_{s_i}^j w_{p_i}^j + Tw_{p_i}^j \text{ for } j = H, A \tag{18}
\]

Using the optimal involvement and effort decisions derived in Lemma 1, the parental utility after some simplification becomes

\[
U_{P_i}^j = Tw_{p_i}^j + \theta_i w_{u_i}^j + \frac{w_{p_i}^j}{2} \left( e_i^* \right)^2 \text{ for } j = H, A \tag{19}
\]

where \(e_i^*\) is the optimal learning effort of \(i\)'s child when schooled in country \(j\) which by (13) is

\[
e_i^* = \left( w_{s_j}^c - w_{u_j}^c \right) \left( \psi_i^j + \frac{2}{3} \theta_i^j w_{Tj}^j - \frac{\Omega_j}{3} \right) \quad \text{for } j = H, A
\]

where \(\Omega_j = \frac{1}{N_j} \sum_{k=1}^{N_j} \psi_k^j\) is the average relative parental concern in a school in country \(j\). We can therefore write parental utility as

\[
U_{P_i}^j = Tw_{p_i}^j + \theta_i w_{u_i}^j + \frac{(w_{s_j}^c - w_{u_j}^c)^2}{2} \left( \frac{\theta_i^2}{w_{p_j}^j} + 2\theta_i \left( \frac{2}{3} \frac{\theta_i^j}{w_{Tj}^j} - \frac{\Omega_j}{3} \right) \right) + w_{p_i}^j \left( \frac{2}{3} \frac{\theta_i^j}{w_{Tj}^j} - \frac{\Omega_j}{3} \right)^2
\]

Observe that the first term of parental utility \(Tw_{p_i}^j\) corresponds to the maximum earnings from working (what a parent can get by working all the time), while the second term \(\theta_i w_{u_i}^j\) reflects the parental utility if the child does not make any educational effort. Parental involvement in the child’s education

\(^{18}\)We are implicitly assuming that how learning incentives translate into the probability of getting a skilled job in the country in which education was received is the same across countries. The crucial element in our analysis is that learning effort is endogenously determined according to different country characteristics.
increases the parental utility whenever future skilled jobs are better paid than future unskilled jobs; that is if \( w_{c_s} > w_{c_u} \), as is reflected in the third term of (20). A parent \( i \) will emigrate from country \( H \) to country \( A \) if \( U_A^i - F_i > U_H^i \). From (20) it follows that

\[
\text{Lemma 2 } U_A^i - F_i > U_H^i \text{ if and only if } \frac{T}{2} \left( w_{p_i}^A - w_{p_i}^H \right) + \theta_i \left( w_{c_s}^A - w_{c_u}^A \right)^2 \frac{w_{p_i}^A}{w_{p_i}^H} - \frac{\theta_i}{2} \left( w_{s_A}^c - w_{u_A}^c \right)^2 \frac{w_{s_h}^c - w_{u_h}^c}{w_{p_i}^H} \left( \frac{2}{3} \frac{\theta_A^T}{w_{s_A}^T} - \frac{\Omega_A}{3} \right) - \frac{\theta_i}{2} \left( w_{s_h}^c - w_{u_h}^c \right)^2 \left( \frac{2}{3} \frac{\theta_H^T}{w_{s_h}^T} - \frac{\Omega_H}{3} \right) \left( w_{s_A}^c - w_{u_A}^c \right)^2 \frac{w_{p_i}^A}{w_{p_i}^H} \left( \frac{2}{3} \frac{\theta_H^T}{w_{s_h}^T} - \frac{\Omega_H}{3} \right) \left( w_{s_h}^c - w_{u_h}^c \right)^2 \frac{w_{p_i}^A}{w_{p_i}^H} \left( \frac{2}{3} \frac{\theta_A^T}{w_{s_A}^T} - \frac{\Omega_A}{3} \right) > F_i.
\]

Since the primary motive for emigration is the possibility 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 \( w_{p_i} \), expected child’s wage if skilled \( w_{c_s} \) and if unskilled \( w_{c_u} \)) must be strictly higher. Then we can interpret the condition for immigration in Lemma 2 as follows: \( T \left( w_{p_i}^A - w_{p_i}^H \right) + \theta_i \left( w_{c_s}^c - w_{c_u}^c \right) \) 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 \( w_{p_i}^A \geq w_{p_i}^H \) and the unskilled child might also earn more money \( w_{c_u}^c \geq w_{c_u}^c \) which is weighted by the parental concern parameter \( \theta_i \). The remaining 3 lines of the sum describe the change in parental utility from emigrating that is achieved by incentivizing the child at school and can be rewritten as \( \frac{w_{p_i}^A}{2} e_A^2 - \frac{w_{p_i}^H}{2} e_H^2 \) (see equation (19)). Parents and schools want to incentivize 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 parental involvement in incentivizing the child, a higher wage has a negative effect on effort as captured by \( w_{p_i} \) dividing in the second line of the sum. However, since school involvement and parental involvement are substitutes a higher \( w_{p_i} \) 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
\[ \xi_i \equiv (\theta_i, w_{A}^{p_i}, w_{H}^{p_i}) \in \Xi, \]
characterizes each individual belongs to a finite set of types \( \Xi \). At the same time the variable \( F_i \) follows the distribution \( F(.) \) in the compact interval \([0, A]\), where we assume \( A > \max_{\xi_i \in \Xi} U_{P_i} \). Note that according to equation (21) if an individual with type \( \xi_i \) 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 \( F_\xi \) such that for all \( i \) with \( \xi_i = \xi \in \Xi \) the individual moves to \( A \) if and only if \( F_i < F_\xi \). Thus,

**Proposition 3** An equilibrium in immigration decisions always exists.

**Proof.** See Appendix B.2. \[ \blacksquare \]

Understanding the effects of differences in parental motivation on the host and source countries requires further clarification about how individuals from \( H \) self-select into the migrant population. We turn to this question in the following subsections.

### 3.1 When immigration does select the most motivated parents

We aim at identifying the conditions under which the most motivated parents from a source country are those who self-select into immigration. As migrating is an individual decision, potential immigrants take \( \Omega_A \) and \( \Omega_H \) as given. This is the same as assuming:

\[
\frac{\partial \Omega_A}{\partial \theta_\xi} = \frac{\partial \Omega_H}{\partial \theta_\xi} = 0
\]

Using the link of school motivation to parental motivation stipulated in assumption 1 and the condition for immigration stated in Lemma 2, we obtain the following crucial result:

**Proposition 4** Assume that wages in the host country are at least as high as wages in the source country. Then, for any skill level, immigrant selection is positive in parental motivation if the following conditions are satisfied:
1. **Absolute Skill Premium:**

\[
\frac{(w^c_s - w^c_u)}{(w^c_s - w^c_u)} > \sqrt{\frac{w^p_A}{w^p_H}} \tag{22}
\]

2. **External Education Incentives:**

\[
w^e_u + \frac{1}{3} (w^e_s - w^e_u)^2 \left( \frac{2k_A}{w^T_A} \bar{\theta}_A - \bar{\Omega}_A \right) \\
\geq w^e_{u_H} + \frac{1}{3} (w^e_s - w^e_{u_H})^2 \left( \frac{2k_H}{w^T_H} \bar{\theta}_H - \bar{\Omega}_H \right) \tag{23}
\]

**Proof.** It follows from inspection of equation 21. See Appendix B.3 for the details.

The ratio of absolute skill premia for children between the receiving and sending countries has to be higher than the (square root of) ratio of parental wages in sending and receiving countries (the gain from immigration). This condition places an upper bound on parental wages abroad, which nicely captures the trade-off parents face when incentivizing their children: forgo parental wage versus higher expected wages for their children. A sufficiently high absolute skill premium for children guarantees that parents incentivize their children more abroad than at home. But this is not sufficient for positive parental selection. The external environment at the host country has to be sufficiently favorable. To see this, notice that condition (23) can be reformulated as:

\[
w^e_u + \frac{1}{2} (w^e_s - w^e_u) c^A_t \geq w^e_{u_H} + \frac{1}{2} (w^e_s - w^e_{u_H}) c^H_t \tag{24}
\]

Thus, we can interpret education incentives as a measure of the expected wage increase for a skilled child weighted by the education incentives provided by the school. This measure has to be higher at the host country. It is instructive to consider a situation in which both countries are identical except for their wage structure. More technically,

**Corollary 1** If the host and the source countries have the same exogenous quality of the school system \((2k_A/w^T_A = 2k_H/w^T_H)\); the same initial distribution

---

19 Notice that this condition can be satisfied even if the relative skill premium is lower in the host country. We are interested in the future human capital of children and therefore in parental selection, for which the absolute skill premium for children matters more. Grogger and Hanson (2011) document the importance of the absolute skill premium for parents to explain immigrant selection in parental education.
of parental motivation; the same distribution of parental motivation among skill groups; and the same proportion of people in skilled employment, then a higher absolute skill premium at the host country is sufficient for inequality (23) to hold.

**Proof.** Notice that due to the equality in exogenous school quality

\[
\left( \frac{2k_A}{w_A^T} \theta_N - \Omega_A \right) > \left( \frac{2k_H}{w_H^T} \theta_H - \Omega_H \right) \iff \Omega_A \leq \Omega_H,
\]

or equivalently

\[
\frac{1}{N_H} \sum \theta_i / w_H^{p_i} \geq \frac{1}{N_A} \sum \theta_j / w_A^{p_j}.
\]

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 \(2k_A/w_A^T > 2k_H/w_H^T\), condition (23) is relaxed. This result suggests that immigration is more likely to positively select motivated parents when the host country pays a higher future absolute skill premium and school quality is better, provided that intrinsic parental motivation is not much higher in the source country. Arguably, this describes a situation where immigrants arrive to highly developed countries from developing countries.

Proposition 4 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. Notice that conditions (22) and (23) being satisfied characterize a situation where highly motivated parents enjoy relatively higher benefits from emigrating. As a consequence, selection improves with higher emigration costs.

**Proposition 5** For a given host country, immigrant children who perform better are those whose parents faced the higher emigration costs.

In Appendix A, we provide empirical support to this result. More precisely, we present novel empirical evidence according to which immigrant performance in the standardized exams for all primary schools in the Madrid region do indeed improve with emigration costs. Proposition 4 also implies the flip-side of the argument:

**Proposition 6** For a given origin country, immigrant children perform better in host countries for which the emigration costs are higher.
An interesting case consistent with this result is provided by Dustmann, Frattini, and Lanzara (2012), who show that Turkish immigrant children not only outperform kids staying in Turkey but also their student achievement varies across four countries with relatively similar education quality: Germany, Austria, Switzerland and Denmark. According to Dustmann, Frattini, and Lanzara (2012) Turkish immigrant children do considerably better in Switzerland and Denmark compared to similar Turkish immigrant children in Germany and Austria - conditional and unconditional on parental background characteristics and the quality of schools they attend. Given that migration costs from Turkey are arguably higher for Switzerland and Denmark than for Germany and Austria, this corollary provides an explanation to this fact.\footnote{The size of the Turkish community in Germany and Austria provides a reason why the migration costs from Turkey might be lower in these countries. Language distance between Danish and Turkish and relatively more strict immigration laws in Switzerland provide additional reasons.}

Our theory can also guide us when the conditions of proposition 4 fail and immigration no longer selects the most motivated parents.

### 3.2 When immigration does not select the most motivated parents

In this section, we briefly discuss the cases where the conditions for a positive selection of immigration in terms of parental motivation no longer hold. In these cases, migrants are not among those who are more motivated and thus the effect of immigration on the school system will be negative.

When both condition (22) and condition (23) are violated, both the parental trade-off, and the external education incentives are worse abroad than at home. This typically happens because the benefits from education abroad (the absolute skill premium) are lower than at home. Hence the incentives to educate children are weaker. Moreover, unskilled wages abroad cannot be much higher than at home. For this reason, parents with higher parental concerns would not migrate and immigrant selection would likely fall on the least motivated parents.

When condition (22) is violated but (23) 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 incentivize their children less, which is a loss for motivated parents. On the other hand, the external environment children face abroad is more favorable, 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.

When condition (22) is satisfied but (23) is violated, then parents set higher education incentives abroad than at home, but the external environment for children is worse abroad. The benefits of immigration (which are a quadratic function of $\theta$) first fall in parental motivation till they reach a minimum and then raise again. Hence, parents willing to emigrate, are likely to fall into the extreme ends of the distribution of parental motivation. Observe, that this case only happens rarely. To see this, recall that $w^e_{uA} > w^e_{uH}$ by assumption, hence $(w^e_{sA} - w^e_{uA}) > (w^e_{sH} - w^e_{uH})$ is a necessary (but not sufficient) condition for condition (22) to hold. This implies that the returns to education are higher abroad, which positively affect both parental incentives and school incentives. Therefore condition (23) can only be violated if external school quality and average parental motivation at home is much higher than abroad, and unskilled wages are very similar. But in this case also the last line of the condition to emigrate given by (21) will become negative and even very low $F_i$ might not be sufficient to induce emigration.$^{21}$

The empirical implications of the model can change considerably if we look at host and origin countries where condition (22) 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 (23) 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 immigration strategy of Argentina, which has one of the most lenient immigration regulations in the world (Albarracín, 2004).

If (23) 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 $\theta$. Under intermediate selection a decline in immigration costs will expand the interval of values of $\theta$ for which emigration occurs at both extremes which can influence in either direction the immigrants’ average level of $\theta$. More specifically, $^{21}$Observe that at least for low-skill immigrants, the main economic motive for immigration reflected by the value of $T(w^p_i - w^p_H)$ will also be very low.
if $\theta$ follows a non-increasing density function, then a reduction in immigration costs induces a decline in the average level of $\theta$ (McKenzie and Rapoport, 2010)

The above results indicate that immigration policies should be specific to the country of origin. For origin countries where both the condition on the absolute skill premium (22) and the condition on the external education incentives (23) are satisfied, imposing additional costs will improve immigrant selection in parental motivation. Otherwise, lowering immigration costs but setting strict and low quotas might be the better policy.

3.3 School quality

In the previous section, 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. $(\frac{2}{3} \theta^T_A w_A^T - \frac{\Omega_A}{3}) > (\frac{2}{3} \theta^T_H w_H^T - \frac{\Omega_H}{3})$. Under these assumptions immigration occurs if (21) holds which reduces to

$$\theta_i (w_s^c - w_u^c)^2 \left( \left( \frac{2}{3} \theta^T_A w_A^T - \frac{\Omega_A}{3} \right) - \left( \frac{2}{3} \theta^T_H w_H^T - \frac{\Omega_H}{3} \right) \right)$$

$$+ \frac{1}{2} (w_s^c - w_u^c)^2 w_p \left( \left( \frac{2}{3} \theta^T_A w_A^T - \frac{\Omega_A}{3} \right)^2 - \left( \frac{2}{3} \theta^T_H w_H^T - \frac{\Omega_H}{3} \right)^2 \right)$$

$$> F_i.$$

which after some examination implies:

**Proposition 7** 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 (25) with respect to $\theta$ and $\frac{2}{3} \frac{\theta^T_A}{w_A^T} - \frac{\Omega_A}{3} > \frac{2}{3} \frac{\theta^T_H}{w_H^T} - \frac{\Omega_H}{3}$ 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.

4 The school performance of immigrant and native children

Our model reveals that the effect of the immigration on the school system depends on the type of parents that immigrate. It can therefore guide us to understand empirical observations on immigrant school performance and their effects on native performance.

In empirical studies, student outcomes constitute a typical empirical measure of school quality. Since these outcomes depend on children’s learning effort we now examine this effort in more detail. It is clear from equation (13) that among children in the same school it is their parents’ characteristics \( \psi_i \), namely the relative parental concern - the net payoff from parental investment - , 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

\[
e^I_i - e^N_j = (\psi^I_i - \psi^N_j) (w^c_s - w^c_u)
\]

which implies that the effort of immigrant children is greater than of natives on average if and only if \( \Omega^I > \Omega^K \). Having established this, the next proposition follows immediately:

**Proposition 8** The children of immigrants exert more effort at a given school than natives if and only if the average relative parental concern is higher among immigrant parents than natives.\(^{22}\)

Therefore, immigrant children performing below average is a sign that immigration policies do not select on average the most motivated parents. Similarly, we can conclude that a highly performing immigrant child will have

\(^{22}\)While Proposition 8 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.
highly motivated parents. Indeed, Proposition 2 reveals that a higher parental motivation always translates into a better performing child via a higher education effort. From Proposition 1 we know that school involvement only increases in parental motivation of parents whose wage is not too low, in particular for parents where $w^p > \frac{w^T}{2k}$. Schools will still set incentive schemes for their students when this condition is violated for some parents but is satisfied for a sufficient amount of parents (technically, condition (16) holds). Highly motivated parents with too low wages in these types of schools have a negative effect on school involvement, but the direct effect of rising parental involvement on student effort offsets this 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.

The net parental concern $\psi_i = \frac{\theta_i}{w^p_i}$, also plays an important role in explaining the variation in school performance of native children due to immigration. Observe that we can rewrite the child’s effort (17) as

$$e_i = (w^e_s - w^e_u) \psi_i + \frac{1}{2} c_T.$$  

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 the net parental concern. A change in $c_T$ simply shifts the initial effort up (if immigrant parents are better on average) or down (otherwise), and therefore the relative change in effort is lower the higher the pre immigration effort level or equivalently, for children associated with a higher $\psi_i$. In other words, the performance of disadvantaged children (low $\psi_i$ parents) is more affected by immigration than that of their more advantaged classmates (high $\psi_i$ parents). The evidence for this effect is considerable. Focusing on the mass migration wave from the former Soviet Union to Israel in the early 1990s, Gould, Lavy, and Paserman (2009) 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. 

Expression (26) 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 $c_T$. According to (26), a higher level of $c_T$ 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 had better results in high school.

5 The effect of immigrant skill composition

Parental net concern reflects both parental skills which determine parental wages and pure parental motivation. This section disentangles the two parameters and serves to illustrate how different skill compositions effect the school system of the immigration receiving country and why. We first reformulate our results when schools’s involvement in providing incentives is positive (equation (16)) and how it varies with parental motivation (Proposition 1) in a world where parents can have skilled and unskilled jobs.

---

23Similarly, 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.

24The 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.
Lemma 3 In a school with $N^U$ unskilled and $N^S$ skilled parents with corresponding wages $w_u^p$ and $w_s^p = \alpha w_u^p$, where $\alpha > 1$, the school will choose a positive learning involvement if
\[
w_s^p = \alpha w_u^p > \frac{w^T}{2k}
\]
and
\[
w_u^p > \frac{w^T}{2k} (27)
\]
where $\beta = \frac{\sum_{i=1}^{N^S} \theta_i}{\sum_{i=1}^{N^U} \theta_i}$.

The school’s learning involvement always increases in the parental motivation of skilled parents. If
\[
w_u^p > \frac{w^T}{2k} (29)
\]
school involvement also increases in parental motivation of unskilled parents. However, if (29) fails then school involvement decreases in the parental motivation of unskilled parents.

Lemma 3 reveals that if unskilled wages are too low relative to the exogenous opportunity cost of schools to incentivize children (Condition (29) fails) then increasing parental motivation among unskilled parents will reduce school quality. In this case, positive school incentives require a sufficiently high skill premium captured by the parameter $\alpha$. A higher $\alpha$ relaxes both conditions (27) and (28) and hence favors school involvement in incentivizing students. The parameter $\beta$ compares total parental motivation of skilled parents with total parental motivation of unskilled parents and $\beta > 1$ if the former is bigger than the latter. A higher $\beta$ relaxes (28). The skilled group is sufficiently motivated so that the resulting positive effect on school incentive outweighs a potential negative effect of the unskilled parental group due to the violation of condition (29).

In the case where highly motivated unskilled parents have a negative effect on the school involvement and therefore impose a negative externality to the remaining parents it is important to distinguish parental skill from pure parental motivation. The need for this distinction becomes even more crucial when immigration changes classroom composition. To see why assume that (29) holds, which is likely in developed countries which are targeted by immigration since these countries typically have a reasonable exogenous level of school quality ($2k/w^T$). In other words keeping the skill level constant an increase in pure parental concern is always beneficial for school involvement in
providing incentives. However, things might look very different if immigration changes the skill composition at school. In a world with skilled and unskilled workers school incentives can also be rewritten as

$$c_T = \frac{2 \left( w_s - w_u \right)}{3 \left( N^U + N^S \right)} \left( \left( \frac{2k}{w_T} - \frac{1}{w_a} \right) N^U \theta^U + \left( \frac{2k}{w_T} - \frac{1}{\alpha w_a} \right) N^S \theta^S \right).$$

This expression allows us to disentangle the effect of only high skill and only low skill immigrations assuming a constant classroom size. 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 (since the weight given to \( \left( \frac{2k}{w_T} - \frac{1}{w_a} \right) \) is likely to be reduced and the weight given to the bigger term \( \left( \frac{2k}{w_T} - \frac{1}{\alpha w_a} \right) \) is likely to be increased). If, however, immigrants are all positively selected but unskilled, 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.

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, 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. Similar results are found by Cascio and Lewis (2012) who show that school districts in California with larger increases in low-English Hispanic enrollment are those which exhibited greater relative reductions in the rate of settlement of non-Hispanic children between 1970-2000. 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 parents were choosing public schools, while in 2008-09 this number raised to 77%.” Farre, Ortega, and Tanaka (2011)

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25If 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, or if immigration does not change the classroom composition of children with skilled versus unskilled parents then the natives always benefit if immigrants have a high parental motivation, and they suffer otherwise.
also discuss this phenomenon for the Spanish case, and provide a calibrated model where immigration is indeed the driving force for this sorting.

6 The effect of immigration on school resources

In this section, we allow school resources to be endogenous. 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. More resource reduce the teacher’s time cost of providing incentives, which we model by dividing this time cost by the amount of resources \( r \). We assume \( r \) is the same for all schools and it is announced by the policymaker before parents and headmasters decide on the level of incentives taking \( r \) as given. Given \( r \) the utility of a headmaster is now:

\[
U_T = \frac{\theta_T}{N} \sum_{i=1}^{N} (w_s c_i + (1 - e_i) w_u c_i) + \left( T_T - \frac{1}{2rN} \sum_{i=1}^{N} e_i c_T \right) w_T. \tag{31}
\]

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

Lemma 4 The optimal strength of the incentives set by parents are given by

\[
c_{ij} = (w_s - w_u) \left( \frac{2}{3} \frac{\psi_{ij} + 2r \theta_T}{w_T} + \frac{N_I \Omega_I + N_N \Omega_N}{3(N_N + N_I)} \right) \text{ for } j = N, I. \tag{32}
\]

while the optimal school incentives are

\[
c_A = \frac{2}{3} (w_s - w_u) \left( \frac{2r \theta_T}{w_T} - \frac{N_I \Omega_I + N_N \Omega_N}{(N_N + N_I)} \right). \tag{33}
\]

The learning effort of an immigrant child and a native child given by (6) are therefore

\[
e_i = (w_s - w_u) \left( \frac{2}{3} \frac{\psi_i + 2r \theta_T}{w_T} - \frac{N_I \Omega_I + N_N \Omega_N}{3(N_N + N_I)} \right) \text{ for } j = N, I \tag{34}
\]

Proof. See Appendix B.4.
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 (the median of the natives) given that 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.$^{26}$ The costs of resources $r$ are paid by parents through general taxation, which parents care about, and are internalized by the policymaker when deciding $r$. Resource costs are assumed to be quadratic.$^{27}$

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

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

(35)

where $\rho$ 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 (34) and (32) into (35), and then optimizing $U_{PM}$ over $r$ we obtain:

$$r = \frac{(w^c_s - w^c_u)^2}{3 \beta w^c} \left( \theta_{iM} + w^{pM} \left( \frac{N_I \bar{\Omega}_I + N_N \bar{\Omega}_N}{3(N_N + N_I)} \right) \right)$$

$$\rho - w^{pM} \left( (w^c_s - w^c_u)^2 \left( \frac{2 \beta^T}{3 w^c} \right)^2 \right)$$

Note that resources increase in the motivation of the immigrant populations through two sources. First $r$ is increasing in $\theta^T$ which by assumption 1 depends on the average motivation of the student parents. Secondly, it also depends positively on the parental motivation of immigrants through $\bar{\Omega}_I$. Hence, the parental motivation of immigrants reinforces the effects of immigrants selection that happen through $c_T$, which we already discussed in section 4. Thus, a poorly selected immigrant population in terms of parental motivation hits the native students (and the more motivated immigrants) directly through

$^{26}$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.

$^{27}$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.
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 edu-
cation 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 (2008). They provide
cross-country evidence (e.g. a mean-difference test) that countries that ex-
perience 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 nega-
tive 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 4, 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. The calibrated model of Farre, Ortega, and Tanaka (2011) also
indicates that immigration in Spain led to a large reduction of about 11 percent
in public spending per student.

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 $c_T$, 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 $\rho$, 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.

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 observable characteristics. Finally, we study endogenous reactions of the school system to the presence of immigrants, and through that channel, the impact on natives and immigrants alike.

Our model can also be used to inform about the effects of different policies in terms of the selection of immigrants in parental motivation. For example it suggests that the naturalization of immigrant children but not of the parents might be a good idea. Naturalization typically means easier access to better jobs in the future.\textsuperscript{28} If only children are naturalized these children but not parents their will have a higher wage prospective for high-skill jobs. In terms of our model this increases the range of parameters for which condition (22) holds and hence favors the selection of highly motivated immigrant parents and leads to better school performance of immigrant children.\textsuperscript{29}

Our model can also explain the bad school performance of children of guest workers in Germany who had to immigrate without their family and were allowed to reunite later on (Dronkers and de Heus, 2010). 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.\textsuperscript{30} Moreover, their children face the same external environment than if their

\textsuperscript{28}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 Fourg`ere and Foug`ere and Safi (2008) for France.

\textsuperscript{29}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.

\textsuperscript{30}Remittance by immigrants is often meant to keep their children in school or to pay for
parents had stayed at home. Incentivating their children has become harder but the benefits are the same, leading to a negative selection of immigrants in terms of parental motivation.\footnote{A formal analysis can be found in an earlier version of the paper on the authors' web-pages.}

We can also incorporate cultural concerns into our model by allowing parents to care for the cultural orientation in schools in their new home country. In other words, immigrant parents might feel culturally alienated and therefore reduce the value they assign to educating their children abroad. This affects the strength of their own parental involvement but also how they evaluated the external environment their children face abroad. The possibility of cultural alienation drives away the most motivated immigrants and may lead to negative selection.\footnote{A formal analysis can be found in an earlier version of the paper available on the authors’ web-pages.} This is particularly relevant for Muslim immigration to a western culture due to the considerable cultural difference and the fact that many Muslims have strong cultural concerns. The existent empirical evidence Dronkers (2010) is consistent with this finding. 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.\footnote{As captured by the degree of differentiation in secondary education.}

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 immigrant parents. 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.

In our model, we emphasize parental motivation as a key characteristic to understand the effects of immigration on human capital formation. Although clearly unobservable, parental motivation may be correlated with other relevant attributes like work ethic or sociability. Our analysis can be extended to understand the role of families in improving assimilation of immigrants and their impact on host societies. It is important to bear in mind that there is no clear correlation between parental motivation and other observable mea-

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\footnote{As captured by the degree of differentiation in secondary education.}
sures of skill intensity like, for example, years of schooling. In this sense, our analysis warns against immigration policies aiming exclusively at attracting immigrants merely on their skills.

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. In fact, Antman (2011) finds evidence of the negative effect of immigration on schooling in the source country. 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.

References


34For example, if (29) holds in the home country. The same is also true if (29) fails but conditions (27) and (28) hold and all emigrants are high-skilled.
35An interesting model analyzing when immigrants get political rights and its consequences is Ortega (2005).
36See Levy (2005) for an example of the subtle interaction between different types of groups and education provision in a political economy context.


A Empirical Appendix: Immigrant School Performance and Immigration Costs: Selection beyond skills

Since the school year 2004-2005, 6th grade students (approximately, 11-12 years old) from all primary schools in the Spanish region of Madrid have been taking a standardized exam called CDI (Prueba de Conocimientos y Destrezas Indispensables). Although the focus is on a particular region, the CDI has the advantage of covering the universe of schools independently on whether they are public, private or charter. Importantly, the CDI provides very precise information about the immigrant status of children and their parents. If immigrant, the CDI identifies for each student, the country of origin of the student and their parents, and the time since arrival to Spain. The case of Madrid is interesting because of the high proportion of immigrant population (17% in 2010), the variety of origins (the 10 top immigration origins explain 70% of total immigration; Romanians are the largest community comprising 20% of the total) and the fact that immigration is a relatively new phenomenon and most immigrants are first or second generation (immigrants comprised only a 0.5% of total population in 1981).

Table 1 reports the average scores from the different parts of the CDI exam in 2010 for ten of the most important migratory groups in Madrid. We also include Mathematics and Language scores. As our model emphasizes the role of parents in the education process, we consider that the country of origin is that of the father, independently on where the student was born.

Notice first that immigrants perform on average worse than Spanish students. Notice as well that the performance of immigrant students varies considerably across origins. The average score from the different parts of the exam is lower for those children whose father is a migrant from Ecuador, Bolivia, Dominican Republic or Morocco compared to those whose father is Romanian, Polish, Russian or Chinese. Surprisingly, Ecuadorians, Dominicans and Bolivians are outperformed by those students whose fathers are Romanian, Polish or Russian even in the Language test.

The fact that student performance varies across different immigration groups may be grounded in differences in immigration costs across source countries of

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37 In English “Indispensable Knowledge and Skills Exam”. More details about the exam are provided in subsection A.1.

38 This information is less precise in other standardized exams such as the PISA.

39 This information is provided by the Observatorio Permanente de la Inmigración and the Spanish Statistical Office.
Table 1: Mean scores in CDI test for principal migratory groups.

<table>
<thead>
<tr>
<th>Country of birth of the father</th>
<th>Total</th>
<th>Language</th>
<th>Mathematics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecuador</td>
<td>20.00</td>
<td>12.34</td>
<td>7.65</td>
</tr>
<tr>
<td></td>
<td>(8.99)</td>
<td>(4.85)</td>
<td>(5.18)</td>
</tr>
<tr>
<td>Romania</td>
<td>22.60</td>
<td>13.34</td>
<td>9.23</td>
</tr>
<tr>
<td></td>
<td>(9.35)</td>
<td>(4.90)</td>
<td>(5.47)</td>
</tr>
<tr>
<td>Morocco</td>
<td>18.66</td>
<td>11.09</td>
<td>7.51</td>
</tr>
<tr>
<td></td>
<td>(10.15)</td>
<td>(5.81)</td>
<td>(5.37)</td>
</tr>
<tr>
<td>Colombia</td>
<td>21.60</td>
<td>13.00</td>
<td>8.68</td>
</tr>
<tr>
<td></td>
<td>(8.99)</td>
<td>(4.82)</td>
<td>(5.27)</td>
</tr>
<tr>
<td>Peru</td>
<td>23.10</td>
<td>13.71</td>
<td>9.41</td>
</tr>
<tr>
<td></td>
<td>(8.90)</td>
<td>(4.47)</td>
<td>(5.43)</td>
</tr>
<tr>
<td>Bolivia</td>
<td>20.53</td>
<td>12.59</td>
<td>7.94</td>
</tr>
<tr>
<td></td>
<td>(9.15)</td>
<td>(4.94)</td>
<td>(5.30)</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>16.47</td>
<td>10.36</td>
<td>6.12</td>
</tr>
<tr>
<td></td>
<td>(9.58)</td>
<td>(5.69)</td>
<td>(4.98)</td>
</tr>
<tr>
<td>China</td>
<td>20.72</td>
<td>9.57</td>
<td>11.08</td>
</tr>
<tr>
<td></td>
<td>(10.71)</td>
<td>(6.71)</td>
<td>(5.27)</td>
</tr>
<tr>
<td>Poland</td>
<td>25.63</td>
<td>14.98</td>
<td>10.69</td>
</tr>
<tr>
<td></td>
<td>(8.51)</td>
<td>(3.99)</td>
<td>(5.47)</td>
</tr>
<tr>
<td>Russia</td>
<td>27.54</td>
<td>15.57</td>
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<tr>
<td>Average for immigrants</td>
<td>21.88</td>
<td>12.97</td>
<td>8.89</td>
</tr>
<tr>
<td></td>
<td>(9.63)</td>
<td>(5.16)</td>
<td>(5.54)</td>
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<td>Average for all students</td>
<td>25.88</td>
<td>14.91</td>
<td>10.95</td>
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<td></td>
<td>(8.94)</td>
<td>(4.38)</td>
<td>(5.46)</td>
</tr>
</tbody>
</table>

Note: Standard deviations in parenthesis
immigrants. To test this conjecture, we estimate student scores for immigrant children using OLS in the following way:

\[ \text{Score}_{iks} = \text{Immigration Costs}_k \alpha + x_i' \beta + \gamma_s + \mu_{iks} \]

*Immigration Costs* is a vector with different proxies for the difficulty of migrating from origin country \( k \) to Madrid. To proxy these costs, we consider a dummy variable indicating whether \( k \) has Spanish as the official language \((\text{Common Language}_k)\); the log of bilateral distance between \( k \) and Madrid \((\ln(\text{Distance})_k)\);\(^{40}\), and the share of the migratory group over total immigration \((\text{Proportion of Migrants}_k)\). The implicit assumption is that immigration costs increase with distance, decrease with the share of the migratory group and are lower if a common language between both countries exists. Finally, we consider an alternative measure of migratory fixed costs \((\text{Fixed HG}_k)\), proposed by Grogger and Hanson (2011).\(^{41}\) Their estimations of migratory fixed costs are meant to capture direct monetary cost of migration (as can be explained by distance) and the monetary value of psychological costs and source-specific immigration policies imposed by Spain (which can be potentially associated with the existence of a common language or a large community of migrants from the source country).\(^{42}\)

Other potential determinants of student performance are included in the vector \( x_i' \) and explicitly discussed below (subsection A.1. These variables control for socioeconomic background of students. Finally, \( \gamma_s \) captures school fixed effects. As scores may be associated with specific characteristics of the migratory group and the schools they may concentrate, we cluster errors to allow within source country groups and within school correlation.

Table 2 reports the main results. We focus on the aggregate scores in 2010 which include those obtained in the mathematics and language parts of the exam. As we discuss below, our findings are qualitatively similar when we use the scores in Mathematics and Language separately.

In column (1) we test the performance of the student in the CDI against \( \text{CommonLanguage}_k \). The coefficient associated with this variable is both negative and significant. That is, coming from a Spanish speaking country has

\(^{40}\)Bilateral distances are calculated as the distance between the biggest cities from two countries, weighted for the share of the city in the overall country population. Variables of distance are obtained from CEPII website: http://www.cepii.fr/.

\(^{41}\)Migratory fixed costs estimations by source-destination pair, available online at: http://harrisschool.uchicago.edu/research/data/migration-data

\(^{42}\)Migratory fixed costs estimated by Grogger and Hanson (2011) are not available for some relevant source countries as Morocco and Argentina, which have been excluded in this specification.
Table 2: Dependent Variable: Standardized Aggregate Score in the CDI exam

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Language</td>
<td>-0.117***</td>
<td>-0.227***</td>
<td>-0.158***</td>
<td>-0.320***</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.035)</td>
<td>(0.037)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>ln(Distance)</td>
<td>0.081***</td>
<td>0.066***</td>
<td>0.132***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.019)</td>
<td></td>
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<tr>
<td>Immigrant Share</td>
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<td>-0.294**</td>
<td></td>
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<tr>
<td></td>
<td>(0.136)</td>
<td>(0.138)</td>
<td></td>
<td></td>
</tr>
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<td>Ln(GDPpc2010)</td>
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<tr>
<td></td>
<td>(0.013)</td>
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<td></td>
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<tr>
<td>Arrival Age</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CommonLang * ArrAgei</td>
<td>0.003</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(0.006)</td>
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<tr>
<td>MotherEduc – Univ</td>
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<td>MotherEduc – Vocational</td>
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<tr>
<td>MotherEduc – Lower</td>
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<td>Livesmmorelbsi</td>
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<tr>
<td></td>
<td>(0.062)</td>
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<td></td>
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<tr>
<td>Livesmfi</td>
<td>0.170***</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livesmfbsi</td>
<td>0.338***</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livesmfmorelbsi</td>
<td>0.263***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.037)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OtherSituationsi</td>
<td>0.204***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.037)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HighestParentalOccup. –</td>
<td>-0.018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus, etc.</td>
<td>(0.035)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HighestParentalOccup. –</td>
<td>0.194***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prof.</td>
<td>(0.027)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agei</td>
<td>-0.576***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malei</td>
<td>0.026</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kindergarten3 – 5i</td>
<td>0.009</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SchoolatSixi</td>
<td>-0.219***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.047)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SchoolatSeven+i</td>
<td>-0.533***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.058)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-0.362***</td>
<td>-0.983***</td>
<td>-0.820***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.153)</td>
<td>(0.155)</td>
<td></td>
</tr>
<tr>
<td>R-squared</td>
<td>0.465***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.363)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Robust standard errors clustered by school and source country in parentheses
*** p<0.01, ** p<0.05, * p<0.1

School FE: Yes Yes Yes Yes
Observations: 11,755 11,755 11,755 10,037
R-squared: 0.269 0.270 0.273 0.414
a negative effect on student performance. The specification in column (2) includes \(\ln(Distance)_k\). Arguably, a larger distance from Madrid is likely to involve higher migration costs, which could give place to a selection of more motivated parents. This variable appears as positive and significant in column (2). This suggests that once we control for Common Language, a larger distance of immigration improves the immigrant children’s performance. Another possible source of lower immigration costs is the existence of an important network of migrants located in Spain. For this reason, specification (3) includes \(Proportion \text{ of Migrants}_k\). The coefficient for this variable is negative and significant, indicating that a more important network of migrants is associated with a reduction in the school performance of children.

Column (4) includes other potential determinants of student performance in the CDI test. A main concern is that the variables considered as proxies of immigration costs may be correlated with the per capita income of the country of origin. For this reason, we include the logarithm of per capita income at current dollars in 2010 of the source country \(\ln(GDP_{pc2010})_k\). While this variable is positive and significant, the effect of our immigration costs variables remain qualitatively unchanged.

To control for socioeconomic and cultural status, we use additional controls following Anghel and Cabrales (2014). These controls include the child’s arrival age to Spain \(\text{Arrival Age}_i\), variables capturing the mother’s education level, the highest parental occupation, the family composition, the age and sex of the student and the age when the child started formal education. The effects of these control variables are as expected and consistent with Anghel and Cabrales (2014) to whom we remit for a specific discussion. The important point to highlight is that once the additional controls are included, our variables of interests which capture immigration costs preserve the signs and significance. Furthermore, the magnitudes of the coefficients are even higher.

Results in column (4) are quantitatively relevant. Sharing the official language reduces the score of the students in 0.32 standard deviations (2.9 points in the exam, which represents a marginal effect of 11%). Taking two countries, as Ecuador and Poland, this variable explain, \textit{ceteris paribus}, half of the difference in the average CDI score between these countries. As to distance, an increase of 1% in distance increases in 0.0013 standard deviations the score in the exam. In the case of two countries as Poland and Morocco, this is equivalent to a difference of 1.3 points, explaining 19% of the difference.

\[43\text{Per Capita GDP at current dollars comes from the World Development Indicators database}\]

\[44\text{For a more detailed description of these variables see subsection A.1.}\]
in the average score of those countries. The variable \( \text{Immigrant Share}_k \) has a negative impact on the exam, at 1% significance level. An increase in 1 percentage point in the share of migrants negatively affects in 0.003 standard deviations the aggregate score. As for the case of Ecuador and Romania (with a proportion of migrants of 22.7% and 10.3% respectively), this predicts that Ecuadorians will obtain, on average, 0.34 points less in the CDI exam, when all other variables remain constant. Considering the difference in the average scores in Table 1, this result explains 13% of the existing difference between both countries.

Finally, we turn to using the direct measure of immigration costs proposed by Grogger and Hanson (2011) \( (\text{Fixed} - HG_k) \). In the regressions reported in table 3 we replace our migration cost variables by \( \text{Fixed} - HG_k \). Column (1) includes the same controls than those we used in the estimation displayed in the column (4) of table 2. Columns (2) and (3) replicate the same regression in column (1) but for Mathematics and Language separately. Column (4) excludes those countries with a similar level of development than Spain. Again, the results show a clear positive relationship between migration costs and student performance.
Table 3: Dependent Variable: Standardized Score in the CDI exam

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate Language</td>
<td>0.004***</td>
<td>0.001</td>
<td>0.006***</td>
<td>0.004***</td>
</tr>
<tr>
<td></td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Mathematics</td>
<td>0.093***</td>
<td>0.070***</td>
<td>0.099***</td>
<td>0.078***</td>
</tr>
<tr>
<td></td>
<td>(0.015)</td>
<td>(0.016)</td>
<td>(0.015)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Arrival Age$_i$</td>
<td>0.000</td>
<td>-0.017***</td>
<td>0.014***</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>CommonLang * ArrAge$_{ik}$</td>
<td>-0.022***</td>
<td>-0.009</td>
<td>-0.025***</td>
<td>-0.021***</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.006)</td>
<td>(0.005)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>MotherEduc – Univ$_i$</td>
<td>0.262***</td>
<td>0.271***</td>
<td>0.207***</td>
<td>0.254***</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
<td>(0.043)</td>
<td>(0.036)</td>
<td>(0.041)</td>
</tr>
<tr>
<td>MotherEduc – HigherSecondary$_i$</td>
<td>0.221***</td>
<td>0.265***</td>
<td>0.144***</td>
<td>0.234***</td>
</tr>
<tr>
<td></td>
<td>(0.036)</td>
<td>(0.041)</td>
<td>(0.034)</td>
<td>(0.037)</td>
</tr>
<tr>
<td>MotherEduc – VocationalTraining$_i$</td>
<td>0.230***</td>
<td>0.316***</td>
<td>0.113***</td>
<td>0.246***</td>
</tr>
<tr>
<td></td>
<td>(0.046)</td>
<td>(0.051)</td>
<td>(0.044)</td>
<td>(0.049)</td>
</tr>
<tr>
<td>Livesm1bs$_i$</td>
<td>0.203***</td>
<td>0.193***</td>
<td>0.184***</td>
<td>0.197***</td>
</tr>
<tr>
<td></td>
<td>(0.056)</td>
<td>(0.063)</td>
<td>(0.054)</td>
<td>(0.062)</td>
</tr>
<tr>
<td>Livesmmore1bs$_i$</td>
<td>0.127*</td>
<td>0.104</td>
<td>0.151**</td>
<td>0.144*</td>
</tr>
<tr>
<td></td>
<td>(0.070)</td>
<td>(0.083)</td>
<td>(0.065)</td>
<td>(0.074)</td>
</tr>
<tr>
<td>Livesmf$_i$</td>
<td>0.179***</td>
<td>0.145***</td>
<td>0.174***</td>
<td>0.179***</td>
</tr>
<tr>
<td></td>
<td>(0.042)</td>
<td>(0.047)</td>
<td>(0.040)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>Livesmfs$_i$</td>
<td>0.268***</td>
<td>0.206***</td>
<td>0.274***</td>
<td>0.264***</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.046)</td>
<td>(0.039)</td>
<td>(0.043)</td>
</tr>
<tr>
<td>Livesmfmore1bs$_i$</td>
<td>0.226***</td>
<td>0.157***</td>
<td>0.237***</td>
<td>0.233***</td>
</tr>
<tr>
<td></td>
<td>(0.040)</td>
<td>(0.045)</td>
<td>(0.038)</td>
<td>(0.042)</td>
</tr>
<tr>
<td>OtherSituations$_i$</td>
<td>0.000</td>
<td>0.012</td>
<td>-0.041</td>
<td>-0.021</td>
</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td>(0.042)</td>
<td>(0.038)</td>
<td>(0.047)</td>
</tr>
<tr>
<td>HighestParentalOcup. – Bus, etc.$i$</td>
<td>0.188***</td>
<td>0.180***</td>
<td>0.158***</td>
<td>0.184***</td>
</tr>
<tr>
<td></td>
<td>(0.030)</td>
<td>(0.031)</td>
<td>(0.031)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>Age$_i$</td>
<td>-0.572***</td>
<td>-0.611***</td>
<td>-0.443***</td>
<td>-0.569***</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.028)</td>
<td>(0.022)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>Male$_i$</td>
<td>0.035*</td>
<td>-0.153***</td>
<td>0.178***</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>(0.021)</td>
<td>(0.023)</td>
<td>(0.021)</td>
<td>(0.023)</td>
</tr>
<tr>
<td>Kindergarten3 – 5$_i$</td>
<td>0.011</td>
<td>0.026</td>
<td>-0.001</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>(0.024)</td>
<td>(0.026)</td>
<td>(0.023)</td>
<td>(0.026)</td>
</tr>
<tr>
<td>SchoolatSix$_i$</td>
<td>-0.178***</td>
<td>-0.102*</td>
<td>-0.195***</td>
<td>-0.178***</td>
</tr>
<tr>
<td></td>
<td>(0.052)</td>
<td>(0.056)</td>
<td>(0.050)</td>
<td>(0.054)</td>
</tr>
<tr>
<td>SchoolatSeven+$_i$</td>
<td>-0.516**</td>
<td>-0.523***</td>
<td>-0.414***</td>
<td>-0.514***</td>
</tr>
<tr>
<td></td>
<td>(0.065)</td>
<td>(0.077)</td>
<td>(0.059)</td>
<td>(0.067)</td>
</tr>
<tr>
<td>Constant</td>
<td>5.293***</td>
<td>6.258***</td>
<td>3.572***</td>
<td>5.326***</td>
</tr>
<tr>
<td></td>
<td>(0.339)</td>
<td>(0.385)</td>
<td>(0.316)</td>
<td>(0.381)</td>
</tr>
</tbody>
</table>

School FE Yes Yes Yes Yes
Observations 8,468 8,646 8,565 7,544
R-squared 0.420 0.374 0.391 0.403

Robust standard errors clustered by school and source country in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As additional robustness exercises, we report the same regressions for a different sample where we exclude countries with similar level of development
than Spain.\footnote{These are: Germany, Austria, Canada, Cyprus, Denmark, United States, United Kingdom, France, Netherlands, Israel, Italy, Norway, New Zealand, Portugal, Sweden, Switzerland, Australia, Belgium, Finland, Greece, Ireland, Iceland, Japan and Luxembourg.} As shown below, our findings are robust to this re-sampling.

Table 4 reports the results of estimating similar specifications to those displayed in columns (4) and (5) of table 2 for the scores obtained in Mathematics and Language. Results are qualitatively similar than what we obtain for the aggregate score.

In table 5 we show the results of re-estimating the regressions reported in table 2 but after excluding those countries with similar level of development than Spain. Clearly, our results hold after this re-sampling.
Table 4: Dependent Variable: Standardized Score in the CDI exam - Mathematics and Language

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Mathematics</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>CommonLanguage_{ik}</td>
<td>-0.373***</td>
<td>-0.192***</td>
</tr>
<tr>
<td>ln(Distance)_{ik}</td>
<td>0.172***</td>
<td>0.059**</td>
</tr>
<tr>
<td>Immigrant Share_{ik}</td>
<td>-0.369***</td>
<td>-0.194</td>
</tr>
<tr>
<td>Ln(GDPpc2010)_{ik}</td>
<td>0.078***</td>
<td>0.082***</td>
</tr>
<tr>
<td>Arrival Age_{i}</td>
<td>0.000</td>
<td>-0.034**</td>
</tr>
<tr>
<td>CommonLang * ArrAge_{ik}</td>
<td>-0.007</td>
<td>0.016**</td>
</tr>
<tr>
<td>MotherEduc − Univ_{i}</td>
<td>0.211***</td>
<td>0.282***</td>
</tr>
<tr>
<td>MotherEduc − HigherSecondary_{i}</td>
<td>0.135***</td>
<td>0.276***</td>
</tr>
<tr>
<td>MotherEduc − VocationalTraining_{i}</td>
<td>0.158***</td>
<td>0.365***</td>
</tr>
<tr>
<td>MotherEduc − LowerSecondary_{i}</td>
<td>0.150***</td>
<td>0.275***</td>
</tr>
<tr>
<td>Livesm1bs_{i}</td>
<td>0.191***</td>
<td>0.188***</td>
</tr>
<tr>
<td>Livesmmore1bs_{i}</td>
<td>0.161***</td>
<td>0.140*</td>
</tr>
<tr>
<td>Livesmf1_{i}</td>
<td>0.167***</td>
<td>0.135***</td>
</tr>
<tr>
<td>Livesmfbs_{i}</td>
<td>0.323***</td>
<td>0.281***</td>
</tr>
<tr>
<td>Livesmfmore1bs_{i}</td>
<td>0.274***</td>
<td>0.194***</td>
</tr>
<tr>
<td>OtherSituations_{i}</td>
<td>0.215***</td>
<td>0.139***</td>
</tr>
<tr>
<td>HighestParentalOcup. − Bus, etc.,_{i}</td>
<td>-0.007</td>
<td>-0.013</td>
</tr>
<tr>
<td>HighestParentalOcup. − Prof.,_{i}</td>
<td>0.172***</td>
<td>0.181***</td>
</tr>
<tr>
<td>Age_{i}</td>
<td>-0.451***</td>
<td>-0.608***</td>
</tr>
<tr>
<td>Male_{i}</td>
<td>0.175***</td>
<td>-0.168***</td>
</tr>
<tr>
<td>Kindergarten3 − 5_{i}</td>
<td>-0.004</td>
<td>0.026</td>
</tr>
<tr>
<td>SchoolatSix_{i}</td>
<td>-0.209***</td>
<td>-0.174***</td>
</tr>
<tr>
<td>SchoolatSeven+_{i}</td>
<td>-0.402***</td>
<td>-0.576***</td>
</tr>
<tr>
<td>Constant</td>
<td>2.899***</td>
<td>5.777***</td>
</tr>
</tbody>
</table>

School FE: Yes, R-squared: 0.378

Robust standard errors clustered by school and source country in parentheses

*** p<0.01, ** p<0.05, * p<0.1
Table 5: Dependent Variable: Standardized Aggregate Score in the CDI exam  
- excludes countries with similar level of development than Spain

<table>
<thead>
<tr>
<th>Variable</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Language $k$</td>
<td>-0.055**</td>
<td>-0.233***</td>
<td>-0.183***</td>
<td>-0.382***</td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.038)</td>
<td>(0.040)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>$ln(Distance)_k$</td>
<td>0.143***</td>
<td>0.127***</td>
<td>0.153***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.023)</td>
<td>(0.023)</td>
<td>(0.022)</td>
<td></td>
</tr>
<tr>
<td>Immigrant Share $k$</td>
<td>-0.555***</td>
<td>-0.235*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.139)</td>
<td>(0.141)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$ln(GDP_{pc2010})_k$</td>
<td>0.124***</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrival Age $i$</td>
<td>-0.021***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common Lang * Arr Age $i_k$</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$MotherEdu - Univ_i$</td>
<td>0.257***</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.035)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$MotherEdu - Higher Secondary_i$</td>
<td>0.222***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$MotherEdu - Vocational Training_i$</td>
<td>0.291***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$MotherEdu - Lower Secondary_i$</td>
<td>0.236***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.034)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livesm 1bs $i$</td>
<td>0.196***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.056)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livesm more 1bs $i$</td>
<td>0.173***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.065)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livesm f $i$</td>
<td>0.167***</td>
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<td></td>
<td>(0.041)</td>
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<td>0.342***</td>
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<td></td>
<td>(0.039)</td>
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<td>0.267***</td>
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<tr>
<td></td>
<td>(0.039)</td>
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<tr>
<td>Other Situations $i$</td>
<td>0.209***</td>
<td></td>
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<tr>
<td></td>
<td>(0.039)</td>
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<tr>
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<tr>
<td></td>
<td>(0.040)</td>
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<tr>
<td>Highest Parental Ocup. - Prof. $i$</td>
<td>0.196***</td>
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<tr>
<td></td>
<td>(0.029)</td>
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<tr>
<td>Age $i$</td>
<td>-0.576***</td>
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<td>(0.023)</td>
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<td>Male $i$</td>
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<tr>
<td>Kindergarten 3 – 5 $i$</td>
<td>0.003</td>
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<tr>
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<td>(0.021)</td>
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<tr>
<td>School at Six $i$</td>
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<td>(0.048)</td>
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<tr>
<td>School at Seven $i$</td>
<td>-0.530***</td>
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<td></td>
<td>(0.059)</td>
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<td></td>
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</tr>
<tr>
<td>Constant</td>
<td>-0.452***</td>
<td>-1.565***</td>
<td>-1.404***</td>
<td>4.178***</td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td>(0.179)</td>
<td>(0.183)</td>
<td>(0.394)</td>
</tr>
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</table>

School FE | Yes | Yes | Yes | Yes |
Observations | 10,734 | 10,734 | 10,734 | 9,112 |
R-squared | 0.256 | 0.260 | 0.261 | 0.403 |

Robust standard errors clustered by school and source country in parentheses

*** p<0.01, ** p<0.05, * p<0.1
A.1 Additional Information About the CDI

The Spanish educational system is composed of 6 years of primary school, 4 years of compulsory secondary education (E.S.O.) and 2 years of non-compulsory education, which is divided into vocational training and preparation for college (bachillerato). There are also three years of free publicly funded pre-school, from ages 3 to 5. The pre-school children share the premises with those in primary school.

6th grade primary students in the Madrid region have been taking the CDI exam (Prueba de Conocimientos y Destrezas Indispensables) since the academic year 2004-2005.\textsuperscript{46} Like the OECD’s PISA exam, the CDI exam does not have any academic consequences for the student, it is only intended to give additional information to teachers, parents and students.

The CDI exam consists of two parts of 45 minutes each: the first part includes tests of Dictation, Reading, Language and General Knowledge and the second part is composed of mathematics exercises. We use as a measure of student achievement the exam scores, standardized to the yearly mean, in the Total Exam, in Language (including dictation, reading, language and general knowledge) and Mathematics. The exams are conducted in Spanish for all students, whether or not they were in a bilingual school.

Before taking the exam, a short questionnaire is filled out by each student. In the questionnaire the students are asked a few questions about themselves, their parents and the environment in which they are living. The answers to these questions provide rich information on individual characteristics of students: from the questionnaire we obtain the country of birth of the student, the country of birth of the parents, the level of education of the parents, the occupation of the parents, the composition of the household in which the students lives and the age at which the student started to go to school/kindergarten. From the exam we have information at student level on age ($Age_i$) and gender (which we include as a dummy variable $Male_i$ which takes the value 1 if the student is male).

Children can start formal schooling before the age of 3 with nursery (our base category in the regressions), or between 3 and 5 with kindergarten ($Kindergarten3-5_i$) or only with primary school at the age of 6 ($SchoolatSix_i$) or 7 ($SchoolatSeven_i$).

Regarding the education of the parents, students were asked to provide this information for both the mother and the father. In the regressions, we control by the educational level of the mother of the student ($MotherEduc$). We

\textsuperscript{46}From the school year 2009/10, the exam is also administered to all students in the third grade of compulsory secondary education (14-15 years old).
distinguish the following categories: university education \((MotherEduc_{Univ})\), higher secondary education \((MotherEduc_{HigherSecondary})\), vocational training \((MotherEduc_{VocationalTraining})\), lower secondary education \((MotherEduc_{LowerSecondary})\) and no compulsory education which serves as our base category. In the case of the occupation of the parents, we choose the highest level of occupation between them. Thus, we differentiate between the following categories: professional occupations \((HighestParentalOccupation_{Prof})\), for example teacher, researcher, doctor, engineer, lawyer, psychologist, artist, etc.; business and administrative occupations \((HighestParentalOccupation_{Business, etc})\), for example CEO, civil servant, etc.; and blue collar occupations (for example shop assistant, fireman, construction worker, cleaning staff, etc.) which is our base category.

The variable on the composition of the household of the student comes from the answers to the question: “With whom do you usually live?”. We differentiate the following seven categories: lives only with the mother (our base category), lives with the mother and one sibling \((Lives_{m1bs})\), lives with the mother and more than one sibling \((Lives_{mmore1bs})\), lives with the mother and the father \((Lives_{mf})\), lives with the mother and the father and one sibling \((Lives_{mf1bs})\), lives with the mother and the father and more than one sibling \((Lives_{mfmore1bs})\) and other situations \((OtherSituations)\).

**B Theoretical Proofs**

**B.1 Proof of Lemma 1**

Using the notation introduced in (9) and (10), the optimal level of incentives of native and immigrant parents (8) can be written as

\[
c^N_{pi} = \psi^N_i (w^c_s - w^c_u) - \frac{1}{2} \left( \frac{\theta^T}{w^T} (w^c_s - w^c_u) - \frac{N_Nc^N_p + N_Ic^I_p}{2N} \right), \tag{36}
\]

\[
c^I_{pi} = \psi^I_i (w^c_s - w^c_u) - \frac{1}{2} \left( \frac{\theta^T}{w^T} (w^c_s - w^c_u) - \frac{N_Nc^N_p + N_Ic^I_p}{2N} \right), \tag{37}
\]

The average parental incentives of immigrants and natives can therefore be written as
\( \overline{c}_p^N = \frac{\overline{\Omega}_N (w^c_s - w^c_u) - 1}{2} \frac{\theta^T}{w^T} (w^c_s - w^c_u) + \frac{N_N \overline{c}_p^N + N_I \overline{c}_p^I}{4N}. \) (38)

\( \overline{c}_p^I = \frac{\overline{\Omega}_I (w^c_s - w^c_u) - 1}{2} \frac{\theta^T}{w^T} (w^c_s - w^c_u) + \frac{N_N \overline{c}_p^N + N_I \overline{c}_p^I}{4N}. \) (39)

Notice as well that \( c_p^I = (\overline{\Omega}_I - \Omega_N) (w^c_s - w^c_u) + c_p^N. \) Using this and simplifying, \( \overline{c}_p^N \) and \( \overline{c}_p^I \) become:

\( \overline{c}_p^N = (w^c_s - w^c_u) \left( \frac{4N - N_I \overline{\Omega}_N}{3N} + \frac{N_I \overline{\Omega}_I}{3N} - \frac{2}{3} \frac{\theta^T}{w^T} \right). \) (40)

\( \overline{c}_p^A = (w^c_s - w^c_u) \left( \frac{3N + N_I \overline{\Omega}_I}{3N} + \frac{N - N_I \overline{\Omega}_N}{3N} - \frac{2}{3} \frac{\theta^T}{w^T} \right), \) (41)

and therefore:

\[ N_N \overline{c}_p^N + N_I \overline{c}_p^I = \frac{2}{3} (w^c_s - w^c_u) \left( 2 \left( N_I \overline{\Omega}_I + N_N \overline{\Omega}_N \right) - \frac{(N_N + N_I) \theta^T}{w^T} \right). \] (42)

Plugging (42) into (36), (37) and (7) we then get the desired result.

**B.2 Proof of Proposition 3**

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

\[ \overline{\Omega}_I (F) = \frac{\sum_{i \in I_+(F_\xi)} \theta_i}{\sum_{\xi \in \Xi} N_+ (F_\xi)}, \quad \overline{\Omega}_H (F) = \frac{\sum_{i \in I_-(F_\xi)} \theta_i}{\sum_{\xi \in \Xi} N_- (F_\xi)}. \]

Clearly

\[ \overline{\Omega}_A (F) = \frac{N_+ (F) \overline{\Omega}_I (F) + N_N \overline{\Omega}_N}{(N_N + N_+ (F))}. \]
Let for any $i$ with $\xi_{i} = \xi \in \Xi$

$$G_{\xi}(F) \equiv \max \left\{ 0, T \left( w_{p_{i}A}^{c} - w_{p_{i}H}^{c} \right) + \theta_{i} \left( w_{u_{A}}^{c} - w_{u_{H}}^{c} \right) \right\}$$

$$+ \frac{\theta_{i}^{2}}{2} \left( \frac{\left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2}}{w_{p_{i}A}^{c}} - \frac{\left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2}}{w_{p_{i}H}^{c}} \right)$$

$$+ \theta_{i} \left( \frac{\left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2}}{w_{p_{i}A}^{c}} - \frac{\left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2}}{w_{p_{i}H}^{c}} \right)$$

$$+ \frac{1}{2} \left( w_{p_{i}A}^{c} \left( \frac{2 \theta_{A}^{T}}{3 w_{A}^{T}} - \frac{\Omega_{A}(F)}{3} \right) \right) \left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2} - w_{h_{i}H}^{c} \left( \frac{2 \theta_{H}^{T}}{3 w_{H}^{T}} - \frac{\Omega_{H}(F)}{3} \right) \left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2}$$

$$+ \left( \frac{w_{s_{A}}^{c} - w_{u_{A}}^{c}}{w_{p_{i}A}^{c}} - \left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2} \right)$$

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 $[0, A[^{\Xi}]$ and $G(.)$ also maps into $[0, A[^{\Xi}]$ by the assumption that $A > \max_{\xi, i \in \Xi} U_{P}$. 

**B.3 Proof of Proposition 4**

Under the assumption that $\frac{\partial \Omega_{A}}{\partial \theta_{A}} = \frac{\partial \Omega_{H}}{\partial \theta_{A}} = 0$ 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 (21) with respect to parental motivation and determine its sign. This derivative is given by

$$\left( w_{u_{A}}^{c} - w_{u_{H}}^{c} \right)$$

$$+ \theta_{i} \left( \frac{\left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2}}{w_{p_{i}A}^{c}} - \left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2} \right)$$

$$+ \theta_{i} \left( \frac{\left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2}}{w_{p_{i}A}^{c}} - \left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2} \right)$$

$$+ \frac{1}{2} \left( w_{p_{i}A}^{c} \left( \frac{2 \theta_{A}^{T}}{3 w_{A}^{T}} - \frac{\Omega_{A}(F)}{3} \right) \right) \left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2} - w_{h_{i}H}^{c} \left( \frac{2 \theta_{H}^{T}}{3 w_{H}^{T}} - \frac{\Omega_{H}(F)}{3} \right) \left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2}$$

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

$$\frac{1}{3} \left( \left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2} \left( \frac{2k_{A}^{T}}{w_{A}^{T}} \theta_{A} - \Omega_{A} \right) - \left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2} \left( \frac{2k_{H}^{T}}{w_{H}^{T}} \theta_{H} - \Omega_{H} \right) \right)$$

so that the derivative can be rewritten as

$$\theta_{i} \left( \frac{\left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2}}{w_{p_{i}A}^{c}} - \left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2} \right)$$

$$+ \left( w_{u_{A}}^{c} - w_{u_{H}}^{c} \right) + \frac{1}{3} \left( \left( w_{s_{A}}^{c} - w_{u_{A}}^{c} \right)^{2} \left( \frac{2k_{A}^{T}}{w_{A}^{T}} \theta_{A} - \Omega_{A} \right) - \left( w_{s_{H}}^{c} - w_{u_{H}}^{c} \right)^{2} \left( \frac{2k_{H}^{T}}{w_{H}^{T}} \theta_{H} - \Omega_{H} \right) \right)$$
It is positive if both lines are positive which gives us conditions (22) and (23). If both (22) and (23) are violated the derivative is negative. If (22) is violated and (23) holds, the derivative is positive for sufficiently small $\theta_i$ and negative for sufficiently high $\theta_i$. Hence, (21) reaches its maximum for some intermediate value of $\theta_i$. Finally, if (22) holds and (23) is violated the derivative first decreases in $\theta_i$ and then increases in $\theta_i$. Hence, (21) reaches its minimum for some intermediate value of $\theta_i$. ■

B.4 Proof of Lemma 4

Using the first order conditions for children’s effort decision (6) we get:

$$U_T = \frac{\theta^T}{N} \left( \sum_{k=1}^{N} \left( (w^C_s - w^C_u) (c^N_{pk} + c_T) + w^C_u \right) + \sum_{l=1}^{N} \left( (w^C_s - w^C_u) (c^I_{pl} + c_T) + w^C_u \right) \right)$$

$$+ \left( T - \frac{1}{2rN} c_T \left( \sum_{k=1}^{N} (c^N_{pk} + c_T) + \sum_{l=1}^{N} (c^I_{pl} + c_T) \right) \right) w^T.$$ 

Hence

$$\frac{\partial U_T}{\partial c_T} = \frac{\theta^T}{N} \left( \sum_{k=1}^{N} (w^C_s - w^C_u) + \sum_{l=1}^{N} (w^C_s - w^C_u) \right) - \left( \frac{1}{2} \sum_{k=1}^{N} c^N_{pk} + \sum_{l=1}^{N} c^I_{pl} \right) + Nc_T \right) w^T = 0.$$ 

So

$$c_T = r\frac{\theta^T}{w^T} (w^C_s - w^C_u) - \frac{N_N c^N_p + N_I c^I_p}{2N}, \quad (44)$$

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

$$c^j_{pi} = \frac{\theta_i}{w^C_p} (w^C_s - w^C_u) - \frac{1}{2} c_T \text{ for } j = N; I. \quad (45)$$

Similar calculations as in Lemma 1 yield the desired result.